

Evaluating the Level of Adherence to The Ministry of Health Guideline in The Management of Severe Acute Malnutrition at Adama Hospital Medical College: A Cross-Sectional Study

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ABSTRACT

Background: Severe Acute Malnutrition (SAM) is defined as a weight-for-height (WFH) of ≤ -3 standard deviations or MUAC of $< 11.5\text{cm}$, or bilateral pitting edema among under-five children. WHO developed 10 steps with evidence generated from multiple countries to reduce case fatality rate among SAM cases but their implementation and impact on case fatality locally remain unknown. **Objective:** To evaluate the level of adherence to MOH guidelines in the management of SAM children. **Methods:** Descriptive cross-sectional study with systematic sampling techniques was conducted from November 1st to 30th, 2023 on medical records of SAM cases. Data analysis done using statistical package for social sciences (SPSS) version 25. **Results:** Of 200 SAM cases, 103 (51.5%) were female and mean age and SD were 23.56 ± 11.93 months. The average length of stay in the hospital was 13.6 days. Overall adherence to MOH guidelines was 15.5%, and the appropriateness of treatment in the management was: Step 1: 20.5%; Step 2: 65.5%; Step 3: 32%; Step 4: 28.5%; Step 5: 41.5%; Step 6: 34%; Step 7: 35%; and Step 8: 39%. Treatment outcome for SAM cases were: stabilized to OTP, cured, transferred out, non-responder, defaulter, and died were 63%, 20%, 2.5%, 2.5%, 2%, and 0%, respectively. **Conclusion and Recommendations:** Adherence level to MOH guidelines was low at 15.5% and appropriateness for step of management ranges

from 20.5 to 65.5%. Thus, improving adherence to MOH guidelines in SAM management and further studies to determine factors affecting adherence and length of hospital stay need to be conducted.

Keywords: Adherence, Children, MOH Guidelines, Severe Acute Malnutrition.

INTRODUCTION

Background

Overnutrition and undernutrition are referred to as malnutrition; undernutrition is further divided into underweight, wasting, stunting, and micronutrient deficiencies. While it can affect people of all ages and both genders to varying degrees, under five children, older adults, women who are pregnant or lactating, and families with fewer than five children are more vulnerable than other population groups. Individuals who suffer from malnutrition are more susceptible to health problems, decreased efficiency, and poor academic performance in comparison to those who are well nourished.

Background of the Study:

Nutrition promotes economic growth while also improving the mental health and physical productivity of the labor force. Nutrition improvement make significant contribution to poverty reduction and meeting health, education, and employment goals (1).

Malnutrition in all its forms is a global burden to almost every country in the globe, posing a substantial risk to public health and significant economic challenge (1). Acute malnutrition is a condition that arises during an emergency as a result of illness and/or low food intake, most commonly in children under the age of five and pregnant and lactating mothers. Wasting is defined as a child that is too thin for his or her height. Wasting is caused by recent rapid weight loss or an inability to gain weight. Severe acute malnutrition (SAM) is defined as a weight-for-height (WFH) of fewer than -3 standard deviations, Mid-Upper Arm Circumference (MUAC) of less than 11.5cm, or bilateral pitting edema [2]. A kid who is moderately or severely wasted is more likely to die [2, 3].

In 2022, globally, 148 million, 45 million, and 37 million children under the age of five were stunted, wasted, and overweight, respectively. Most children with malnutrition live in Asia and Africa which are a home to majority of malnourished children, with 52% and 43% stunted, 70% and 27% wasted, and 48% and 28% overweight respectively [3].

Malnutrition is a major issue in developing and poor nations such as Sub-Saharan Africa, impacting a large number of children and resulting in significant losses of human capital and economic productivity in the region. Africa is home to 52 million stunted children (one-third of the global total) and 14.1 million wasting children. Again, Africa is the second highest in the world for children born small for gestational age accounting for 24%. These youngsters are at danger of morbidity and mortality, with an average death rate 11 times higher than their healthy counterparts [4].

In 2018, 256.1 million Africans were undernourished, affecting the continent's socioeconomic status, health, education, and total productivity. The increasing number of undernourishments in the continent is largely due to food insecurity caused by drought, climate change, conflicts,

the COVID-19 pandemic, and an economic slump. In 2019, Africa accounted for 22% of global undernutrition, with 57.6 million stunted, 12.7 million acutely malnourished, and 3.5 million severely wasted (severe acute malnutrition) children. In 2019, the socioeconomic cost of child undernutrition in Africa was estimated to be 3.2 billion USD in the health sector, 345 million USD in education, and 4.17 billion USD in productivity [5].

Children suffering from wasting, a type of acute malnutrition, have reduced immunity, long-term developmental problems, an increased risk of mortality in general, and much more when the wasting is severe [6, 7]. According to the global joint child malnutrition estimate for 2022, 45 million under five children were wasted, with 13.6 million severely wasted [3]. In Ethiopia, 7% of children under five years were wasted, 1% were severely wasted, 37% were stunted, 12% were severely stunted, 21% were underweight, and 6% were severely underweight [2, 6, 7]. A global hunger index (GHI) report, which is intended to determine the food security and nutrition status of the population in countries using four key indicators: undernourishment, child stunting, child wasting, and child mortality, shows an 18.2 index at the global level, with an estimated 828 million people undernourished in 2021, and categorized Ethiopia in a serious category (20.0–34.9) for the year 2022 with a hunger index of 27.6 [8].

Malnutrition costs the lives of children and has a negative impact on the population's socio-economic level, health, education, and total productivity. According to the cost of hunger in Africa and Ethiopia, the socio-economic cost of child undernutrition in the health sector, education, and productivity was estimated to be 3.2 billion USD, 345 million USD, and 4.17 billion USD, respectively, in 2019 [9]. Ethiopia costs a total of 4.7 billion USD (55.5 billion ETB) due to undernutrition related to health, education, and productivity, with a loss of 154 million USD, 7.9 million USD, and 4.5 billion USD, respectively [5,10].

SAM is a leading cause of morbidity and mortality among under the age of five, and with children with SAM being 9 to 11 times more likely to die than well-nourished children [2,4,6,11]. Several factors contribute to SAM case fatality, including childhood co-morbidities such as diarrhea, pneumonia, shock, and nonadherence to management guidelines by health care professionals [2, 22].

Even though number of children with severe acute malnutrition in Africa is unacceptably high, in different Africa countries level of adherence to WHO guideline was inadequate and needs improvement [12], and case fatality rate among severely malnourished children ranges from 15% to 40% [13,15]. Appropriate management of SAM cases based on adopted guideline saves the life of children with malnutrition, shorten average length of hospital stay and improves economy of the individual, household, and country. With appropriate implementation of case management practices and follow-up care case fatality rates reduced from 30 % to < 5% in health facility providing services in Ethiopia [16] and from 40 - 50% to lower than 6% in developing countries [17].

The WHO guidelines on SAM recommend careful clinical assessment of health problems of children with SAM. This is to ensure early prevention or treatment of health issues common to children with SAM, such as hypoglycaemia, hypothermia, dehydration, electrolytes imbalance, infections, and micronutrient deficiencies [16,18].

Objective of the Study

The overall objective of the study was to identify level of adherence to Ministry of Health Guideline in management of SAM and specifically to determine the proportion of children aged 6 to 59 months with SAM who received appropriate treatment as per FMOH guidelines and to describe the treatment outcome of SAM children in Adama Hospital Medical College paediatric wards.

MATERIALS AND METHODS**Study Area and Period**

The study was conducted at Adama Hospital Medical College, Pediatric Ward, from November 1st to 30th, 2023. The pediatric ward of the hospital provides services for children aged < 15 years, including SAM cases. The hospital has a capacity of 232 beds. The pediatric ward has a total of 41 beds, of which 15 are dedicated to SAM cases.

Research Design

Hospital-based retrospective descriptive cross-sectional study was conducted on the medical records of SAM cases.

Research Approach

The approach of the study was quantitative, which quantified the level of adherence and appropriateness of treatment for admitted cases in AHMC.

Target Population

The target population, documents, and records for the study were obtained from the medical records of children aged 6 to 59 admitted to AHMC pediatric wards and diagnosed with SAM during the specified period from January 1st to October 31st, 2023.

Source of Data

The data was collected retrospectively from the medical records of children admitted to the hospital with diagnosed SAM. For the intended purpose, a registration book, history sheet, multi-chart, laboratory sheet, and physician note were used as sources of data to obtain necessary information during the study period.

Inclusion and Exclusion Criteria

All children aged 6 to 59 months admitted to the Adam Hospital Medical College Pediatric ward with SAM were included in the study. Children with chronic medical conditions such as cardiac and renal diseases and cancer that predispose them to malnutrition were excluded. Children less than 6 months old with SAM were excluded from the study since the step of feeding modalities were different and preparation for transfer out was not necessary for them.

Sample Size Determination

The sample size of the study was determined using the formula for a single population proportion with assumptions of 55.8% perceived quality of care for SAM cases in Addis Ababa [19], a 95% confidence interval, and a 5% degree of desired precision or margin of error for sampling. (n = sample size, P = prevalence, d = margin of error).

$$n = \frac{Z^2 P(1-P)}{d^2} \quad n = \frac{(1.96^2 * 0.558)(1-0.558)}{0.05^2} = \underline{\underline{379}}$$

Adjustment for a finite population: children aged 6 to 59 months with SAM admitted to pediatric wards at AHMC. From medical records during the period of January 1st to October 31st of 2023, 437 cases were admitted. So, **N = 437**. Since the total number of the source population was 437 and below 10,000, a correction formula was used to adjust the sample size as follows:

$$nf = \frac{n}{1+n/N} \quad nf = \frac{379}{1+\frac{379}{437}} = \frac{379}{1.867} = \underline{\underline{202.99}} = \underline{\underline{203}}$$

Sampling Technique

A systematic sampling technique was employed on SAM case records during the study period.

Data Collection Methods

Data was collected from the medical records of children with SAM admitted to AHMC by using a structured data collection tool.

Data Collection Instrument/Tools

Data collection tools were developed based on on the Kobo Toolbox data collection application and used by the data collectors.

Data Collection Procedure

The data was collected using a structured data collection tool from medical records (registration, multi-chart, physician note, and laboratory sheet) of children with SAM admitted to AHMC. Anthropometric and demographic characteristics of admitted children were recorded, and detailed data on adherence to guidelines was recorded with respect to WHO steps for the management of SAM cases in the stabilization center. For each child, the necessary data was collected for each step with the prepared data collection tool.

Data Quality Management

A structured data collection tool was prepared in the English language. A pre-test of the data collection tool was done on 5% of the sample size in a similar area, which was not included in the study before the actual data collection, to see the accuracy and consistency and to estimate the time needed. On a daily basis, collected information was reviewed, and possible errors were returned to the collectors for correction. Training and orientation were given to the data collectors, and close supervision was done during data collection.

Data Processing and Analysis

Data was checked for completeness and consistency, and transported to the computer software SPSS version 25.0 from the Kobo Toolbox data collection application.

Descriptive statistics were done to summarize the data. For categorical data frequencies and proportions were tabulated, and graphs were plotted to show the distribution. For numerical data measures of central tendencies and dispersion were reported and presented in tables, charts, and graphs.

Ethical Consideration

Ethical clearance was obtained from the Ethical Review Board of Skillmart International College, Department of Project Management Analysis and Evaluation. Privacy and confidentiality of collected information were ensured at all levels.

RESULTS AND DISCUSSION

Introduction

In the study, 200 children diagnosed with SAM cases was included, while data from three children was excluded due to incompleteness and not fulfilling the diagnosis of SAM, with the response rate of the study 98.5%. The findings of the study were summarized into socio-demographic characteristics, nutritional assessment and classification, the steps of SAM case management, and the outcome of the management. The findings of the study are presented in tables, charts, graphs, and others are narrated.

Socio-demographic Characteristics

From all collected data for the study, 97 (48.5%) were male and the mean age and SD of the children were 23.56 ± 11.93 months, with a minimum and maximum of 6 and 59 months, respectively. Nearly three-fourths, 148 (74.0%) were rural residents, while the remaining 54 (26.0%) were urban residents.

The study findings indicated that the male-to-female gender ratio was 1:1.06, which goes with the study conducted in Ghana, with 54.7% female [20], but is lower than the study conducted at Kalakla Turkish Hospital in Khartoum, Sudan, with 60.1% female [21], and Kenyatta National Hospital, Kenya with 43% female [22]. The proportion of males was lower than the study conducted at Garissa Provincial General Hospital, Kenya [23] and Moi Teaching and Referral Hospital, Kenya [24] with 63.5% and 63% male proportions, respectively. The mean age of the current study was 23.56 months, almost similar to the study conducted by Warfa et al. with a mean age of 25 months [23], but higher than studies done in Ghana with a mean age of 18.5 months [21], in Sudan with 19.2 months [20], in Moi Teaching and Referral Hospital, Kenya [24], with 13 months, and Kenyatta National Hospital, Kenya with 14.4 months [22], but similar to the study conducted at Busia County Referral Hospital of Kenya with a mean age of 21.5 months [23]. The residence from which SAM cases were treated in the hospital was slightly higher in rural areas than in urban areas.

Average Length of Stay (ALOS) in Hospital

Average length of stay (ALOS) means number of days that SAM children were treated from admission till the assigned outcome of treatment which indicates the quality of care provided for the children in the hospital. The average length of stay in the hospital was assessed for all children included in the study, and found that the mean and SD were 13.60 ± 18.18 days, with a minimum and maximum of 5 and 118 days, respectively.

The ALOS for SAM cases in this study was higher than the recommended SPHERE standard of 3 to 7 days [25]; study conducted at Moi Teaching and Referral Hospital of Kenya, 10 days [14, 15], Kalakla Turkish Hospital in Khartoum 11days [21] and Garissa Provincial General Hospital, Kenya, 7.6 days [15], but lower than a study conducted in Africa that found ALOS of 14 to 21 days [13]. The discrepancy among ALOS could be due to study area, hospital context in the

management of SAM, resource availability and quality of care, and adherence to management guidelines.

Anthropometric Measurement and Classification of Nutritional Status

Among the study participants, 167 (83.5%) of the cases were new admissions, 29 (14.5%) were readmissions, and 4 (2.0%) had no type of admission documented. The mean weight and SD of children with SAM cases were 7208.45 ± 2237.68 g, 190 (95.0%) had their height and length measured, while the remaining 10 (5.0%) didn't. Those whose height/length were measured had a mean of 74.37cm and SD of ± 9.64 cm.

MUAC measurement was taken for 197 (98.5%) of the children and found that the mean and SD were 10.93 ± 1.24 cm with a minimum of 8 cm and a maximum of 14 cm, and 152 (77.2%) of the children had a MUAC of < 11.5 cm. Among children admitted to the hospital, 74 (38.5%) of them had edema of any grade, and among oedematose children, 56 (75.6%) and 18 (24.4%) of them had grade 3 (+++) and grade 2 (++) edema respectively. Of the children included in the study, 117 (58.5%) and 76 (38.0%) were classified as non-oedematose and oedematose SAM, while 7 (3.5%) of SAM children weren't classified as neither oedematose nor non-oedematose SAM.

Table 1: Nutritional assessment and classification of children involved in the study AHMC, December 2023. (n=200).

<i>Variables</i>	<i>Response</i>	<i>Frequency</i>	<i>Percent</i>
Bi-lateral pitting edema of the child	0 (No)	100	55.0
	++	18	9.0
	+++	56	28.0
	Not recorded	16	8.0
MUAC of children	< 11.5 cm	152	76.0
	≥ 11.5 cm	45	22.5
	Not recorded	3	1.5
Weight -for-Height/Length of the children	≤ -3 SD	155	77.5
	≥ -2 SD	45	22.5
Classification of SAM	Non oedematose SAM	117	58.5
	Oedematose SAM	76	38.0
	Not classified	7	3.5
Hemoglobin test done for children?	No	121	60.5
	Yes	79	39.5

To identify children with anemia among SAM cases, a hemoglobin test and clinical evaluation are important. A hemoglobin test was done for 79 (39.5%) of SAM children admitted to the hospital. The mean and SD of hemoglobin levels for tested children were 8.6 ± 2.4 mg/dl. Among those tested for hemoglobin level and having low hemoglobin concentration, 8 (88.8%) of them received blood transfusions per the cut-off points for hemoglobin.

Anthropometric measurement and indices of the children with regard to age and gender were analyzed and found that among children, 80 (52.8%) male had MUAC < 11.5 cm, and 88 (56.7%) male had WFH < -3 SD, which indicated more males were severely wasted than female children in the study.

Table 2: Anthropometric measurement by age and sex of the children Adama Hospital Medical College, December 2023.

<i>Variables</i>	<i>Response</i>	<i>Sex of the child</i>		<i>Age of the child in months</i>		
		<i>Female</i>	<i>Male</i>	<i>6 to 12</i>	<i>13 to 24</i>	<i>25 to 59</i>
MUAC of the child	< 11.5cm	72	80	55	52	45
	> or = 11.5cm	24	21	6	21	18
WFH/L of the child	> or = - 2 SD	30	15	13	21	11
	< or = -3 SD	67	88	49	52	54

Based on anthropometric indices and measurements undertaken in this study, 77.5% and 76% of SAM children had WFH $\leq$ -3SD and MUAC of < 11.5 cm respectively. This finding had a lower WHF compared with 98% of participants having a WHZ score of $\leq$ -3 SD, and only 2% had a MUAC of < 11.5%, which is much lower than the current study [14, 15]. Another study conducted at Garissa Provincial General Hospital in Kenya [15] indicated 52% of children had Z scores of $\leq$ -3SD, which was lower than the current study. A study conducted by Jalal A. et al. at Khartum, Sudan, showed similarity with the current study that 75% of SAM children had < or = -3 SD of WFH [21].

Adherence to MOH Guidelines in Management of Severe Acute Malnutrition

Adherence to the MOH guideline was assessed using 8 steps out of 10 steps and the findings summarized as follow.

Step 1: Prevent or Treat Hypoglycaemia:

Random blood sugar (RBS) was tested in 68 (34.0%) of children, while two-thirds, 132 (66.0%) of the children were not tested for RBS level on admission. The mean and SD of RBS for SAM children in the hospital were 82.7 ± 19.91 mg/dl. All children, 14 (100.0%) with low RBs (< 54 mg/dl), received treatment for hypoglycemia with 10% glucose and NGT feeding 9 (64.2%) and 6 (35.8%), respectively. Half, 100 (50.0%) of the children received their first feed within 1 hour of admission. The mean and SD of the time of initiating the first feed from the time of admission were 3.09 ± 3.32 hours, with a minimum and maximum of 1 hour and 12 hours, respectively. At the hospital level, a random blood sugar (RBS) test should be done for all children during admission to identify hypoglycemia early and manage it appropriately. Prevention and treatment of hypoglycemia is the first and most lifesaving step in the management of SAM children. Hypoglycemia commonly occurs with hypothermia in SAM cases [16].

In this study, even though all SAM cases admitted to the hospital were recommended to be tested for RBS, only 34% of children tested for RBS. Adherence level to step 1 with appropriate treatment was 20.5%. This finding was much lower than the study conducted in Pakistan at Lahore Teaching Hospital, with an RBS testing of 71%. But treatment of identified hypoglycemia was better for this study since Lahore Teaching Hospital was only 41% treated for hypoglycemia with 10% dextrose [24]. The RBS test for this study was ten times higher than that of Upper East Regional Hospital in Ghana, where only 1.3% tested their RBS for hypoglycemia, and none of them were given 10% IV glucose for the prevention or treatment of hypoglycemia [12]. In West Cape, South Africa, hypoglycemia was poorly managed [26], in South Sudan, 40.2% of hypoglycemia was appropriately managed, and the appropriate treatment of step 1 was 77% [27], which was higher than the current study of step 1 (20.5%). Garissa Hospital of Kenya's appropriate management of hypoglycemia was 14.6% [15], a slight

lower than this study. Moi Teaching Hospital reported 39.3% RBS tests, and only 6.7% of them received 10% dextrose [14, 15]. That was two-fold lower than this study in RBS testing but much lower with the treatment of hypoglycemia with the provision of 10% glucose. In Kenya, referral hospital hypoglycemia-appropriate management was only 8.5% given 10% dextrose [28].

Step 2: Prevent or Treat Hypothermia:

In this study, the initial body temperature of SAM cases was recorded in 133 (66.5%) cases, hypothermia was noted in 56 (42.1%) cases, and hyperthermia was recorded in 17 (12.8%). SAM cases were managed using various hypothermia management approaches, including Kangaroo mother care (KMC), warm blankets, heaters, and others. Among the total hypothermic cases, 12 (21.4%), 19 (33.9%), 33 (58.9%), and 20 (35.7%) were treated with KMC, heaters, warm blankets, and other methods, respectively. The study identified that a single hypothermic child has been treated with one or more methods of hypothermia management in the hospital.

Hypothermia is one of the medical complications in SAM children, and it occurs frequently as a result of muscle loss for energy production. Unless close follow-up and monitoring of body temperature done for SAM children, it can kill the child commonly during the night. For this reason, all children admitted to hospital with diagnosed SAM should have their body temperature measured at the time of admission and monitored regularly to guide hypothermia management [2].

Compared with other studies, this study had better adherence than West Cape, South Africa, poorly managed hypothermia [26]; South Sudan, 18.9% [19]; Al-Sabah Hospital, Juba, South Sudan, 59% [27]; Kenyatta National Hospital, 46.5% [22]; Garissa Provincial General Hospital, Kenya, only 5.2% [15]; and Moi Teaching Hospital of Kenya, 69.5% [14] of children appropriately managed for hypothermia. While Kenya, Busia country referral hospital 100% hypothermia appropriately managed similarly with this study [28]. Variation in management of hypothermia in different countries estimated to be the study design, the knowledge gap among HCWs on the management of hypothermia, and the evaluation criteria used in this step.

Step 3: Prevent or Treat Dehydration:

Among the SAM cases included in the study, 76 (38.0%) had diarrhea, and 40 (20.0%) had vomiting. Assessment of dehydration among SAM cases is usually overdiagnosed and requires experience and a good history taking on SAM cases in the hospital. From the total number of children included in the study, 72 (36.0%) had dehydration, 60 (30.0%) had no dehydration, and 68 (34.0%) had dehydration that was not documented. From a total of 72 dehydrated children, ReSoMal was prescribed for 65 (90.2%) and the correct ReSoMal amount was prescribed for 52 (80.0%) of the children.

In the study, 15 (7.5%) of the children admitted with SAM were in shock. All of them were treated with the appropriate type of IV fluids, with 11 (73.3%) received correct amount of IV fluids in the first hour, 15 (100.0%) cases IV fluids were monitored and recorded, and 14 (93.3%) of the cases were re-assessed by the clinician after 1 hour of IV fluid treatment. After one hour, 14 (93.3%) of the shock treated children improved/were out of shock, and 14

(100.0%) of children improved treated with alternate ReSoMal after 1 hour. One (6.7%) patient who remained in shock after 1 hour was not transfused but continued to receive IV fluid.

Table3: Dehydration status, management and underlying comorbidity among SAM cases, AHMC, December 2023

<i>Variable</i>	<i>Response</i>	<i>Frequency</i>	<i>Percent (%)</i>
Diarrhea	Yes	76	38.0
	No	66	33.0
	Not recorded	58	29.0
Vomiting	Yes	40	20.0
	No	98	49.0
	Not recorded	62	31.0
Child dehydrated	Yes	72	36.0
	No	60	30.0
	Not recorded	68	34.0
ReSoMal prescribed	Yes	65	90.2
	No	7	9.8
Correct volume of ReSoMal prescribed	Yes	52	80.0
	No	13	20.0
Child in shock	Yes	15	7.5
	No	185	92.5
Correct type of IV fluid for child in shock	Yes	15	100.0
	No	0	0.0
Correct volume of IV fluid for child in shock	Yes	11	73.3
	No	4	26.7

In this study, dehydration was reported in 36% of the children; 90.2% of them were prescribed ReSoMal, and 80% of them received the appropriate volume of ReSoMal solution. Furthermore, 7.5% of them were in shock, 73.3% received an appropriate volume of IV fluid, 100% of them were monitored, and 93.3% improved. In general, children with SAM, and particularly non-oedematose SAM cases, appear dehydrated physically. Because of the dehydration level in SAM cases, they are frequently overdiagnosed. To prevent fluid overload and heart failure, IV fluid is limited to children in shock, and children with dehydration should be given a special prepared solution ReSoMal [2, 28]. For step 3, prevent or treat dehydration, the overall adherence level was 32%. Compared to other study findings, this study had a higher rate of ReSoMal prescription than Pakistan, Lahore Teaching Hospital, where none of the dehydrated children were prescribed ReSoMal [24] and East Regional Hospital of Ghana, where only 21.1% of children with dehydration received recommended ReSoMal[12]. Regarding the overall adherence level of 32% in step 3 of this study, studies at Al-Sabah Hospital, Juba, South Sudan, 85.5% [27], Kenya, a Busia country referral hospital, 100% of dehydrated cases rehydrated with locally made ReSoMal [28] and Kenyatta National Hospital's treatment of dehydration was 54.9% [22] reported higher adherence to step 3. But Garissa Provincial General Hospital, Kenya treatment of dehydration (step 3) was 31.3% [15], found to be similar with current study.

Step 4: Correct Electrolyte Imbalance:

From the total number of cases, 156 (78.0%) and 158 (79.0%) were provided F-75 with the correct volume and frequency, respectively, to prevent or treat electrolyte, mineral, and

micronutrient imbalances. The adherence level of correction of electrolyte imbalance in this study was 28.5%.

Electrolyte imbalance can be treated or prevented by feeding the child with commercially produced formula feeding that is rich with minerals, vitamins, and electrolytes or by supplementing the children with specific minerals and. But, if the children are treated with a locally prepared feeding formula, they will require additional minerals and vitamins, particularly potassium and magnesium [16]. In this study, 100% of SAM children were fed F-75 to prevent or treat electrolyte imbalances and 78% and 79% were fed correct volume and frequency respectively. In contrast in South Sudan, 62.7% [29] and Kenyatta National Hospital in Kenya, 55% [22] of SAM children received F-75, which was much lower than this study. The discrepancy could be attributable to the study design, study period, and number of hospitals included in the study. A study conducted at Al-Sabah Hospital, Juba, South Sudan [27] and Moi Teaching and Referral Hospital, Eldoret, Kenya [14] had similarity with 98% and 100% feeding of F-75 for SAM children, respectively. The adherence level of correction of electrolyte imbalance in this study was 28.5%, which was lower than that of Kenyatta National Hospital in Kenya [22] and Garissa Provincial General Hospital, Kenya [15], which reported 45.5% and 57.3%, respectively, of adherence to step 4.

Step 5: Treatment of Routine Infection:

Routine antibiotics were prescribed for all SAM cases included in the study. The type of routine antibiotics prescribed per the standard was Gentamycin plus Ampicillin, followed by Amoxicillin for 163 (81.5%), Ceftriaxone plus Ciprofloxacin for 86 (43.0%) for those cases that did not respond to Gentamycin plus Ampicillin within 48 hours of treatment, Amoxicillin only for 34 (17.0%), and other antibiotics for 29 (14.5%) of cases based on the specific infection identified. Regarding the dosage of antibiotics prescribed for SAM cases in the hospital, 153 (76.5%) of cases received the correct dose of antibiotics.

Common signs and symptoms of infection, such as fever and increased white cell count, are not apparent in SAM children. Thus, treating hidden infections in SAM children with routine antibiotics is required in all cases, regardless of the sign and symptom of the infection (FMOH 2019). In the current study, overall adherence to step 5 (treat routine infections) was 41.5%. All SAM children received routine antibiotics for infection; 81.5% of them were treated with the correct types of antibiotics (Ampicillin and Gentamycin, followed by Amoxicillin), and 76.5% of them were prescribed the correct dosage of antibiotics. Similar findings were reported for all children with SAM cases treated for presumed infection in Kenya, Busia Country Referral Hospital [28] and Moi Teaching and Referral Hospital, Eldoret, Kenya [14, 15]. The similarity in finding for this step could be that the age of the children included in the study was 6 to 59 months, and the study design used was retrospective cross-sectional. This study was higher than the study conducted in the Upper East Regional Hospital of Ghana, where 88% of children were treated for presumed infection, of which only 8% received ampicillin and gentamycin [12]. Regarding overall adherence, the step 5 study conducted in Al-Sabah Hospital, Juba, South Sudan 58% [27], Kenyatta National Hospital in Kenya 90%; [22], and Garissa Provincial General Hospital, Kenya 89.5% [15] was highly adherent compared to the current study (41.5%). The discrepancy with this study was estimated to be the age of the children involved in the study, the study design and period, and the country health service quality difference.

Step 6: Correction of Micronutrient Deficiency:

In this study, Vitamin A supplementation was given and recorded only for 83 (41.5%) of the cases, and more than half, 117 (58.5%) either didn't receive vitamin A supplementation or it was not recorded. Among those children who received vitamin A supplementation for eye signs, 68 (93.1%) of them received the expected high dose, 67 (91.7%) received the correct dosage of vitamin A, and 61 (83.5%) received vitamin A at the right frequency on days 1, 2, and 15.

From a total of 200 cases, the majority, 147 (73.5%) didn't receive iron as recommended by the guideline, 37 (18.5%) received it during phases I, 11 (5.5%) received it during transition, and 5 (2.5%) received it during the rehabilitation phase. Folic acid and zinc sulfate were given to 23 (100.0%) and 87 (100.0%) of the indicated cases to treat micronutrient deficiency, respectively. To prevent micronutrient deficiency and treat intestinal parasites that can cause micronutrient deficiency, mebendazole is recommended for SAM children. More than two-thirds, 139 (69.5%) of the study participants didn't receive mebendazole during the management in the hospital, and only 61 (30.5%) were supplemented with mebendazole.

All severely malnourished children with eye signs require vitamin A immediately on day 1, with other eye care followed by days 2 and 15. SAM children are at high risk of anemia, and iron supplementation is recommended only when the child is gaining weight, if not on RUTF or F-100 after phase 1 (the stabilization phase) of the management [2]. In this study, vitamin A supplementation was given and recorded in only 41.5% of the cases, and 93.1% of them received the expected high dose of vitamin A.

Correct dosage and frequency were reported in 91.7% and 83.5% of children receiving vitamin A supplementation, respectively. The adherence level to step 6 (correction of micronutrient deficiency) was 34% in this study. The current study reported better adherence to vitamin A supplementation compared with a study conducted in Upper East Regional Hospital in Ghana, in which none of the children supplemented with vitamin A during management [12]. In Al-Sabah Hospital, Juba, South Sudan, 58% [27] and Garissa Provincial General Hospital, Kenya, 89.6% [15] of adherence to step 6 were reported, which was higher than the current study, and in Kenya, Busia Country Referral Hospital, only 20.8% [28] of SAM children were supplemented with micronutrients, which was much lower than the current study. The differences in the finding could be the study period variation, study methodology, and type of data used, and study country difference.

Step 7: Initial Feeding:

All children with SAM cases are expected to be treated with the F-75 starter formula, which contains low protein and calories that do not overwhelm the child's body system, before the F-100 feeding. In this study, all 200 (100.0%) SAM cases hospitalized were given the F-75 starter formula as an initial feeding. The F-75 feeding routes of administration were by cup and NGT for 128 (64.0%) and 72 (36.0%) of the children respectively. For children with SAM cases hospitalized, the frequency of feeding and daily monitoring and documentation of the feeding play an important role in the recovery of the child and shortening the length of hospital stay. More than half, 115 (57.5%) of the children feed on 3 hourly bases, 67 (33.5%) on 2 hourly bases, and the remaining 18 (9.0%) feed on 4 hourly bases. Among the study participants, 148 (74.0%) had their feed intake monitored and documented on a daily basis. The mean and SD of days the children feed on F-75 were 4.76 ± 1.93 days, with a minimum and maximum of 2 and

12 days respectively. Monitoring the body weight of the children during the initial phase of feeding will help to change the treatment phase and evaluate the weight gain of the child. Weight monitoring was done for 153 (76.5%) of the children.

Table 4: Initial feeding volume, frequency, route and monitoring and documentation in SAM children AHMC, December 2023.

<i>Variables</i>	<i>Response</i>	<i>Frequency</i>	<i>Percent</i>
Correct volume of F-75 prescribed	Yes	156	78.0
	No	44	22.0
Correct frequency of initial F-75 feeding	Yes	67	33.5
	No	133	66.5
Initial frequency of F-75 feeding	2 Hourly	67	33.5
	3 Hourly	115	57.5
	4 Hourly	18	9.0
Number of days the child on F-75	< or = 3 days	51	25.5
	4 to 7 days	130	65.0
	> or = 8 days	19	9.5

During initial feeding a low-protein and energy diet is recommended for SAM children to prevent overwhelming their body systems that can be provided by the F-75 starter formula. WHO recommends all children with SAM admitted to SC start small and frequent feedings with a 2-hourly schedule, and feeding must be monitored [2]. In this study, all children received the prescribed F-75 starter formula; 78% of them received the correct volume with only 33.5% feed with the correct frequency of 2 hourly at the recommended initial feeding; and 74% of children were monitored for body weight, making the overall adherence to step 7 of the management 35%. In less developed countries, hospitals reported only 24% of children monitored for body weight in the hospital [31], which was three times lower than the current study's finding. Over 97% of children admitted to the hospital received therapeutic diet F-75 in Upper East Regional Hospital in Ghana [12], which was almost similar to this finding, and in Moi Teaching and Referral Hospital, Eldoret, Kenya, 100% [14,15] of children were prescribed F-75, which had a similar finding. In South Sudan, 62.7% [21] and in Kenyatta National Hospital, Kenya, 55% [22] of children received F-75 formula feeding, which was much lower compared to this study's finding of F-75 formula. In Al-Sabah Hospital, Juba, South Sudan, 97% [27]; Garissa Provincial General Hospital, Kenya, 91.7% [15]; and Busia Country Referral Hospital, Kenya, 100% [28], adherence to step 7 was reported to be much higher than this study's 35%. Variation between the current study and other findings is primarily related to the sample size employed, the type of data collected, the study design implemented, the number of hospitals included in the study, and the knowledge gaps of health care workers.

Step 8: Catch-up Growth Feeding:

Following the transitional phase of SAM management, children are fed on F-100, which has a higher calorie and protein content than F-75. The majority of 186 (93.0%) children were prescribed F-100, and 103 (55.3%) received the correct volume of F-100. The volume of F-100 should be increased by 10 ml per feed up to a maximum of 130 ml. In this study, the volume of F-100 increased only for 73 (39.2%) of children.

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Table 5: Catch-up growth feeding (F-100) for SAM children Adama Hospital Medical College, December 2023

<i>Variables</i>	<i>Response</i>	<i>Frequency</i>	<i>Percent</i>
F-100 prescribed for children	Yes	186	93.0
	No	14	7.0
Initial volume of F-100 correct	Yes	103	51.5
	No	97	48.5
Volume of F-100 increased appropriately during and after transition phase (n=186)	Yes	73	39.2
	No	113	60.8

Catch-up growth feeding for SAM children is provided by F-100 formula feeding, which gives 2.9 g of protein and 100 kcal of energy per 100 ml of feed after the children are stabilized [2]. For the majority of children included in this study, F-100 formula feeding was prescribed, of whom 55.3% fed with the correct volume, and in 39.2%, F-100 volume increased per feed, contrary to WHO recommendations that the amount of feed should be increased by 10 ml up to a point where some remains uneaten [16].

The adherence level for step 8 in this study was evaluated at 39%. In South Sudan, 68% (3), Kenyatta National Hospital in Kenya, 23.8% [22], and Moi Teaching and Referral Hospital,

Eldoret, Kenya, had 100% [14,15] of SAM children admitted to SC-prescribed F-100 catch-up growth feeding. In a study conducted by Salih and Nzioki et. al., children prescribed F-100 were lower than in the current study, while a study done by C. Respher showed similarity in F-100 prescriptions for SAM children in the management. Comparison of adherence to step 8 in different studies: Al-Sabah Hospital, Juba, South Sudan, 86% [27]; Garissa Provincial General Hospital, Kenya, 87.5% [15]; and in Kenya, Busia Country Referral Hospital, 91.9% [28], reported appropriate management children for step 8 that had higher adherence than the current study. The higher adherence in Step 8 in different countries could be due to differences in study area, study time, age group of study population, time of study, availability of formula milk, and knowledge gaps among service providers.

Adherence to MOH Guideline in SAM Management

The overall adherence of each child was determined by whether all steps of management were followed. Accordingly, the overall adherence level to MOH guidelines in the management of SAM cases in the hospital was 31 (15.5%), ranging from 41 (20.5%) to 131 (65.5%) to prevent or treat hypoglycemia and hypothermia respectively. A detailed level of adherence for all steps is presented in the table below.

Table 6: Level of adherence to MOH Guideline by steps of management, AHMC, December 2023

Management Steps	Adhered		Not Adhered	
	Freq.	%	Freq.	%
Step 1: Prevent or treat hypoglycemia	41	20.5	159	79.5
Step 2: Prevent or treat hypothermia	131	65.5	69	34.5
Step 3: Prevent or treat dehydration	64	32.0	136	68.0
Step 4: Correct electrolyte imbalance	57	28.5	143	71.5
Step 5: Treatment of routine infection	83	41.5	117	58.5
Step 6: Correct micronutrient deficiency	68	34.0	132	66.0
Step 7: Initial feeding of F-75	70	35.0	130	65.0
Step 8: Catch-up growth feeding with F-100	78	39.0	122	61.0

This research evaluated overall adherence to MOH guidelines and the specific appropriateness of management for each step and found complete adherence only for 31 (15.5%) children included in the study. The highest adherence was observed on step 2: prevent or treat hypothermia (65.5%), while the lowest adherence was on step 1: prevent or treat hypoglycemia (20.5%). This indicated that overall adherence to the guidelines was inadequate. The finding was similar with the West Cape of South Africa [26], hospitals in underdeveloped countries [31], and the North provenance of South Africa [13], and lower than study in Busia Hospital of Kenya [28], Nigeria Borno State 73.9% [32], and quality of care for SAM children in Ethiopia 55.8% [19].

In contrast, the current study was three times higher than the study conducted at Moi Teaching and Referral Hospital of Kenya 4.5% adherence [14, 15] and similar, with poor adherence to guidelines reported from Felege Hiwot Hospital of Ethiopia as a barrier to SAM management [34]. Inadequate initial assessment, inappropriate management of SAM cases, and inadequate monitoring were reported for 76% of children in research conducted in 21 hospitals in underdeveloped countries [31], while in this study inappropriate management and non-

adherence to guidelines were identified in 84.5%. This difference could be the number of hospitals included in the study in various countries, sample size in the study, type of data used for the study, and study design, while this study included only one hospital and used secondary data with a retrospective descriptive study.

Treatment Outcome of SAM Children

In the study, 126 (63.0%) of the children stabilized in the Outpatient Therapeutic Program (OTP), where they continued and completed their management at the health center or health post level, while 40 (20.0%) of the children were cured. Five (2.5%) of the cases stayed for more than 16 weeks in the hospital and were discharged as non-responders to treatment, and four (2.0%) disappeared from treatment and were recorded as defaulters. Children transferred out to other health facilities were 25 (12.5%), and none of the cases died while on treatment.

Treatment outcome indicators of SAM cases are generally categorized as favorable outcomes (cure and stabilized to OTP) and unfavorable outcomes (died, defaulted, non-responder) [16]. In this study, the preliminary favorable treatment outcome met with SPHERE standards [25] and MOH guidelines [2], which recommend > 75% favorable outcome, < 10% death, and < 15 defaulter rate among SAM cases on the therapeutic feeding program. However, it was slightly higher than the treatment outcome of SAM cases admitted to Southern Ethiopia Hospital, with 70%, 15.2%, and 15.2% of the cases improved and been discharged, defaulted, and died, respectively [35]. A similar finding was reported from GADO Outpatient Therapeutic Center in Cameroon, with no deaths among SAM case fatality rate reported from Africa hospitals 35% [13], Pawe General Hospital cases [37]. The, Northwest Ethiopia, 16% (4), and North West Ethiopia, University of Gondor Hospital, 12.5% [39] had high case fatality rate compared to this study that found no death among SAM cases in the hospitals. A study conducted in Kabale District in Southwestern Uganda reported a cure rate of 36.3%, a defaulter rate of 58.6%, a non-responder rate of 0.5%, and death rate of 1.1% for the outcome of SAM cases [40], which had a discrepancy with the current study that may relate to the management practice of health care workers in the hospital and adherence to the management guidelines.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The overall adherence to MOH guidelines in management of SAM was 15.5% and the study concluded that there was very low adherence to MOH guidelines in the management of SAM cases at AHMC. Specifically, appropriate treatment for SAM cases in each step ranges from 20.5% to 65.5% for hypoglycemia and hypothermia, respectively. Even though MOH and WHO recommend a complete follow-up of each step in hospitals, the appropriateness of all steps was below standards.

In the management of SAM cases, a >75% cure rate is expected and recommended by WHO and MOH. According to this finding, only 20% of SAM children were cured and discharged, while 63% stabilized at OTP. Favorable outcomes were recorded at 83% (cured and stabilized to OTP), while 17% of them had an unfavorable outcome, that met the expected treatment outcome indicators of WHO, MOH, and SPHERE standards.

The study found that ALOS in the hospital for SAM cases was 13.6 days, which was also longer than the recommended 3 – 7 days duration. Longer ALOS in hospital increases the chance of health facility-acquired infections, extra use of hospital resources, and a burden on households.

Recommendations

- Close follow-up and supervision with periodic monitoring need to be in place to improve adherence to MOH guidelines, appropriate treatment of SAM children, and shorten ALOS.
- This study included only one hospital. Therefore, for greater representativeness a large-scale assessment on adherence levels to MOH guidelines needs to be conducted.
- An advocacy workshop needs to be conducted for health sector leaders, CMAM implementating partners, and hospital medical directors regarding adherence to MOH guidelines.
- Availing and ensuring proper utilization of SAM management manuals and MOH guidelines in the management of SAM for HCWs is required at AHMC.
- The MOH and CMAM implementing partners should provide capacity-building training, on-the-job orientation, mentoring, and coaching for health care workers working on SAM case management in the pediatric ward of AHMC.
- Further studies need to be conducted to determine factors affecting adherence to MOH guidelines and the length of hospital stay at AHMC.

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