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Severe Acute Malnutrition (SAM) Evaluation of Associated Risk Factors, Screening Tools, and Therapeutic Management among South Sudanese Children Age 6<59 Months in Emergency Settings: Case Reports and Review of Literatures

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Abstract

Severe Acute Malnutrition (SAM) is a major silent killer among children under five years of age, in low resources settings. It's also being regarded as a disease of hungry communities. Therefore, to assess and classify an individual nutritional status under SAM is by anthropometry that determines body measurement. Measurable variables, age, sex, weight, height and Mid-Upper Arm-Circumference (MUAC) for children 6-59 months. SAM characterized with visible wasting and bilateral edema, in infants <6 months. However, social criteria like the absence of a mother or inadequacy of breastfeeding predict nutritional risk. Once more, SAM in U5 assessed by nutritional indices of Weight-For-Height (WFH), MUAC, and bilateral edema. Children 5-19 years BMI-for-age plus clinical signs are used. MUAC preferable during pregnancy. WHO Growth Standards of 2007 suggested over NCHS 1978. Nutrition indices in Z-scores opposed to median percentage. Median off use in classifying individual's nutritional status. Methods and protocols for assessment of children 6-59 months are more developed than for other age. Therefore, best practice to produce functional outcomes is needed. The level of malnutrition at admission phase influences hospitals stay. Evidence suggests that malnutrition is more frequent and severe among males than females. Implications, no special consideration in severe acute malnutrition admitted in a critical phase". Protocols to discharge patients upon recovery needs harmonization. MUAC misdiagnose Kwashiorkor children due to fluid retention but remains a reliable tool. Ready to Use Therapeutic Food (RUTF) used for management of SAM. The study aimed to evaluate the effectiveness of screening tools, therapeutic interventions and shed light on the risk factors associated with SAM. A later effect includes but not limited to mental retardation, poor school performance, and low self-esteem.

Keywords: Severe acute malnutrition; Risk factors; Therapeutic; Emergency; South Sudan

Abbreviation:

MUAC: Mid-Upper-Arm Circumference; CMAM: Community Management of Acute Malnutrition; SAM: Severe Acute Malnutrition; WHO: World Health Organization; UNICEF: United Nation Children's Fund; OTP: Outpatient Therapeutic Program; SFC/TFP: Supplementary Feeding Center/Program/Therapeutic; NCHS: National Center of Health Statistics; RUTF: Ready to Use Therapeutic Food; BMI: Body Mass Index; WFHZ: Weight For height Z score

Introduction

Malnutrition is the clinical condition that affects all age groups, with high prevalence among impoverished populations [1] and it remains as a major public Health threats in Sub-Saharan Africa particularly countries under emergency situations [2], Malnutrition is categories into two forms; undernutrition (wasting, stunting, and underweight) associated with lack of nutrients in the body due to dietary deficiency or imbalances of calories, protein and micronutrients the phenomenon most common in low-income countries [3,4]. Overnutrition, having enough to eat, individual health believes the model that grossly resulted in obesity too many calories, the prevalence in high and middle-income countries [4].

However, World Health Organization (WHO) defined Malnutrition as "cellular imbalance between the supply of nutrients and energy and body's demand for them to ensure growth, maintenance, and specific functions" [3-5]. Nutritional imbalance is a major contributor to Severe Acute Malnutrition (SAM) in an emergency situation [6], It's established fact that, SAM in U5 years children are a Neglected Tropical (NTD) [7] and Non-Communicable Disease (NCD) among low-income impoverished communities [7,8] with the highest risk of dying [9,10]. Child Malnutrition or SAM is a known leading cause of death and disability worldwide [6,11]. However, the scale of SAM is much common during rapid onsets of emergency and chronic emergency scenarios [12]. The levels and trends of child malnutrition tend to vary from year to year depending on several factors, WHO/UNICEF/World Bank Group joint report 2017 pointed out that, Stunting affected an estimated 150.8 million children under the age of 5 globally in 2017 and 50.5 million cases due to Wasting while an estimated 5.6% or 38.3 million children were overweight in 2017.

However, on contrary note, an approximate of 20-40 million children U5 years potentially suffered from SAM per annum [3,4] while 0.5 miliion die of SAM each year rounds, depending on reporting system [4,13]. However, cases of SAM are on the rise as

exposed in the study conducted by William PC et al. that SAM affects more than 18 million children worldwide, and accountable for up to 1 million died in the age bracket of U5 years [4,5,8]. Nonetheless, the intensity of moderate malnutrition (MAM) as the precursor of SAM has a high prevalence in countries with increasing emergencies such as South Asia and Sub-Saharan Africa [5,14]. 800 million children stunted worldwide [4] of which 195 million U5 years stunted [15]. 85% of global stunted children in lives in 20 countries. The stunted condition is not reversible after a certain age in life for proper management nutritional interventions to be targeted to children below 18 months and pregnant women [3,5].

South Sudan is one of the worst affected countries in the world with emergencies situation, among others [16] as in Figure 1. It experiences cycles of civil unrest that necessitate humanitarian emergency response to rescue 5.5 Million people in dare needs [3,4]. However, South Sudan remains "The Hungriest place on Earth". Since the outbreak of violence in 2013 [16]; four countries in the world are badly stricken by humanitarian crises and therefore having high cases of SAM mortality and morbidities includes South Sudan, North East Nigeria, Yemen and Somalia, with 1.4 million children at imminent point of death [3,16] The prevalence of acute malnutrition defined by weight-for-height and bilateral edema in children 6-59 months is frequently assessed in emergencies and used to determine response and to identify target groups and geographical areas at risk [4,16]. It reflects recent changes in dietary intake and infection and acts as a proxy for the nutritional status of the entire population [4,17]. The concern, however, is not just for the children who are classified with moderate or severe acute malnutrition, but for the entire population whose nutritional status is sub-optimal [3,4]. However, severe Acute Malnutrition (SAM) is the most serious form in emergency settings causing high mortality and morbidity among children aged 6-59 months across the former 10 states of South Sudan [3,16]. Three clinical manifestations are known to associate with SAM [4], such as Marasmus a condition with severe weight loss or wasting of muscles while kwashiorkor associated with bi-lateral edema then a combination of 2 Marasmic-Kwashiorkor, wasting and bi-lateral Edema co-exist [4]. Not only that but also chronic malnutrition and stunting occurs in latency progression, just unlike SAM, children with Chronic malnutrition appears normal in proportion but actually shorter than expected threshold for his/her age [18]. However chronic condition start before birth as an influence by; poor maternal nutrition, poor feeding practice, low food quality, and frequent infections possibly lower down growth response [18,19]. The developmental, economic, social, and medical impacts of the global burden of malnutrition are serious and lasting, for individuals and their families, for communities and for countries (Figure 2).

There are several factors that increase the chances of children under 6-59 months of dying from malnutrition or being affected by the condition, a study conducted in Southern Ethiopia by Tadesse et al. among 1,048 Malnourished children admitted in Outpatient Therapeutic Program (OTP) revealed that children with severe edema on admission had the highest mortality rate of (12.0% 9/75) [20]. Furthermore, SAM children admitted in OTP after 2 weeks were still acutely malnourished during the time of discharge as set in program criteria [20], severe edema increase the length of hospital stay [20-22] This is in agreement with Prasad V, et al., findings 76% of SAM children improved over 4-6 months of management [23]. Consistent evidence was a study at Therapeutic Center, Gado Refugee Camp Cameroon where 254 children enrolled, and 72.8% got discharged as fully recovered [24].

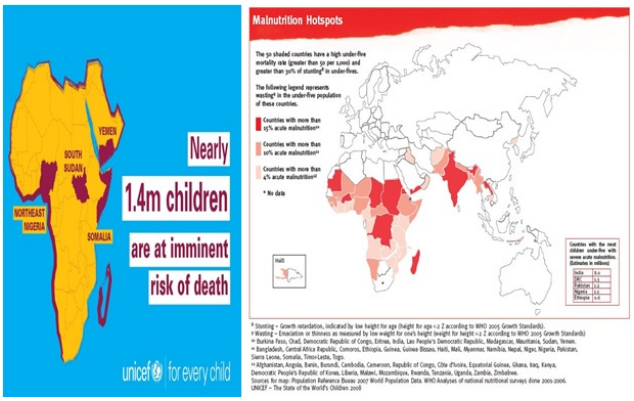

Figure 1: Countries affected by emergencies and severe acute malnutrition in U5 years children (Adapted WHO/UNICEF 2017) [3,4].

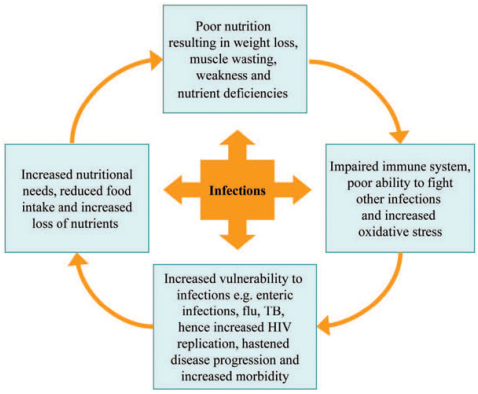

Figure 2: Malnutrition infection cycle adapted from Tomkins and Watson, 1989 by UNICEF.

Risk factors associated with SAM in children age 6-59 months

A similar study carried out in Uganda by Nabukeera-Barungi N, et al., to Predict mortality among hospitalized children with severe acute malnutrition, exposed that, diarrhea, lack of appetites, suspected sepsis and skin ulcers including chest indrawn, oxygen saturation and HIV infection are predictors of mortality in SAM patients [25]. Stunting associated with increasing child age, low birth weight, low maternal weight, and low paternal height, while wasting associated with younger child age, and low maternal BMI [26]. Growth faltering and early life exposures may be important determinants of malnutrition in South Sudan; however, child growth does not recover to the median [11].

Mathur, A. et al revealed that SAM is related to underweight, stunted growth, wasted, and oedematous in children <24 months, where more males were affected than females [20,27,28]. This is consistent with the study carried out to determine the risk factor for SAM in the district of Tharparkar-Sindh, Pakistan, by Sand A et al. reported that, male children were more malnourished than females with 55% and 45% [20,27,28]. In addition, Kabalo, MY et al.

demonstrated that Children with edema recover better than those with severe wasting in the outpatient therapeutic program [20,27].

While factors related to SAM frequency among rural impoverished communities; maternal education level, household income, family size, breastfeeding period, vaccination status, weak to suckle, not gaining weight despite feeding, insufficient breast milk, the absence of mother and frequent infections associated with the severe acute malnutrition [9,10,29].

Life-Threatening Events (LTEs) as infections require re-hospitalization or causing death in relation to anthropometric of SAM is mainly attributed to pneumonia and diarrhea, however, mental retardation sometimes blamed for acute malnutrition [30]. Nonetheless, early and high case fatality of SAM linked to preference for traditional management than conventional care [31], child negligence by parent [9], misdiagnosis of SAM, lack of specialized personnel to deal with complex cases, inadequacy of beds and small size health centers and lack of uniform protocols to discharge patients upon recovery [20,31]. WHO guidelines, even though relatively simple to implement, no clear difference made in severe acute malnutrition cases that are admitted in a critical point [31].

The severity of disease at the time of admission influences the length of stay in hospitals and increased the likelihood of malnutrition in male infants' demographic and educational risk factors in the home environment could influence acute and chronic malnutrition [17,18,20]. Evaluating individual Clinical forms of acute malnutrition; -the diagnosis of SAM can be missed capturing children in with Kwashiorkor due to body weight relatively dominated by fluid retention and to an untrained eye as results of Kwashiorkor children looking fleshy though suffered from SAM [17,18].

Historical information concerning diet, health status, the drug used, and Socioeconomic Status (SES) collected for assessment and evaluation [1,19,32]. Anthropometric data measurement of physical characteristics, such as height and weight Physical examination require advanced skills and to reveal nutrition imbalances Laboratory test can detect early malnutrition [18,33] Other infections are contributors to mortality among children with severe malnutrition [20,25,31].

Although CMAM is an approach to treat large cases of Severe Acute Malnutrition (SAM) in a community setting, it basic screening tool Mid-Upper Arm Circumference (MUAC) for admitting and discharging SAM children is debated over reliability, effectiveness, and efficiencies [34,35]. There is no current community base stabilization centers sets up by the government due to lack of RUTF produce locally from presently available resources [36].

Nevertheless, admission and discharge criteria in the CMAM program lower cut off for MUAC <115 mm for admission and MUAC >=115 mm at discharge preferably a higher threshold [34]. Long distances between home and treatment centers, coupled with lower MUAC at admission, diarrhea, vomiting, fever, or a cough during treatment episode are companies with negative impacts (Figures 3 and 4) [9,34].

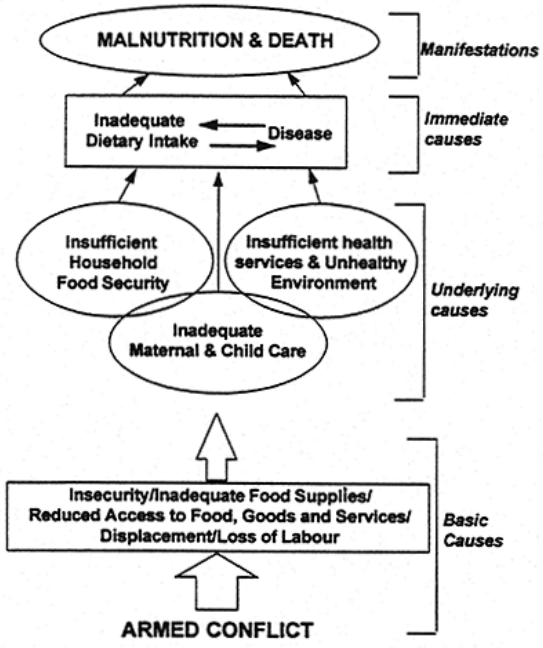

Figure 3: Conceptual model for causes of child malnutrition adapted from UNICEF and WHO [3,4].

Figure 4: Risk factors of dying from malnutrition in U5 years children.

SAM evaluation tools used in South Sudan context

Anthropometric: Evaluation of nutritional status relies on observable indicators. Nutritional assessment is of 4 methods; anthropometry, biochemical assessment, clinical assessment, and dietary intake. Anthropometry commonly used in emergencies, plus clinical diagnosis of visible wasting and bilateral edema [9].

The measurement of physical dimensions and body composition (height/length in children <24 months or <87cm in height), weight,

MUAC, age, and sex is anthropometry [37]. The cut-off points define the individual degree of specific malnutrition [15]. Individual Values of same sex and age are comparable e.g. a growth reference, reflects the expected values in a reference population [38]. However, MUAC and BMI, interpreted directly with cut-off points, without contrast to reference [37].

Evaluating malnutrition in <6 months toddlers

Anthropometric measures not suitable for this age, except in birth weight assessment as it's not an indicator of acute malnutrition [16,27,38]. Clinical signs and risk factors primarily use to admit infants <6 months into a selective feeding programme[16,39] However, in emergencies, a principal focus is on wasting, due to its relationship with morbidity and mortality [40]. Severe Acute Malnutrition (SAM) measurements is Indices in emergency, a weight for height z-score <-3 standard deviation [38,41].

Conversely, MUAC is the accurate diagnostic test for a severe wasting lower range of MUAC cut-offs (110 mm-120 mm), with higher cut-offs (140 mm-150 mm) [42], The optimal MUAC cut-off to detect severe wasting was 135 mm [43]. While also consider, Community case-detection of acute malnutrition that involves screening [38], SAM is distinct by MUAC <115 mm, and >90% for Global Acute Malnutrition (GAM), defined by MUAC <125 mm) [42,43] The parameters for SAM, effect of child health, birth history, age, sex, maternal and paternal health and education, and household wealth and sanitation on child nutritional status [11,44,45].

Screening and measurement in-depth

MUAC and Weight-for-Height Z-score indicator for the measure and classifying wasting in a child tape wrapped around the mid-upper arm (between elbow and shoulder) to be measured to nearest 0.1 cm [38,46]. MUAC is a rapid and good predictor of risks of death in children age 6-59 months, gaining use in adult nutrition status assessment [39,44].

WFHZ-score this is a calculation of two measurement weight and height into a single value to equate children of different ages [47]; use to evaluate how far a dimension from the median or average. AWHZ score calculation for individual indicates one's weight compare to the average weight of individual of the same height in the WHO growth standard (GS) [48].

A positive WFHZ score means individual measurement is higher than median weight value of an individual's of the same height in WHO GS, and a negative of the same height in WHO GS [48], while a negative WFHZ score indicates that individual's weight is lower than the average weight of an individual of the same height in WHO GS [47] (Tables 1 and 2).

The commonly calculated nutritional indices for children 6-59 months [39].

Nutrition Indicator	Condition
Weight-for-height (WFH)	An indicator of wasting and determine acute malnutrition. Reflects current weight gain or loss
Height-for-age (HFA)	A measure of stunting or best indicator for stunted growth used for determining chronic undernutrition (malnutrition), the reflection of skeletal growth [38]
Weight-for-age (WFA)	A composite measure that reflects, underweight or wasting and stunting or combination of both, steadily changing WFA can assume to be the result of changing WFH, meanwhile low WFA in older children more likely to be the result of low HFA hence an indicator used for determining underweight [38,39].
MUAC	Reflects recent weight loss or gain. A measure of wasting or acute malnutrition, MUAC functions in emergencies it determines the prevalence of malnutrition as a quick alternative to WFH, also act as 1st phase screening for selecting feeding intervention such as Supplementary Feeding Programs (SFP)or therapeutic feeding centers (TFCs) finally to admit children to TFCs [4,38].

Table 1: Measuring malnutrition in children 6-59 (60) months in an emergency.

Nutrition Indicator	Moderate Acute Malnutrition (MAM)	Severe Acute Malnutrition (SAM)
WFH (wasting)	≥ -3 SD and <-2 SD	<-3 SD
MUAC	≥ 115 mm and <125 mm (≥ 11.5 cm and <12.5 cm)	<115 mm <11.5 cm
MUAC age/height		<-3 SD
Bilateral Edema	No	Yes

Table 2: Classification of acute malnutrition in children 6-60 months.

The 1978 National Center for Health Statistics (NCHS) international reference was used to calculate nutrition indices among children 0-6 months till 2006 [22,48,49] when WHO introduced a new growth standard (WHO GS) endorsed in 2009 by WHO and UNICEF for identification of severe acute malnutrition [48]. Cut-off points presented as Z-scores (also called standard deviation (SD) scores) [4], furthermore, in the year, WHO/UNICEF also approved the cut-off point of MUAC <115 mm/11.5 cm (previously the cut-off was 110 mm/11.0 cm) as an independent admission criterion for the treatment of SAM [38]. A child with bilateral edema is classified with SAM [4,48]. The disadvantage of reference population curves needs updating from generation to generation to cope changes genetic evolution and differences in ethnic growth and development so the drawback in using MUAC is inaccuracy in measurement due to differing techniques [50,51] (Tables 3-9).

WHO/UNICEF/NCHS standardizes measurement of malnutrition by each parameter and cut-off point due for admission and discharges of children 6-59 months.

Category	% of the median	z-scores
Severe	<80%	<-3 z-scores
Moderate	<90% to>=80%	<-2 z-scores to >=-3 z-scores
Global	<90%	<-2 z-scores

Table 3: Height-For-Age (HFA) cut-off points in children 6-59 months.

System	Cut-off	Malnutrition classification
WHO	<-1 to <-2 z-scores	Mild

	<-2 to >-3 z-scores	moderate
	<-3 z-scores	severe
Road-to-Health charts	>80% of the median	Normal
	>60% to <90% of median	mild-to-moderate
	<60% of median	severe
Gomez classification	>90% of the median	Normal
	>75% to <90% of median	mild
	>60% to <75% of median	moderate
	<60% of median	severe

Table 4: Weight-For-Age (WFA) cut-off points in children aged 6-59 months.

Acute malnutrition using WFH	% of the median	Z-scores	Edema
Severe	<70%	<-3 z -scores	Yes/no
	>70%	>-3 z - scores	yes
Moderate Global	<80% to > =70%	<-2 z-scores to >=-3 z-scores	No
	<80%	<-2 z-scores	Yes/no

Table 5: Definition of acute malnutrition using weight-for-height and/or edema in (Children aged 6-59 months old).

Agency	Age group	Moderate acute mal.	Severe acute malnutrition
The sphere project	6-59 months	110-125 mm	<110 mm
Medecins Sans Frontiers (MSF, in press)	12-59 months	<12 months	<110 mm <100 mm, or <110 mm in poor clinical condition.
WHO	6-59 months	Differs accord. to age	Differs according to Age

Table 6: MUAC cut-offs recommended by different agencies.

Category	% of the median	z-scores
Severe	<80%	<-3 z-scores
Moderate	<90% to >=80%	<-2 z-scores to >=-3 z-scores
Global	<90%	<-2 z-scores

Table 7: Height-For-Age (HFA) cut-off points in children 6-59 months.

System	Cut-off	Malnutrition classification
WHO	<-1 to <-2 z-scores	mild
	<-2 to >-3 z-scores	moderate
	<-3 z-scores	severe
Road-to-Health charts	>80% of the median	normal
	>60% -<90% of median	mild-to-moderate
	<60% of median	severe
Gomez classification	>90% of median	normal
	>75% -<90% of median	mild
	>60% -<75% of median	moderate
	<60% of median	severe

Table 8: Weight-For-Age (WFA) cut-off points in children aged 6-59 months.

Name of product	Salter hanging scale	Seca 835	Seca 835	Leicester height measure	TALC/MUAC tapes
Max/minimum	0-25 kg	0-136 cm	0-130 cm	75-205 cm	0-390 mm
Gradations	100 g	20 g for babies 100 g for adults	1 mm	1 mm	1 mm
Other details	robust, reliable suspended weighing scale, provided with pants	combined adult/baby digital scale (uses batteries) has removal baby tray, weight hold, tare and power down features	wooden height/length board+head block	Used/UNICEF lightweight consists of a foot plate of 4 section measuring, Column. Complete with, lightweight, portable case	Durable material
Recommended Use	Nutrition surveys for U5 children	Nutrition surveys including	Nutrition surveys 6-59 months	Nutrition surveys of adults.	Nutrition surveys to, Complement WFH. Two-stage screening

		infants <6 months and older Children or adults. TFCs		TFCs admitting adults	

Table 9: Measurement tools.

Therapeutic management of SAM in children 6-59 months

WHO/UNICE standardize the management of acute malnutrition by improving outcome and preventing complications with the introduction of therapeutic milk and ready-to-use therapeutic foods [31,36,41] stock-outs of nutritional supplements [52], Cow milk can be used with sugar-maize-soybean-vegetal oil preparations is an acceptable alternative [41]. RUTF used in low-income communities and Oral Nutritional Supplement (ONS) used in affluent societies [3,36,53]

Furthermore, Ready-To-Use Therapeutic Foods (RUTFs) from local products, with reduced milk content lower costs [3,36,52]. Routine short-term antibiotic (amoxicillin) and long-term antibiotic (cotrimoxazole) to treat pathogenic bacteria flourishing in the intestinal microbiome of malnourished children plus deworming, vitamin A supplementation includes measles vaccination [3,37].

SAM treatment with amoxicillin dose of 40 mg/kg twice daily and antimicrobial to be continuing for more than 2 days upon the clinical condition of a child [8,53], this is in line with WHO Guidelines recommends, oral amoxicillin for children with uncomplicated malnutrition while parenteral benzylpenicillin and gentamicin for complicated cases due to cost pressure and increasing resistance of antimicrobial administration of antibiotics for children with SAM is a hot debate of time [4,8] (WHO). Severe malnourished children with anemia; blood transfusion could be given if Hb <4g/dl or respiratory.

Distress and Hb is between 4 g/dl and 6g/dl [8]. Treatment regimens whole blood 10 ml/kg body weight slowly over 3 hours [8]. Furosemide 1 mg/kg IV at the start of transfusion and if a child with anemia has signs of cardiac failure then give transfuse packed cells (5-7 ml/kg) instead of whole blood [4,8] (UNICEF and WHO). Anthropometric recovery a goal standard for treating SAM in childhood, in addition, prevention of short-term death such as minimizing risks of infections, the frequency and level of risks of serious illness and changes during management interval [30].

Common signs and symptoms of malnutrition

Poor appetite, weight loss, Jaundice (yellowing of the skin and white eyes) and increase thirst or vomiting and diarrhea plus behavior changes as well as excessive drooling (Figure 5).

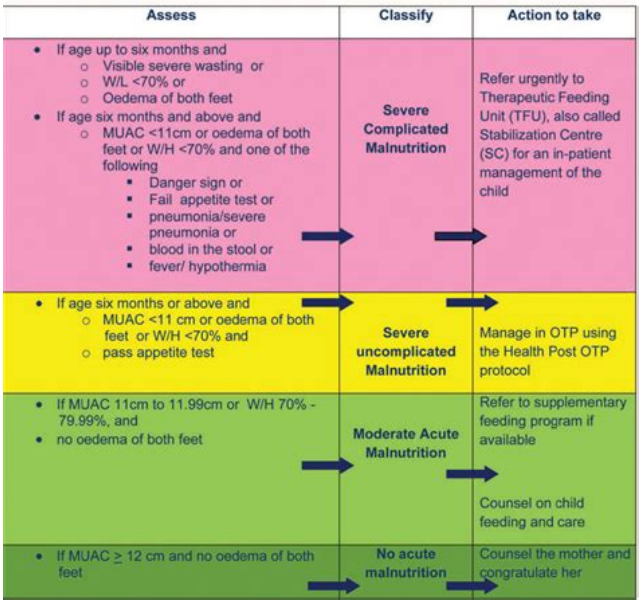

Figure 5: Evaluation of SAM signs and symptoms, category level, and therapeutic action.

Prevention strategies for severe acute malnutrition (children 6-59 months)

- Improve water supply, sanitation, and hygiene among rural settings
- Provision of Nutritious food security to poor households both in quantity and quality
- Provide adequate nutrition for mothers and children to minimize SAM cases [36]
- Promotion of early initiation and exclusive breastfeeding through 6 months for at least 2 years period of time UNICEF/WHO recommendation [4]

Perspective strategies and approaches in the management of SAM cases in children 6-59 months

SAM management requires integration of Community-Based Management Of Acute Malnutrition (CMAM) into the government primary health care system [27]. There is a need to attain peace and stability in the country to allow an enabling physical environment for the intervention of SAM by integrating CMAM into PHC [54].

Besides, it's necessary to strengthen the existing health care facilities through training health staff, paid and voluntary community workers, and provision of timely and constant supply of medicines and logistics to the functional facilities as immediate priorities [19].

Ensuring access and availability of Ready-To-Use Therapeutic Food (RUTF) is an important element of integrating CMAM into government PHC [3,55].

Not only that but also encourage production of locally RUTF for effective integration of CMAM into the health system policies [36,54]. Though World Health Organization guidelines had been used in program implementations in emergency situations for the management of SAM mortality outcome among U5 remain high in South Sudan [31]. The establishment of stabilization feeding centers and PHC scale up efforts of the integrated outpatient therapeutic program in decreasing SAM cases by bringing treatment nearer to the community [21]. Complicated SAM cases required setting adequate infrastructure and facilities for management of SAM cases [27,38].

Considerations for screening and case detection in the community, the current WHO definition of severe acute malnutrition may not warrant modification [21,43]. However, to target community outreach activities on severe acute malnutrition focusing on the types is crucial [20].

Not only that but also the programs promoting exclusive breastfeeding for at least 6-12 months or 2 years, vaccination, and early health care seeking behaviors and attitudes definitely would impact a reduction in SAM fatality rate [28].

Nonetheless, multi-sectoral approaches needed on girls education as the genesis of SAM lies in women KABP [56], poverty and food security strategies in the country to address the issue of malnutrition and over-dependence on humanitarian aids [18,57] above all security stability paramount [28].

Management of SAM at the community base is beneficial with fair results [23]. Therefore, SAM management engulf, trained personnel, functional facilities, and stock-out urgency of medicine and therapeutic diet not available furthermore, inconsistence protocols on import or local preparation of Ready-To-Use Therapeutic Food (RUTF) among partners, multi-sectoral coordination remains huge a gap [36] and above all no enabling environment in South Sudan as insecurity spread all over the states [54,57].

Once again, OTP constrained in service provision quality by health care system plus challenges of service utilizations beneficiaries should be identified and addressed for better out comes [21,36]. However, updating guidelines to use the combined protocol would eliminate the need for separate products, resources and procedures for MAM treatment [16]. SAM, harmonized and standard management protocols need to implemented across various settings [14,24]

Managing SAM with a medical complication

In an effort to bridge the gaps of child survival, WHO is providing training as lifesaving interventions for early identification, as well as referral and timely treatment of malnourished children [4,10,58] (Mr. Evans Liyosi, WHO Representative for South Sudan May 2017, https//www.who.int/malnutrition).

Furthermore, the World Health Organization SAM kit contained antibiotics, antifungal, de-worming, antimalarial and anti-scabies therapies, and a rehydration mix specific package to treat cases of SAM, in an effort of decreasing child mortality and improving maternal health care entirely relies on reducing malnutrition cases [3,59].

Nevertheless, the under-five mortality rate due to severe acute malnutrition could only be lowered by taking into consideration the physiological and metabolic changes [6]. WHO guidelines suggested that case-fatality rate can be reduced by 55% in hospital settings through management [4,58]. However, as of recent studies suggest that communities can use ready-to-use therapeutic foods to manage severe acute malnutrition in CMAM programs [6,60,61]. Double burden of malnutrition in the world helps to offer unique opportunities for integrated actions on malnutrition across all forms [62]. However, addressing the existing double burden of malnutrition will be a positive step to attaining Sustainable Development Goal number 2 and Target 3.4 of United Nation (SDG) [4].

Measuring malnutrition in older children and adolescents

WHO recommends that acute malnutrition among children and adolescents 5-19 years be assessed by calculating Body Mass Index (BMI), and then adjusting for age to generate BMI-for-age? BMI is calculated based on the weight (in kg) divided by the square of the height (in m) of the individual. BMI-for-age should be presented as Z-scores based on 2007 WHO Growth Reference (WHO GR) for children and adolescents 5 to 19 years of age (Table 10).

Conditions	BMI-for-age Z-score
Severe thinness:	<-3SD
Thinness:	≥ -3 SD and <-2 SD
Overweight:	>+1SD and ≤ +2 SD
Obesity:	>+2SD

Table 10: Classification of children and adolescents 5-19 years of age.

Measuring malnutrition in adults

SAM in the adult's priority group is assessed by use of BMI but not for pregnant women [26]. Sphere guidelines recommend that BMI is adjusted for the ratio of sitting height to standing height, or Cormic Index, though this is not often done in practice. MUAC in combination with clinical signs is often used to screen adults for admittance to feeding centers [3]. While cut-offs have been defined for BMI in adults [63], there is no international consensus on the cut-off points for classifying severe malnutrition in adults using MUAC [3]. The cut-offs shown below are commonly used during emergencies (Tables 11 and 12).

	Well-nourished	Mild acute malnutrition	Moderate acute malnutrition	Severe acute malnutrition
BMI(WHO 1995)	≥ 18.5	<18 to ≥ 17	<17 to ≥ 16	<16

Table 11: Cut-off points for BMI in adults.

Nutrition indicator	Moderate acute malnutrition	Severe acute malnutrition
MUAC	≥ 214 mm and ≤ 221 mm (women)	<214 mm (women)
(WHO)	≥ 224 mm and ≤ 231 mm (men)	<224 mm (men)
MUAC	<190 mm (women)	<160 mm (women)

(Ferro-Luzzi)	<200 mm (men)	<170 mm (men)
MUAC (SCN)	<185 and ≥ 160 mm plus clinical signs*	<160 mm
Bilateral Edema	No	Yes

Table 12: Classification of acute malnutrition in adults with MUAC.

Clinical signs include the inability to stand, evident dehydration and presence of edema [10]. For pregnant women of any age, BMI is an inadequate nutritional index because body weight will be due in part to the growing fetus [10]. MUAC is recommended as the preferred nutritional index for pregnant women [63] since it does not change significantly during pregnancy [26]. The Sphere Minimum Standards recommend a cut-off point of 210 mm (21.0 cm) for identification of nutritional risk in pregnant women in emergencies.

Measuring malnutrition in older people

BMI of elders be assessed and the same cut-off points as for adults applied. There are no global standard or reference populations for adults or the elderly at this time (Figures 6 and 7) [10,63].

Figure 6: SAM Assessment tools Weighing Scale, board, and MUAC tape common in South Sudan.

Figure 7: SAM Children <5 years old at CMAM SFP.

Limitation

The time factor was too short for quality review article to be design and reproduction, no specific research was done on a comprehensive analysis of severe malnutrition risks factors, therapeutic and assessment of tools in the emergency situation. Ridding tasks such as lectures, exams plus a review of two articles of Nutrition and Tropical medicine due for submission on same the date. First review article on Malnutrition in South Sudan hence limited data.

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