Prevalence of Acute and Moderate Malnutrition among Under Five Children in Three Counties of Western Lakes State, South Sudan

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Abstract

The prevalence of Severe Acute Malnutrition (SAM) and Moderate Acute Malnutrition (MAM) of under-five children, in South Sudan is considerably high and is being aggravated by various internal conflicts and food insecurity ravaging the country. The situation has attracted the attention of various international organizations like World Food Programme (WFP), United Nations Children Emergency Fund (UNICEF), and other international Non-governmental Organizations (INGOs), for possible interventions. However, the success of the nutrition therapy programme in reducing the prevalence of SAM and MAM among under-five children, as implemented by these humanitarian organizations is hinged on many factors.

A retrospective cohort study was conducted by collecting reported data from District Health Information Software (DHIS) of SAM and MAM prevalence of under-five children across three years; 2015, 2006 and 2007 for three counties, and was analysed using SPSS. Findings revealed significant differences in SAM and MAM within counties and among counties across the three years. It was further revealed that there was rising prevalence of SAM and MAM (poor impact) among the counties as the nutrition therapy programme progressed across the three years in the three counties. It was suggested, among others, that training and re-training of health and nutrition workers, timely availability of food supplements, ensuring food security, unwavering adherence to the principle of neutrality and impartiality on the part of INGOs and government, and conduct of pre and post-intervention surveys for feedbacks, may serve as the panacea towards the present unsatisfying state of the nutrition therapy programme in the war-torn Lakes State of South Sudan.

Keywords: Nutrition therapy, Prevalence, Malnutrition, SAM, MAM, and South Sudan.

Introduction

In a developing country like South Sudan, various socio-economic problems are common, and this is always associated with negative effects like food scarcity with consequential malnutrition effect on the people especially the most vulnerable groups-women and the under-five children. According to World Food Program (2013), the situation in South Sudan is being worsened by the continuous insecurity following various internal conflicts which has caught the attention of various world-acclaimed donors and international Non-Governmental organizations (INGOs) The term "malnutrition" is actually a category of diseases that includes any illness resulting from an imbalance of calories or micronutrients (e.g. vitamins), either in dearth or excess. This study focused on the on the prevalence of Severe Acute Malnutrition (SAM) and Moderate Acute Malnutrition (MAM) in under-five children in Lakes state of South Sudan. The main purpose was to evaluate the efficacy of the nutrition therapy program on the prevalence of SAM and MAM in Lakes state of South Sudan in the three counties where the program is being implemented, as study areas.

The nutritional status of women and children is particularly important, because it is through women and their off-springs that the pernicious effects of malnutrition are propagated to future generations. A malnourished mother is likely to give birth to a low birth-weight (LBW) baby susceptible to disease and premature death, which only further undermines the economic development of the family and society, and continues the cycle of poverty and malnutrition. Although child malnutrition declined globally during the 1990s, with the prevalence of underweight children falling from 27% to 22% (Onis et al., 2004a), national levels of malnutrition still vary considerably (0% in Australia; 49% in

Afghanistan) (WHO, 2003). The largest decline in the level of child malnutrition was in eastern Asia where underweight levels decreased by one half between 1990 and 2000.

Underweight rates also declined in South-Eastern Asia (from 35% to 27%), and in Latin America and the Caribbean the rate of underweight children decreased by one third (from 9% to 6%) over the last 10 years. In contrast, South-Central Asia still has high levels of child malnutrition, even though the rate of underweight children declined from 50% to 41% during the 1990s. In Africa, the number of underweight children actually increased between 1990 and 2000 (from 26 million to 32 million), and 25% of all children under five years old are underweight, which signals that little changed from a decade earlier. The projection for 2005 is that the prevalence of child malnutrition will continue to decline in all regions in Africa, especially in sub-Saharan Africa (de Onis et al., 2004b). The World Food Program (WFP) estimates that 842 million people worldwide do not have access to enough food, approximately 146 million of which are children. Those included in this estimate range from simply too little food to extreme malnourishment. Severe Acute Malnutrition (SAM) and Moderate Acute Malnutrition (MAM) have been recognized as the most serious type of hunger, with 20 million and 35 million respective cases each year occurring in children less than 5 years of age (Edesia, 2012). According to WHO (2009), SAM is defined as a child having a weight-for-height ratio >3 standard deviations below the mean for their age, and MAM is a weight-for-height ratio >2 but <3 standard deviations. A notable point is that the majority of these cases occur in South Asia and Sub-Saharan Africa.

This study was therefore directed towards unraveling the efficacy of nutrition therapy program, supported by WFP and UNICEF, on the SAM and MAM prevalence among under-five children in three counties (Rumbek North, Yirol West, and Cueibet) of Western Lakes State of South Sudan.

Statement of problem

The prevalence of acute malnutrition among under-five children, in South Sudan is reportedly high. Effective intervention in terms of nutrition therapy programme from the humanitarian organizations has always been playing a pivotal role in addressing the situation. However, the impact of the much needed programme may be confronted with various challenges which may serve as threats to the overall success of the interventions and hamper the achievement of the set goals in this regard. One of such problem is the internal wars besieging South Sudan, and food insecurity.

Conducting an impact study on the efficacy of the various therapeutic programmes as sponsored by UNICEF and WFP in South Sudan is therefore an important step to unravel the state of the programme, and to determine the possible challenges that may be confronting the system.

Justification of the study

Implementing nutrition therapy programme has become important in controlling the acute malnutrition level especially among under-five children, in sub-sahara Africa countries with poor resources, and low level of income with many people earning below one U.S dollar per day. But it is not without its challenges in which having the knowledge about its impact during the programme will be of great importance. Hence this study was intended to bridge this gap of knowledge regarding the impact of the nutrition therapy programme on the prevalence of SAM and MAM in the war-torn Lakes state of South Sudan. It will serve as a clue to the next line of action for all stakeholders involved in the implementation of the nutrition therapy services for this vulnerable group of people – the under-five children, especially in a yet unstable country, like South Sudan.

Background of study area

Western Lakes State was one of the ten states of South Sudan. It has an area of 40,235 km². Rumbek was the capital of the state. Lakes State was in the Bahr el Ghazal region of South Sudan, in addition to Northern Bahr el Ghazal, Western Bahr el Ghazal, and Warrap states. Bahr el Ghazal itself was a former province which was split from the Anglo-Egyptian or province of Equatoria, in 1948. The eastern border was the White Nile with Jonglei on the opposite bank. To the northeast lied the Unity State. Other borders included Warrap State towards the northwest, Western Equatoria to the south and west, and Central Equatoria to the south.

According to the population census conducted in 2008, Lakes state comprises of eight (8) counties, with their respective population thus; **Cuiebet (47,041), Rumbek North** (43,410), Rumbek Central (153,550), Wulu (40,550), Rumbek East (122,832), **Yirol West (103,190),** Yirol East (67,402), Awerial (47,041). This study was conducted in the three of the eight counties namely; Cueibet, Rumbek North and Yirol West.

Hypotheses

The two hypotheses of this study include;

1. Ho: There will be no significant differences in the prevalence of SAM and MAM among under-five children in each of the three counties, across the three years in Lakes State of South Sudan

H_1: There will be significant differences in the prevalence of SAM and MAM among under-five children, in each of the three counties, across the years in Lakes State of South Sudan

2. Ho: There will be no significant differences in the prevalence of SAM and MAM among under-five children, among the three counties, across the three years in Lakes State of South Sudan

H_1: There will be significant differences in the prevalence of SAM and MAM among under-five children, among the three counties, across the three years in Lakes State of South Sudan.

Literature review

Concept of malnutrition

Malnutrition can be defined as the lack of a sufficient quantity or quality of nutrients to maintain the body system at some definable level of functioning. It has been estimated that 37-80 per cent of all pre-school children in the developing countries suffer from protein calorie malnutrition as assessed by the manifestation of syndromes, nutritional indexes, and weight deviations (Bengoa 1974). Nutrition encompasses processes leading to and involved with the utilization of nutrients for growth, development, maintenance and activity. Malnutrition results from the inadequate intake of nutrients, or from disease factors that affect digestion, absorption, transport and the utilization of nutrients. (UNICEF,1992). World Health Organization defines malnutrition as the cellular imbalance between supply of nutrients and energy and body's demand to ensure growth, maintenance and specific function (WHO, 2000).

The nutrition status in South Sudan is poorly characterized by high level of underweight and chronic malnutrition, with persistently elevated level of acute malnutrition. Therefore, the available data about nutritional status of children under 5 years in South Sudan reflects the worse and miserable situation, especially in the marginalized rural areas but the situation is extending to urban area of Sudan. (Abdalla et al., 2009) The terms `malnutrition' and `under-nutrition', however, tend to be used interchangeably in the literature (Lehmann, 1991).

Epidemiology of global acute malnutrition

A recent analysis estimated that 32 out of 134 countries with available data had a prevalence of acute malnutrition1 of 10% or more, a burden commonly recognized as a "public health emergency requiring immediate intervention" Globally, these estimates equate to about 33 million children suffering moderate acute malnutrition and a further 19 million suffering severe acute malnutrition (UNICEF et al., 2012).

Prevalence of acute malnutrition may increase substantially with high levels of severe acute malnutrition and excess child mortality. For instance, global acute malnutrition (GAM) rose to around 40% in Southern Somalia during the famine in 2011, where an estimated 258,000 deaths occurred, over half of which were children (Checchi and Robinson, 2013). The prevalence of under-nutrition is highest in rural areas, particularly on commercial farms and in informal (urban and peri-urban shack) settlements. HIV Contributes to an increased prevalence and severity of under-nutrition and micronutrient deficiency in children. More than 50% of children with HIV-infection become stunted or underweight; and at least 1 in 5 develop wasting (HST, 2007).

Malnutrition contributes to between 35 and 55 percent of all childhood deaths. In acute emergency situations, malnutrition can account for even more. There are currently a number of classification systems related to nutrition related emergencies, most including reference to crude mortality rate

(CMR), under-five mortality rate (U5MR), and levels of acute malnutrition. The WHO classification system below provides simple guidance using thresholds for rates of global acute malnutrition (GAM). These thresholds are a reasonable starting point in assessing the severity of a crisis. (WHO, 2003) In the world, annually, over three million deaths occur from protein energy malnutrition (PEM) in the children under five (Stephan et al., 2000). Currently, 195 million under-five children are affected by malnutrition; 90% of them live in sub-Saharan Africa and South Asia. At least 20 million children suffer from severe acute malnutrition and another 175 million are undernourished (Black et al., 2008).

Global acute malnutrition in south sudan under-five children

South Sudan is a country where a brutal civil war has displaced millions of people, destroyed basic services, increased disease and exacerbated hunger and this has made malnutrition a chronic problem in South Sudan. According to World Food Programme (WFP, 2015) report, "every two minutes in South Sudan, another child becomes severely malnourished hence rates of Global Acute Malnutrition (GAM) are alarmingly high in the country. The scourge is well above the emergency threshold of 15 percent in most parts of the country, especially in the Greater Upper Nile States, Warrap and Northern Bahr el Ghazal and about a quarter of a million children have been reported to be severely malnourished (WFP, 2015); a recent report by the United Nations Children's Fund (UNICEF) (Voice of America (VOA), 2016) specifically submitted that seven out of the 10 states in South Sudan have reached the emergency threshold of 15 percent global acute malnutrition, while in Northern Bar el Ghazal the malnutrition rate is 33 percent. Tens of thousands of South Sudanese children under the age of five have remained at the risk of malnutrition-related death in spite of temporary improvements in the food security situation as reported by the Integrated Food Security Phase Classification (IPC) group of experts (UNICEF, 2014).

Unfortunately, high rates of disease, lack of safe water and lack of access to basic health care have actually hampered efforts being made to reduce malnutrition among under-five children through improvements in food security (UNICEF 2014). Diarrhoea and other illnesses prevent children from absorbing nutrients, so even in places where there is improved access to food; children can still be dangerously malnourished and those in conflict-affected areas, especially the 1.4 million people who are internally displaced – more than half of whom are children – are the most at risk (UNICEF, 2014).

Methodology

Study type: This study is a retrospective cohort study, with data collection from the District Health Information Software (DHIS) of the Republic of South Sudan. Data from three counties across three years-2015, 2016 and 2017 were obtained.

Study setting: This study was conducted across three counties in Western Lakes state of South Sudan. They include Cueibet, Rumbek North and Yirol West counties.

Study population: The study populations were the under-five children with either Severe Acute Malnutrition (SAM) or Moderate Acute Malnutrition (MAM), diagnosed by measuring Middle Upper Arm Circumference (MUAC) using MUAC tape.

Sampling frame: The sampling frames for the study are the eight counties (8) counties in the Lakes state, one of the major ten states of South Sudan. This study focused on three counties where nutrition therapy programme for under-five children is being implemented for three years 2015-217.

Data collection: Data was obtained from the District Health Information Software (DHIS) of South Sudan.

Data analysis: Data analysis was done using the Statistical package for Social Science (SPSS) version 21. Friedman Analysis of Variance (ANOVA) was used to compare SAM and MAM Middle Upper Arm circumference (MUAC) values of under-five Children across the three years in each of the three counties, while Wilconxon Signed Rank Test was used as post hoc analysis for Friedman ANOVA comparison of MUAC values for SAM and MAM across the three years. Kruskal Wallis was used to test for comparison of under-five children MUAC values for SAM and MAM across the three counties (in general), while Man Whitney U Test was used as the post hoc analysis for Kruskal

Wallis of MUAC values for SAM and MAM of under-five children across the three counties in the three years- 2015, 2016 and 2017. Statistical level of significance was set at P-value <0.05.

Ethical considerations: An approval to conduct the study was obtained from Health Research Ethics Committee of the State Ministry of Health (SMoH) of Lakes state in South Sudan, with endorsement of the Director General of the ministry.

Results

A total of 36 months data for SAM and MAM prevalence were extracted from the District Health Information Software (DHIS), for each of the three counties, across the three years-2015, 2016 and 2017.

Table 1. Friedman ANOVA comparison of SAM middle upper arm circumference of under five children across years 2015, 2016 and 2017 in each of the three counties

Year	2015	2016	2017		
County	Median (MUAC)	Median (MUAC)	Median (MUAC)	Chi-Square	p-value
Cueibet	134.00	315.00	200.00	5.167	0.076
Rumbek N.	18.00	27.00	51.00	8.167	0.017*
Yirol W.	45.00	71.50	243.50	0.500	0.779

*indicates significant difference at $\alpha = 0.05$

The table above revealed a significant difference in SAM MUAC values of Rumbek North County only, across the three years. It also showed a rising median values across the three years in the three counties.

Table 2. Wilconxon Signed Rank Test post hoc analysis for Friedman ANOVA comparison for SAM MUAC across years 2015, 2016 and 2017

County/Time Period	Chi-square	p-value
Rumbek North		
2015 vs 2016	0.863	0.388
2015 vs 2017	2.511	0.012*
2016 vs 2017	1.490	0.136

*indicates significant difference at $\alpha = 0.05$

The table above revealed that, the significant difference of SAM MUAC values in Rumbek North was between the 2015 and 2017.

Table 3. Friedman ANOVA comparison of MAM middle upper arm circumference of under five children across years 2015, 2016 and 2017 in each of the three counties

Year	2015	2016	2017		
County	Median (MUAC)	Median (MUAC)	Median (MUAC)	Chi-Square	p-value
Cueibet	67.50	409.50	344.50	10.50	0.005*
Rumbek N.	43.50	70.00	103.00	6.50	0.039*
Yirol W.	72.50	143.50	654.50	17.167	0.000*

*indicates significant difference at $\alpha = 0.05$

The table above showed significant differences in MAM MUAC values in each of the three counties across the three years. It also showed a rising median values in Rumbek North and Yirol west across the three years.

Table 4. Wilconxon signed rank test post hoc analysis for friedman ANOVA comparison for MAM MUAC across three years 2015, 2016 and 2017

County/Time Period	Chi-square	P-value
Cueibet		
2015 vs 2016	1.465	0.075
2015 vs 2017	2.353	0.019*
2016 vs 2017	-0.157	0.875
Rumbek North		
2015 vs 2016	1.569	0.117
2015 vs 2017	2.589	0.010*
2016 vs 2017	1.020	0.308
Yirol West		
2015 vs 2016	1.726	0.084
2015 vs 2017	3.059	0.002*
2016 vs 2017	2.981	0.003*

*indicates significant difference at $\alpha = 0.05$

The table above revealed that, the significant difference in MAM MUAC values, across the three years in Cueibet, is between 2015 and 2017, in Rumbek North is between 2015 and 2017, and in Yirol West is both between 2015 and 2017, and between 2016 and 2017.

Table 5. Kruskal Wallis Test comparison of under-five children SAM and MAM MUAC across the three counties (In general)

	County				
	Cueibet (n=36)	Rumbek N. (n= 36)	Yirol West (n =36)		
Malnutrition type/Year	Median	Median	Median	H	p-value
SAM 2015	134.00	18.00	45.00	12.933	0.002*
SAM 2016	315.00	27.00	71.00	25.891	0.001*
SAM 2017	200.00	51.00	243.50	19.344	0.001*
MAM 2015	67.50	43.50	72.50	3.090	0.213
MAM 2016	409.50	70.00	143.00	20.701	0.001*
MAM 2017	344.50	103.00	654.50	16.740	0.001*

*indicates significant difference at $\alpha = 0.05$

The table above showed that, there are significant differences in SAM MUAC values, among the three counties, across the three years-2015, 2016 and 2017. It also showed significant differences in MAM MUAC values, among the three counties in 2016 and 2017.

Table 6. Man whitney U test post hoc analysis of SAM and MAM MUAC of under-five children across the three counties in 2015, 2016 and 2017

County	Z score	P-value
SAM 2015		
Cueibet vs Rumbek North	-2.890	0.004*
Cueibet vs Yirol West	-1.559	0.119
Rumbek North vsYirol West	-3.062	0.002*
SAM 2016		
Cueibet vs Rumbek North	-4.158	0.000*
Cueibet vsYirol West	-4.042	0.000*

Rumbek North vs Yirol West	-2.599	0.009*
SAM 2017		
Cueibet vs Rumbek North	-3.984	0.000*
Cueibet vs Yirol West	-.404	0.686
Rumbek North vs Yirol West	-3.580	0.000*
MAM 2016		
Cueibet vs Rumbek North	-3.811	0.000*
Cueibet vs Yirol West	-3.522	0.000*
Rumbek North vs Yirol West	-2.225	0.026*
MAM 2017		
Cueibet vs Rumbek North	-2.656	0.008*
Cueibet vs Yirol West	-2.367	0.018*
Rumbek North vs Yirol West	-3.580	0.000*

*indicates significant difference at $\alpha = 0.05$

The table above revealed that the existing significant differences of SAM MUAC in under-five children, are among the three possible combinations of the three counties (Cueibet vs Rumbek North, Cueibet vs Yirol West, and Rumbek North vs. Yirol West) across three years except in 2015 SAM MUAC and 2017 SAM MUAC between Cueibet and Yirol West. It also showed significant differences in MAM MUAC among the three possible combinations of the counties, across 2016 and 2017.

Discussion

This study aimed to determine the impact of nutrition therapy programme on the prevalence of Severe Acute Malnutrition (SAM) and Moderate Acute Malnutrition (MAM) in three counties of war-torn Lakes State of South Sudan. In the results, and considering each county, there was a significant difference in SAM prevalence of Rumbek North County only, across the three years 2015, 2016 and 2017**.** It was also discovered that, there was a rising median values of SAM across the three years in the three counties the post-hoc analysis further revealed that the significant difference of SAM prevalence in Rumbek North was between the 2015 and 2017.

The possible reasons for these significant differences, in conjunction with rising median values of SAM prevalence (poor outcome) across the three counties, were as suggested by the report of a similar study (Mwanza et al, 2016) on the outcome of the Outpatient Therapeutic Program (OTP), which is the nutrition therapy programme for SAM cases of under-five children, in three districts of eastern province in Zambia. These include; dependence on donor-funds, consistent stock outs of ready-to-use therapeutic food and other supplies, high volunteer dropout, and inadequate monitoring and feedback on defaulters, all of which are applicable in the three counties under this study.

Taking the MAM prevalence into consideration, the result revealed significant differences in each of the three counties across the three years. It also showed a rising median values of MAM prevalence (poor outcome) in Rumbek North and Yirol west across the three years. The result of the post-hoc analysis further revealed that, the significant difference in MAM prevalence, across the three years, in Cueibet and Rumbek North is between 2015 and 2017, while in Yirol west are both between 2016 and 2017, and between 2016 and 2017. This may be attributed to possible reasons, as suggested by Neitzel (2011) in a study conducted in five regions in Ethiopia (Tigray, Afar, Amhara, Oromia and SNNPR), to determine the impact of Targetted Supplemetary Feeding Programme (TSFP), which is the therapeutic program for MAM cases in under-five children, across five years, 2007-2011. The study suggested large proportion of children enrolled were not acutely malnourished, poor compliance, which is food sharing among other non-malnourished children, and increased food insecurity during the follow-up, all of which are closely applicable in the context of this study, as possible reasons.

Considering the relationship among the three counties, the results of this study showed that, there are significant differences in SAM prevalence, among the three counties, across the three years-2015, 2016 and 2017. It also showed significant differences in MAM prevalence, among the three counties in 2016 and 2017. The post-hoc analysis further revealed that, the existing significant differences of

SAM prevalence in under-five children, are among the three possible combinations of the three counties (Cueibet vs Rumbek North, Cueibet vs Yirol West, and Rumbek North vs. Yirol West) across three years except in 2015 SAM and 2017 SAM between Cueibet and Yirol West.

The results of this study also showed significant differences in MAM prevalence among the three possible combinations of the counties, across 2016 and 2017. The significant differences in SAM prevalence among the three counties, in the three possible combinations, across the three years, and MAM prevalence among the three possible combinations, among the three counties, across 2016 and 2017, may not be unconnected with the fact that, each county do not get supplies of the food supplements in the same simultaneous periods and that the differences in the distances, in conjunction with variations in the non-pliability of the roads to each county, for food supplement distribution, may be responsible reasons. Additional factors like the variations in diagnosis according to standard by the Community Nutrition Volunteers (CNVs) and Community Health Workers (CHWs) in each county using MUAC tapes, and political sentiments in health policy implementation as it relates to nutrition therapy programme, may also be responsible for these significant differences.

Conclusion

The results obtained from this study do not support the null hypotheses of the study. The first null hypothesis states that, there will be no significant differences in the prevalence of SAM and MAM among under-five children in each of the three counties, across the three years in Lakes State of south Sudan. The results of this study showed conspicuous significant differences in SAM and MAM prevalence in each county across the years. Factors recognized for the significant differences in SAM and MAM values, coupled with poor intervention outcome, ranges from dependence on donor-funds, consistent stock outs of ready-to-use therapeutic food and other supplies, high volunteer dropout, inadequate monitoring and feedback on defaulters, to large proportion of children enrolled were not acutely malnourished, poor compliance, and increased food insecurity during the follow-up. The second null hypothesis which states that, there will be no significant differences in SAM and MAM prevalence among under-five children in the three counties, across the three years in Lakes State of South Sudan, was also at variance with the results of this study, as there were various significant differences in SAM and MAM prevalence among the three counties, across the three years. The possibility of each county not getting supplies of the food supplements in the same simultaneous periods, the differences in the distances and non-pliability of roads for hitch-free food supplements supply, variations in diagnosis according to standard by CNVs and CHWs in each county using MUAC tapes, and political sentiments in health policy implementation as it relates to nutrition therapy programme, were suggested as possible reasons for these significant differences, and poor impact.

In overall, this study has shown that, despite the various interventions of international organizations, like United Nations Children Emergency Fund (UNICEF) as the major donor for OTP programme for SAM cases, and World Food Programme (WFP) as the major donor for TSFP programme, for MAM cases, in south Sudan, with the duo working in collaboration with other International Non-governmental Organizations (INGOs), to implement nutrition therapy programme, the impact of the programme in the three counties, in Lakes State of south Sudan, as revealed in this study, is still at abysmal level. Complete overhaul of the programme, including training and re-training of CNVs and CHWs for correct screening, timely availability of food supplements, enactment of every possible policy to ensure food security, unwavering adherence to the principle of neutrality and impartiality on the part of INGOs and government, and conduct of pre and post-intervention surveys to communicate feedbacks, and help in re-evaluations, may serve as the panacea towards the present unsatisfactory state of the nutrition therapy programme in the Western Lakes State of south Sudan.

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