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Persistent Malnutrition among Children under five in Pastoral Communities of Aweil Centre, South Sudan

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Abstract
Malnutrition is one of the leading causes of morbidity and mortality among children globally, and has been linked to 60% of the 10.9M deaths annually of under-fives. High prevalence of infectious diseases contributes to malnutrition and vice versa making the situation even worse. In WHO's African region, the median stunting prevalence is 31.3%.

The worst scenarios are seen in the war tone countries; for example Aweil Center of South Sudan has consistently high malnutrition rates despite running nutrition projects by UN agencies, government and other partners with relative stability. Results from Survey carried out in 2013 indicated poverty levels at 76%, severe acute malnutrition (SAM) prevalence rate of 6.3% (95% CI, 4.5-8.9), Global acute malnutrition (GAM) rate of 22.4% (95% CI, 17.8-27.7) with under five mortality rate of 152 deaths/ 1,000 live births.

A cross-sectional study with two-stage cluster sampling method done to determine the associated factors of malnutrition among children 6-59 months in Aweil Center County. The results showed high burden of infectious diseases like fever, diarrhea, eye, skin and respiratory tract infections at 94.5% with p-value 0.00022 (95%C.I, 0.1667-0.291). Very low household dietary diversity score of only 24 % (125out of 513 families). There was low coverage of primary health care interventions; e.g. Vitamin A, LLITN and measles vaccinations at 53%, 52.8% and 55% respectively. Accessibility to CBDs for iCCM associated with better nutrition status of children p-value 0.032 and OR 0.62 (95% CI 0.41-0.94). Poor feeding methods, family planning practices; and poor access roads to markets impact on nutrition status of children.

Multifaceted approach is needed to root out the persistent malnutrition from Aweil Center: Shift from food aid to support of food production, scale up of primary health care and iCCM interventions to include IPT for malnourished children and community awareness on feeding practices and family planning.

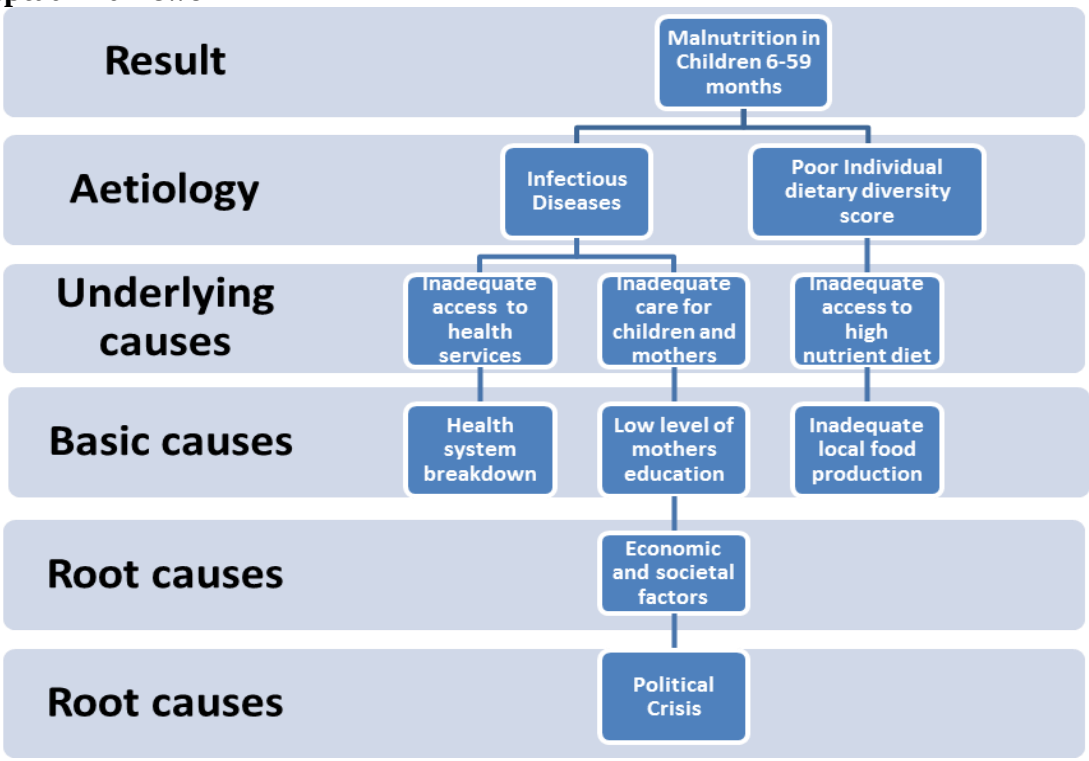
Keywords: Associated-factors, Persistent-Malnutrition, Children, Infectious-diseases, Poverty, iCCM, Genetics.

Introduction

Malnutrition continues to be one of the most common causes of morbidity and mortality among children throughout the world contributing to one third of childhood deaths (WHO 1999). It has been directly or indirectly linked to 60% of the 10.9million deaths annually of children under five. Lack of access to nutritious foods made worse by rising food prices, poor feeding practices such as inadequate breastfeeding for infants, provision of wrong food to the children and infections particularly persistent or frequent diarrhoea, malaria, pneumonia and measles contribute to under nutrition (WHO, 2018). Not only that; 50-70% of the burden of diarrhea, malaria, respiratory infections among others in childhood are attributed to under nutrition with underlying poverty (WHO 2003). Studies done in other developing countries showed

that infants born with low birth weight (LBW) were 1.74 times more likely to be stunted (95% CI, 1.38–2.19) than those born with normal weight (Aryastami et al 2017).

Conceptual framework



Conceptual framework: (UNICEF, 2015)

Available global data shows that 88% of the countries face serious burden of malnutrition. Bad nutrition severely retards personal, social and national development which is more obvious among the poor and the disadvantaged. In the developing world, 50.6 million children under the age of five years are malnourished and those who are severely malnourished and admitted to hospital face 30-50% case fatality rate (Ann Ashworth et al, 2003).

Malnutrition comes from two words; “mal” meaning bad and “nutrition” meaning feeding. Literarily malnutrition means bad feeding resulting from lack of enough food, not eating food containing the right nutrients, over eating or inability of the body to make use of the food consumed. Malnutrition can be acute or chronic. Chronic malnutrition leads to stunting and obesity.

Undernutrition includes Marasmus (carbohydrate deficiencies leading to wasting), kwashiorkor (protein deficiencies), Marasmic-kwashiorkor (both energy and protein deficiencies), stunting (low height for age due to chronic malnutrition), and micronutrient deficiencies (lack of or insufficient minerals and vitamins for example vitamin A deficiency can lead to night blindness) (WHO, 2016). According to the global fatalities and disability - adjusted life - years (DALYs) in children under 5 years of age attributed to micronutrient deficiencies in 2004, vitamin A deficiency in newborn babies, infants, and children resulted in about 6% of under - 5 deaths, 5% of under - 5 DALYs (Black 2008).

Vitamin A deficiency (VAD) or hypo-vitaminosis A is a lack of vitamin A in blood and tissues. It is common in poorer countries, but rarely is seen in more developed countries. Xerophthalmia is a spectrum of ocular manifestations due to VAD. These include epithelial disruptions of the cornea and conjunctiva, such as Nyctalopia (night blindness), Bitot spots, conjunctival and corneal xerosis (dryness), keratomalacia (corneal ulceration) (WHO 2014).

VAD is the number one cause of preventable blindness in children and increases the risk of disease and death from severe infections due to the fact that Vitamin A maintains the normal epithelial integrity to prevent entry of infections and loss of water. Improvements in vitamin A status can reduce risk of mortality

from childhood infections by 54% (Sommer 1995). It is estimated that 500, 000 vitamin A - deficient children become blind every year and half of them die within 12 months of losing their sight (WHO, 2018).
Malnutrition is further classified into moderate malnutrition and severe malnutrition. Severe malnutrition is also further classified as severe malnutrition without complications or with complications (edematous malnutrition); based on the assessment of the nutritional status according to weight-for-height or length (for infants), height (or length for infants)-for-age and edema.
Children whose weight-for-height is below -3 Standard Deviations (SD) or less than 70% of the median WHO reference values are classified as severely wasted, or who have symmetrical of the feet (edematous malnutrition). Height-for-age of less than 85% (SD-score<-3) is termed severe stunting. Those without symmetrical edema and weight-for-height 70-79% (-3≤SD-score <-2) or height –for-age 85-89% are classified as moderately malnourished (WHO, 1999). These calculation are made using the formula

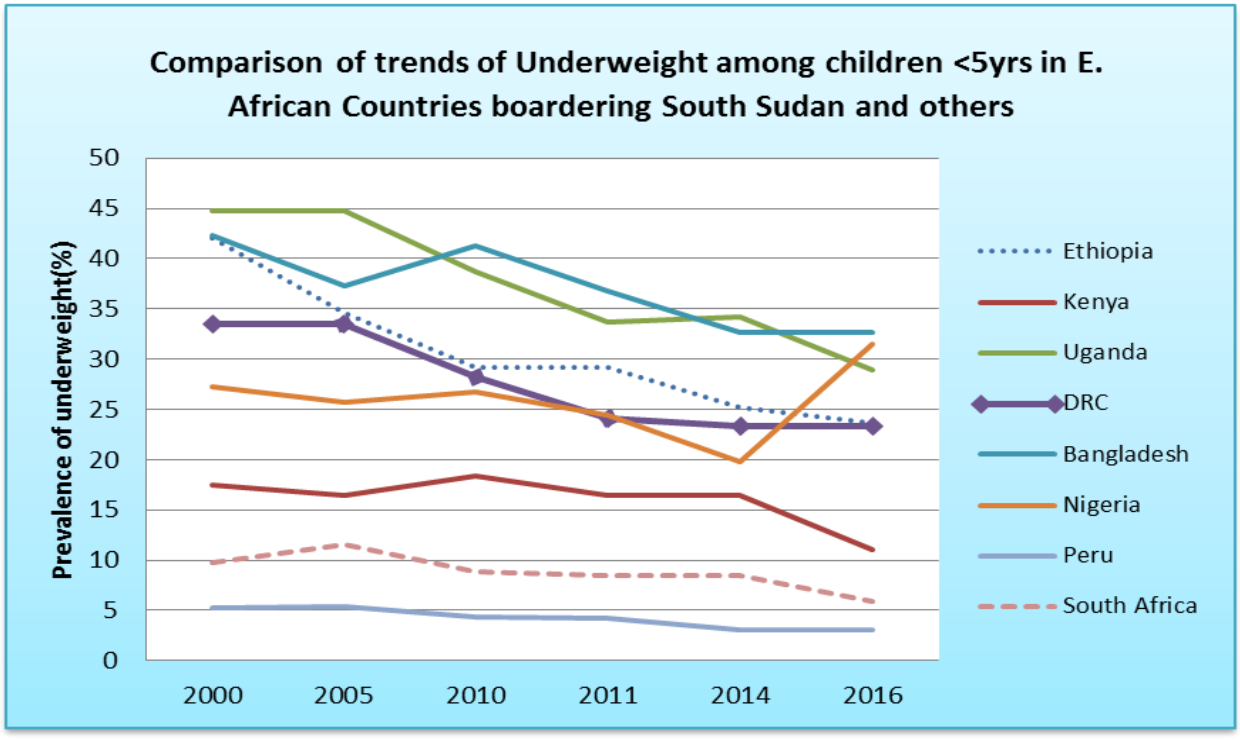
$$SD - score = \frac{(observed\ value) - (median\ reference\ value)}{standard\ deviation\ of\ refernce\ population}$$

Chronic malnutrition will lead to either stunting if it's under nutrition or obesity if it's over nutrition. Stunting refers to children who are too short for their ages. These children can suffer severe irreversible physical and cognitive damage as result of stunted growth which can even affect the next generation.
Overweight refers to a child who is too heavy for his or her height. It is a result of over feeding the child with foods and beverages that exceed the child's energy requirements which increases the risk of non-communicable diseases later in life if continued. The table below shows the prevalence thresholds and corresponding labels for stunting, overweight and wasting for children under the age of 5 years (WHO 2018)

Table 5: WHO prevalence thresholds for stunting and wasting/overweight

Labels	Prevalence thresholds (%)	
	Stunting	**Overweight and Wasting**
Very low	< 2.5	< 2.5
Low	2.5 - < 10	2.5 - < 5
Medium	10 - < 20	5 - < 10
High	20 - < 30	10 - < 15
Very high	≥ 30	≥ 15

Trend of malnutrition



(Source: WHO 2018)

The world faces a grave large-scale multiple burden of malnutrition. This is because since the year 2000, malnutrition rates have remained alarming with many children wasted and stunting declining too slowly and overweight on the other hand increasing, hence giving malnutrition the status of a double edged sword cutting through young children globally. Global rate of stunting was at 32.6% (198.4 Million children) in the year 2000 and this reduced to 22.2% (150.8 Million children) in 2017 which is only 10.4% reduction after a period of 17 years. On the other hand by the year 2000, 4.9% (30.1million) children under the age of 5 years were overweight, but by 2017 this number had increased to 5.6% (38.3 million) which is 0.7% (8.2Million) increase in 17 years (UNICEF, WHO and WBG 2018).

There is wide disparity in the degree of reduction in stunting among children less than 5 years of age within the WHO regions in the world. For example in Asia region, stunting reduced from 38.1% in the year 2000 to 23.2% in 2017, while in Latin America and Caribbean it reduced from 16.9% in the year 2000 to 9.6 in 2017 and in African region, stunting reduced from 38.3% in the year 2000 to 30.3% in end of 2017, which is only 8% reduction in 17 years (WHO 2018).

Although the African region like the rest of the WHO regions showed reduction in the rate of stunting, in terms of the actual numbers, there was actually an increase by 8.2 million children from 50.6 million in the year 2000 to 58.8 million children by end of 2017 .
Southern Africa has the least number of stunted children in Africa which has remained stable for nearly two decades at 2Million children; followed by Northern Africa at 5Million with a slight increase of 0.1Million. The worst number of stunted children is in East African Sub-region which increased from 21.5 Million in the year 2000 to 23.9 million in 2017, followed by Western Africa that has 23.9 Million stunted children in 2017 up from 21.5 million in 2000 (UNICEF,WHO and WBG 2018).

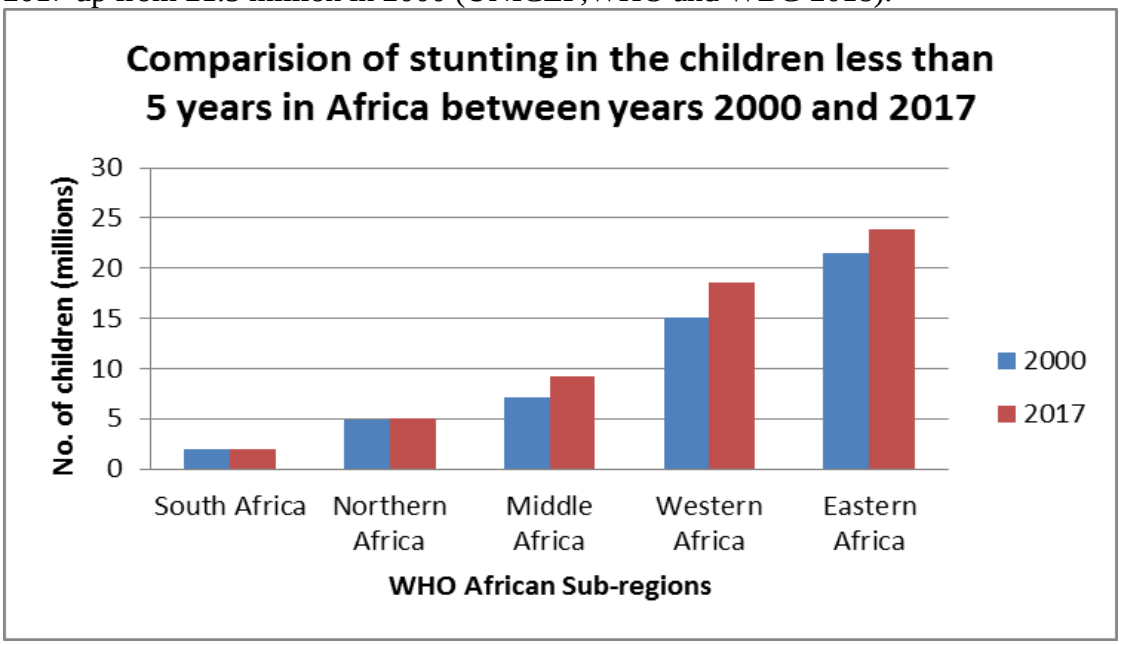


Figure 1: Comparison of stunting in Africa - Source- UNICEF/WHO/WBG 2018

It has been noted that stunted mothers of reproductive age are more likely to have stunted children. This is because the genes for stunted growth are passed on to the next generation in their children (Thokozani 2014). Prevalence of stunting among children under the age of 5 years in the WHO African region is even higher than that of the low birth weight. The median stunting prevalence from 45 Countries is 31.3% and ranges from 7.9% in Seychelles to 50.3% in the Eritrea and 57.5 % in Burundi (WHO, 2017).

Data collected from 45 Countries between 2007 and 2015 showed median wasting of 6.3% and ranged from 2% in Swaziland to 22.7% in South Sudan. 17 Countries had wasting level less than 5% (acceptable prevalence), 19 countries had wasting prevalence of 5-9% (poor prevalence); 6 countries had wasting prevalence of 10-14% (serious public health emergency range). These included Chad, Gambia, Mali,

Comoros, Burkina Faso, and Mauritania. 3 Countries exceeded the critical public health emergency threshold. These included South Sudan at 22.7%, Niger 18.7% and Eritrea 15.3% (WHO 2017).
The 2017 WHO report showed South Sudan with the worst rate of malnutrition in Africa with wasting rate of 22.7%. However, South Sudan is not on the top in terms of stunting; instead its Burundi, at 57.7%, followed by Niger 43.9% and Chad at 39.9%. This is partly because of genetic composition of some of the predominant tribes in South Sudan, especially the Dinka who are known to be one of the tallest tribes in Africa. Just like for stunting, the genes for tallness are also passed from the parents to the next generation.

The declaration of famine in South Sudan is not a surprise as the situation has been gradually deteriorating with GAM rates of 29.2% in the neighboring Western Bahr el Ghazal state (UNICEF 2017). Just like GAM rates, vitamin A deficiency is equally high in South Sudan estimated at 25% based on studies along the equatoria region (Burgess 2008). The prolonged nature of malnutrition in South Sudan means that many children could be stunted, which is height for age below that expected on the basis of international growth reference (Teferi et al 2016).

Aweil Centre of South Sudan is one of the Counties with Chronic and acute Malnutrition especially among children under the age of 5 years. Results from a nutrition survey conducted in November 2013 indicated a severe acute malnutrition (SAM) prevalence rate of 6.3% (95% CI, 4.5-8.9) and a global acute malnutrition (GAM) rate of 22.4% (95% CI, 17.8-27.7). Both prevalence rates were above the WHO global acute malnutrition and severe acute malnutrition rates of 15% and 2% respectively. The high malnutrition rates continue to exist among the preschool children in South Sudan after surviving the 6-59 months of age (Harvey and Rogers 2007).

Due to the collapsed health systems and poor health infrastructure in South Sudan following the years of conflict, community management of acute malnutrition (CMAM) was introduced in the year 2000. The components of CMAM implemented in Aweil included:

- Outpatient therapeutic feeding program (OTP) which is supported by UNICEF and implemented by partners and supplies ready to use therapeutic foods for severe acute malnutrition without complications
- Supplementary feeding program (SFP) supported by World Food Program (WFP) which provides dry rations for children with moderate acute malnutrition without complications and is implemented by non-governmental organizations.
- Community mobilization of the Aweil population for sensitization, engagement, participation and ownership of the nutrition programmes and provide referral of complicated cases to stabilization Centre.
- Stabilization Centre at Aweil state hospital which provides inpatient care for acutely malnourished children with medical complications.

Community mobilization is key for the success of CMAM program because this is where the children who are malnourished are screened and referred by community based distributors(CBDs) volunteers either to OTP, SFP at the PHC facilities or stabilization Centre at the state capital in Aweil (Keene et al 2013).

The government, UN agencies and implementing partners have a number of nutrition and health projects running in the County, but the malnutrition rates have remained high despite the relative stability in this region compared to the neighboring states of lakes, Western Bahr el Ghazal and Unity states that are at the heart of the conflict in South Sudan. There was need to determine associated factors for persistent under nutrition among the children 6-59 months so as to address the root causes of the malnutrition in this pastoral communities.

Methods

Study area

The study was conducted in Aweil center County, one of the five Counties of the former Northern Bahr el Ghazal state of South Sudan which is located 800KM from Juba, the capital of South Sudan. It lies on the North West part of the Country at coordinates: 8° 46' 02.00"N, 27° 23' 59.00"E (Latitude: 8.7671; Longitude: 27.3998).

The topography of Aweil is flat with savannah grassland devoid of most of its trees for firewood, charcoal and shelter, hence making this County prone to flooding every year at the peak of rainy season from August to October. The soils are silty making them retain flood water for weeks and sometimes even months blocking transport from some villages to the town center which lies close to the confluence of Lol and Pongo Rivers.

The main economic activities are cattle keeping since most of the villagers are pastoralist who move with cattle to look for pasture during dry season and move to high grounds near the town during the floods at peak of the rain season. A good proportion of the population does mixed farming with growing of crops and rearing of smaller number of animals. Others along the Lol and Pongo rivers do some fishing. Foreigners are mostly in the town and are involved in cross border trade with neighboring Countries like Uganda, DRC, Kenya and Sudan. Despite these economic activities, poverty level is the worst in the country at 76% (fig1).

South Sudan has one of the worst health indicators with infant mortality rate at 79 deaths per 1000 live births, but the highest infant mortality rates are in the former Northern Bah El Ghazal state at 120 deaths per 1,000 live births and also under five mortality rate at 152 deaths per 1,000 live births.

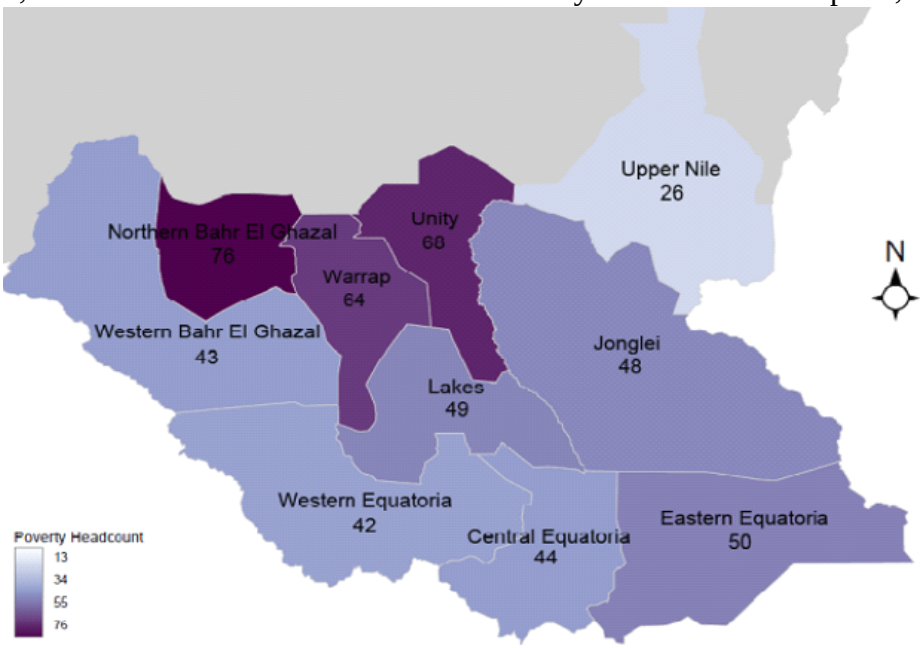


Figure5: Poverty headcount in South Sudan. Source: Poverty in Southern Sudan: National Baseline Household Survey (NBHS), 2010

Research design

A community based cross-sectional study design was applied for children and their care takers. A two stage cluster sampling method was adopted to select the villages and the households. A total of 39 clusters (villages) were selected, 9 of which were reserves. One child (6-59 months) in the selected household was randomly included in the anthropometric assessment and the care taker interviewed using interviewer administered questionnaire to get more information on the associated factors of malnutrition. Using village lists provided by the County health department, village level enumerators were trained to do systematic random sampling to select 13 households per cluster who were then interviewed. The 30cluster * 13household per cluster survey design enabled the calculation of 95% confidence interval point estimates to give 390 households as the minimum number of households, children and their care takers. Those children 6-59 months confirmed to be malnourished were identified and referred for treatment in the outpatient therapeutic feeding program (OTP) or stabilization Centre (SC) during the survey depending on their classification of malnutrition without or with complications.

Research Variables:

The research variables are grouped into three: anthropometrics and health for the children 6-59 months, infant and young child feeding practices (IYCF) and food security. To ensure that the respondents

understood the message, the structured questionnaire was translated to Dinka language and back to English to confirm the translation.

Results

Demography

A total of 517 children and their care takers were reached. 217(42%) of the children were males and 297 (58%) were females. Out of 517 children 514 care takers were able to give all the needed information which was 99.42% response rate. 55(10.7%) of the children were infants and the highest number of children in a single age bracket was 128 (25%) within 12-23 months of age. The rest were between 24 and 59 months of age with more or less uniform distribution (fig.2 below).

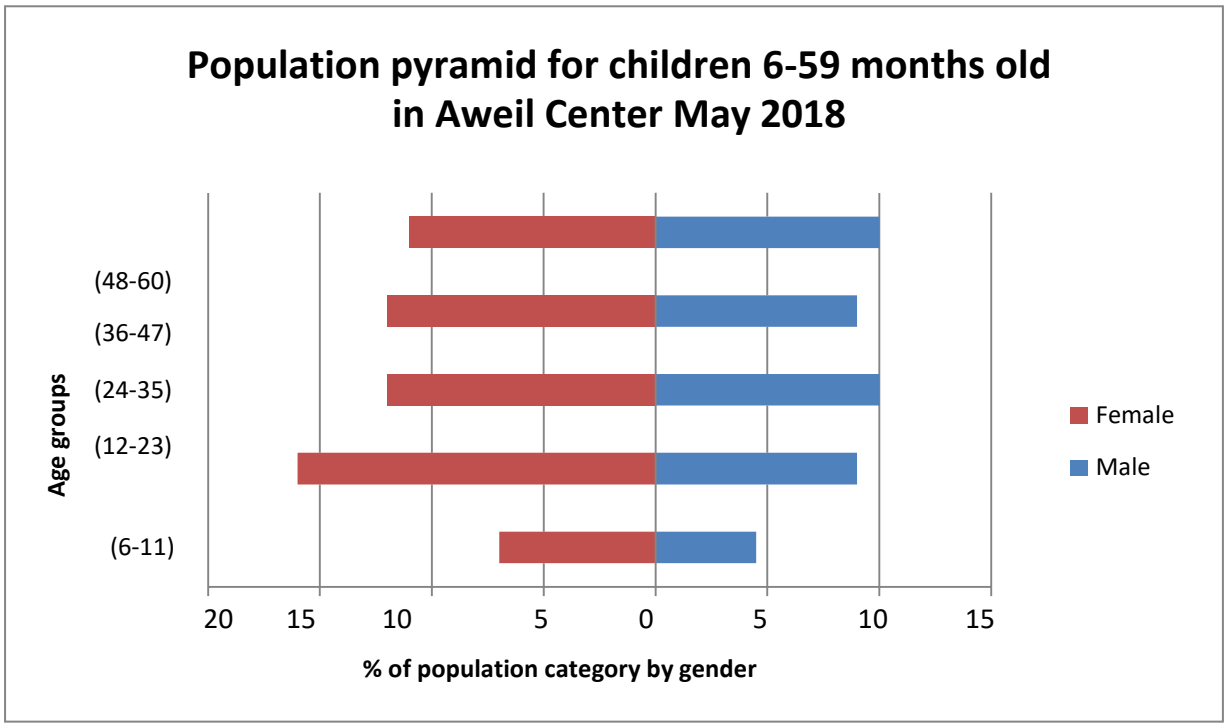


Fig1: Population pyramid

Prevalence of malnutrition

The results of the study showed that generally children 6-59 months in Aweil Center have poor nutritional status compared to the WHO standard. This has been reflected in Fig7 below with the curve of z-score in red shifted to the left of the WHO standard in green on the right with the prevalence of global acute malnutrition -GAM (<-2 z-score and/or edema) [119] 23.2%. Prevalence of severe acute malnutrition (SAM) (% < -3SD) was 7% in Aweil which was also higher than the WHO threshold of 2% (95% CI, 4.9- 9.9) (table3).

Severe acute malnutrition was least among the infants in the age category of (6-11) months at [n=55]1.9 (95%CL, 0.3-12.8) but highest among children among the age category of (36-47) months at [n=107] 10.3(95 % CI, 5-20). For MAM, the age group with the list prevalence was (12-23) months [n=128] 17.2 (95% CI, 11.1-25.6), whereas the MAM burden was highest among the children in the age category (36-47) months same with SAM. Prevalence of MAM was 29.9% (95% CI, 19-43.7) (Table2).
Prevalence of underweight based on weight-for-age z-scores was 16.6% (95% CI, 13.8- 19.7). Boys were more likely to be underweight compared to girls with prevalence 19.8% (95% CI, 15.6-24.8) and 14.1% (95%CI, 10.4-18.9) respectively (table4).

Prevalence of stunting based on height/length-for-age z-scores was 8.7% (95% CI, 6.5-11.6), which was within the acceptable new WHO's threshold regarded as low. However, children between 12-23 months had the highest level of stunting at 11.7% (95% C.I. 6.4-26.7) (Table5).

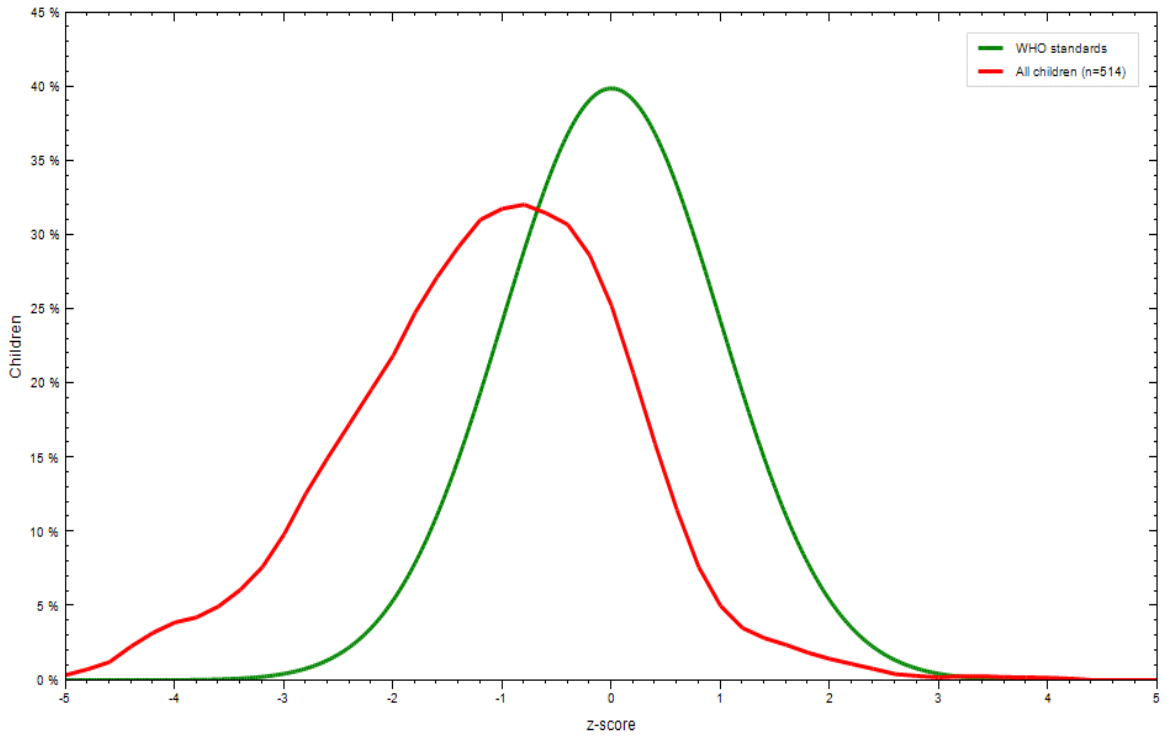


Figure2: General nutritional status of the children in Aweil compared with WHO standard

Table1: Prevalence of malnutrition by age group for gender combined children 6-59 months

Age groups	**N**	**Weight-for-length/height (%)**			
		% < -3SD	(95% CI)	% < -2SD	(95% CI)
Total:	514	7	(4.9- 9.9)	23.2	(19-27.9)
(6-11)	55	1.9	(0.3-12.8)	25	(15.7-37.4)
(12-23)	128	5.5	(2.6-11.3)	17.2	(11.1-25.6)
(24-35)	108	5.6	(2.7-11.1)	21.3	(13-32.9)
(36-47)	107	10.3	(5-20)	29.9	(19-43.7)
(48-60)	107	9.3	(5.2-16.2)	24.3	(15.4-36.1)

Table2: Prevalence of acute malnutrition based on W/H z-scores and edema disaggregated by gender

Variables	**All N=514**	**Boys n=217**	**Girls=297**
Prevalence of global acute malnutrition -GAM (<-2 z-score and/edema)	[119] 23.2% (95% CI, 19.0-27.9)	[55]25.3% (95% CI, 19.3-32.5)	[64]21.5% (95% CI, 16.1-28.2)
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, no edema)	[83] 16.2% (95% CI, 14.1-18.0)	[37]17% (95% CI, 14.3-19.0)	[46]15.4% (95% CI, 12.5-18.3)
Prevalence of severe malnutrition (<-3 z-score and/edema)	[36] 7% (95% CI, 4.9-9.9)	[18]8.3 (95% CI, 5-13.5)	[18]6.1% (95% CI, 3.6-9.9)

Table3: Comparison of prevalence of underweight based on weight-for-age z-scores for male and female

	Under Weight	Weight-for-age (%)				
Category	N	% < -3SD	(95% CI)	% < -2SD	(95% CI)	SD
Total:	507	4.1	(2.8-6.2)	16.6	(13.8-19.7)	1.07
Male	217	2.8	(1.3-5.7)	19.8	(15.6-24.8)	0.98
Female	290	5.2	(3-8.8)	14.1	(10.4-18.9)	1.12

Table 4: Prevalence of stunting based on height/length-for-age z-scores

Age groups	N	Length/height-for-age (%)			
		% < -3SD	(95% CI)	% < -2SD	(95% CI)
Total:	505	2.4	(1.4%, 4.1%)	8.7	(6.5%, 11.6%)
(6-11)	55	0	(-, -)	5.8	(2%, 15.3%)
(12-23)	128	2.3	(0.8%, 6.8%)	11.7	(6.9%, 19.1%)
(24-35)	108	5.6	(2.6%, 11.7%)	12	(6.2%, 22%)
(36-47)	106	0.9	(0.1%, 6.9%)	4.7	(1.9%, 11.2%)
(48-60)	108	1.9	(0.5%, 7.1%)	7.4	(3.6%, 14.5%)

Bivariate analysis

The study results show that vitamin A supplementation for children 6-59 months old was 273(53%), p-value 0.0006 and odds ratio (OR) 0.47 (95% C.I. 0.31-0.72) which was significant protective measure against malnutrition(Table 16: section 1).

Measles vaccination with evidence from a vaccination card 284 (55%) p-value 0.005 and OR 0.54 (95% C.I. 0.36-0.82) which is significant and contributes to reduction in the prevalence of malnutrition 273 (53%) of the children were reported to be sleeping under long lasting insecticide treated mosquito nets. P-value was 0.01 and OR 0.57 (95% C.I. 0.37-0.86) which is statistically significant and protective. (table16: section 2 and 7).

However, gender was not associated with malnutrition. For instance, prevalence of severe stunting based on height/length-for-age z-scores among boys 6-59 months was 2.8% (95% CI, 1.3-5.8); and among the girls in the same age group was 2.1% (95% CI, 0.9-4.5) with p-value of 0.611054 for comparison of the two gender which is not significant (table11 and 14).

Within 30 days prior to the study, 361(70%) families enrolled in the study had lacked food or money for food for at least once. Malnutrition rate in these families was one of the highest with 101 children under five (28%) malnourished. P-value was 0.0001 and OR 2.96 (95% C.I. 1.72-5.09) which was significant and scarcity of resources increased the risk of malnutrition.

Table 16: Bivariate analysis of various factors of malnutrition with their p-values, Odds ratio and 95% confidence intervals

S	FACTOR	NO.	%	CASES	NO CASE	P-V	OR	LIMITS	
1	Vitamin A supplementation	No.	%	Malnutrition	No malnutrition	*P-value*	OR	Lower 95%	Upper 95%
	Yes	273	53	46	227	0.0006	0.47	0.31	0.72
2	Children sleeping under LLITN	No.	%	malnutrition	No malnutrition	*P-value*	OR	Lower 95%	Upper 95%

	Yes	273	52.9	50	223	0.01	0.57	0.37	0.86
3	A day of lack of food/money for food in the last 30days prior to study	No.	%	malnutrition	No malnutrition	*P-value*	OR	Lower 95%	Upper 95%
	Yes	361	70%	101	260	0.0001	2.96	1.72	5.09
4	Agricultural production	No.	%	malnutrition	No malnutrition	*P-value*	OR	Lower 95%	Upper 95%
	Yes	282	54.7	49	233	0.001	0.49	0.32	0.75
5	Still has Cereals of last harvest	No.	%	malnutrition	No malnutrition	*P-value*	OR	Lower 95%	Upper 95%
	Yes	181	35%	30	151	0.014	0.55	0.35	0.87
6	CBD within Easy reach	No.	%	malnutrition	No malnutrition	*P-value*	OR	Lower 95%	Upper 95%
	Yes	259	50.2	49	210	0.032	0.62	0.41	0.94
7	Measles Vaccination	No.	%	malnutrition	No malnutrition	*P-value*	OR	Lower 95%	Upper 95%
	Not vaccinated Yet	201	39	60	141				
	Vaccinated with Card	284	55	49	235	0.005	0.54	0.36	0.82
	Vaccinated without card	31	6	10	21				
	Total	516	100	119	397				

Out of the 516 care takers interviewed, 282(54.7%) were involved in their own food production (agriculture). 49 (17.38%) of the children in these homes were malnourished with p-value of 0.001 and OR 0.49 (95% C.I. 0.32-0.75) which was statistically significant. 181 (50%) of those who had produced food had cereals still available by the time of administering questionnaire. 30 (10.64%) of the children in these group who still had their food from last harvest were malnourished with p-value of 0.014 and OR 0.55 (95% C.I. 0.35-0.87) which is significant (Table 16: sections 4 and 5).

Community based distributers (CBDs) were found to be within easy reach of 259 (50.2%) of the 516 care takers interviewed. 49 (18.92%) of the children with access to CBDs were malnourished with p-value of 0.032, OR 0.62 (95% C.I. 0.41-0.94). P-value is significant and OR shows risk reduction to malnutrition in the presence of CBDs (table16: section 6).

Multivariate analysis

Main sources of food for the 6-59 months old children were the families own produce with estimate of 282(54.7%). This was followed by market or shop at 123 (23.9%) and work for food 67 (13%). Significant number of respondents 31 (6%) reported to have no food for the family hence resort to begging from relatives, friends and well-wishers both in town and villages; only 1(0.2%) reported to be relying on food aid from the humanitarian workers. Source of food is a factor that affects the nutrition status of children with p-value of 0.00357 and (95% confidence interval of 0.081-0.2). Those who mainly buy from the market have the least rate of malnutrition among 6-59 months old children at 16% (20) followed by those who produce their own food at 17 % (47). However, those who rely on food aid have the highest rate of malnutrition at 50% (1) followed by those who work for food at 45 % (30) (table17 section 8).

The food is prepared and given to children daily, but there was wide variation in the frequency at which the food is given. 163 (57.6%) of the children were fed once or twice in a day, 79 (15.4%) were fed thrice a day and the remaining 139 (27%) were fed four or more times a day (fig 10). Feeding children once or twice a day contributes to malnutrition with P-values 0.00035, 0.4058 and odds rations 2.20(95% C.I 1.44-3.35) and 1.24 (95% C.I. 0.79-1.96) respectively. Meanwhile feeding young children 4 or more times a day has protective significant effect against malnutrition with p-values 0.000278 and OR 0.2 (95% C.I. 0.08-0.5) (table17: section 1).

The study revealed high burden of infectious diseases at 94.5% and only 28(5.5%) of the children were reported not to have any illness in the past two weeks prior to the study. 225 (43.7%) of the children were reported to have suffered from a febrile illness, 130 (25.1%) from diarrhea, 104 (20.2%) from cough, 23 (4.4%) from skin infections and 6 (1.1%) were reported to have suffered from eye infections (fig8).
Children 6-59 months old who were reported to have suffered from any illness were more likely to suffer from malnutrition than those who were not sick with p-values 0.043, and 0.040 for fever, and diarrhea respectively. The odds ratios for fever and diarrhea were above 1(one) meaning that the infections contributed to the malnutrition though at varying degrees for example, odds ratio (OR) for fever was 1.56(95% C.I 1.03- 2.36) and OR for diarrhea was 1.64 (95% C.I 1.05-2.57). Cough has slight effect on malnutrition with OR 0.93 (95% C.I 0.56-1.57) (table17: section 2).

The results of the study showed that 94.5% of the children were reported to have been sick two weeks prior to the study. The health seeking behavior for the parents or care takers however varied. 156(30.2%) of the respondents sought health services from a community based distributor (CBD), 108 (20.9%) went for treatment in a primary health care center (PHCC) or primary health care unit (PHCU). 88 (17%) of the respondents sought health services from hospital, 23(4.4%) from private physician within Aweil town, 53(10.3%) from drug shops, 20 (3.9%) from traditional healer and 6 (1.1%) from village health worker (table23).

Table 17: Table of P-values, O.R. (95% C.I.) of different factors - multivariate analysis

	VARIABLE	**No.**	**%**	**CASES**	**NO CASES**	**P-VALUE**	**OR**	**95% CI**	
1	**Frequencies of meals eaten by children**	**No.**	**%**	**Mal nutrition**	**No mal nutrition**	***P-value***	**OR**	***Lower 95%***	***Upper 95%***
	Once	163	31.50	54	109	0.00035	2.20	1.44	3.35
	Twice	136	26.10	36	100	0.40581	1.24	0.79	1.96
	Three times	139	27.00	24	115	0.07507	0.62	0.38	1.02
	Four or more times	78	15.00	5	73	0.00028	0.20	0.08	0.5
	Total	**516**	**99.60**	**119**	**398**		**0.47**	**0.040**	**0.02**
2	**Disease condition**	**No.**	**%**	**Mal nutrition**	**No mal nutrition**	***P-value***	**OR**	***Lower 95%***	***Upper 95%***
	Fever	225	43.7	62	163	0.04282	1.56	1.03	2.36
	Cough	104	20.2	13	91	0.89	0.93	0.56	1.57
	Diarrhea	130	25.1	39	91	0.04027	1.64	1.05	2.57
	Skin Infections	23	4.4	3	20	0.36085	0.49	0.14	1.67
	Eye Infections	6	1.1	1	5	0.90974	0.72	0.12	4.34
	Non illness	28	5.5	2	26	0.02964	0.12	0.02	0.93
	Total	**516**	**100**	**119**	**397**	**0.00022**		**0.167**	**0.291**
	How many months did the food from last harvest season last								
3	**Months**	**No.**	**%**	**Mal nutrition**	**No mal nutrition**	***P-value***	**OR**	***Lower 95%***	***Upper 95%***

	1 to 3	30	11%	15	15	0.01939	3.18	1.29	7.81
	4 to 6	50	18%	13	37	0.32	0.59	0.25	1.38
	7 to 9	21	7%	4	17	0.2564	0.44	0.13	1.43
	Total	**101**	**36%**	32	69				
	Denominator 282- those who did agricultural production								
4	**1st time breast fed**	**No.**	**%**	**Mal nutrition**	**No mal nutrition**	***P-value***	**OR**	***Lower 95%***	***Upper 95%***
	Immediately (<1 hr.)	98	19	8	90	0.0002	0.25	0.12	0.52
	1-24 hours	387	75	98	289	0.046	1.74	1.04	2.94
	24-48 hours	4	0.8	2	2	0.49133	3.38	0.47	24.23
	After 48 hours	1	0.2	1	0				
	Don't know	26	5	10	16				
		516	**100**	**119**	**397**	**0.00015**		**0.192**	**0.286**
5	**Age of introducing other foods**	**No.**	**%**	**Mal nutrition**	**No mal nutrition**	***P-value***	**OR**	***Lower 95%***	***Upper 95%***
	Below 1 month	98	19	19	79	0.41	0.76	0.44	1.32
	1-5 months	155	30	50	105	0.02513	1.65	1.08	2.5
	6 months	206	40	38	168	0.05457	0.64	0.41	0.99
	7-12 months	53	10.3	10	43	0.55311	0.76	0.37	1.55
	Above 12 months	4	0.7	2	2				
		516	**100**	**119**	**397**	**0.00044**		**0.1694**	**0.289**
6	**Mothers' education level**	**No.**	**%**	**Mal nutrition**	**No mal nutrition**	***P-value***	**OR**	***Lower 95%***	***Upper 95%***
	Never attended school	397	76.9	102	295	0.01362	2.07	1.18	3.63
	Primary level	98	19	10	88	0.00126	0.39	0.21	0.72
	Secondary level	13	2.5	4	9	0.72440	1.52	0.46	5.02
	Institution	8	1.6	3	5	0.57950	2.03	0.48	8.61
		516	**100**	119	397	0.00035		0.2031	0.288
7	**Age of the Mother or care taker**	**No.**	**%**	**Mal nutrition**	**No mal nutrition**	***P-value***	**OR**	***Lower 95%***	***Upper 95%***
	Less than 20	166	32	49	117	0.0347	1.62	1.06	2.47
	20-29	133	25.8	70	103	0.96712	0.96	0.6	1.54
	30-39	144	27.9	29	115	0.38744	0.79	0.49	1.27
	40-49	65	12.6	10	55	0.1573	0.57	0.28	1.16
	50 and above	8	2	1	7				
		516	**100**	**119**	**397**	**0.00107**		**0.158**	**0.312**
8	**Main Sources of food**	**No.**	**%**	**Malnutrition**	**Prevalence**	***P-value***	**OR**	***Lower 95%***	***Upper 95%***
	Own production	282	54.7	49	17%				
	Market/shop	123	23.9	20	16%				
	Food Aid/relief	2	0.2	1	50%				
	Work for food	67	13	30	45%				
	Hunting	7	1.3	3	43%				

	Fishing	5	0.9	1	20%				
	Other	30	6	15	50%				
	Total	**516**	**100**	**119**		**0.00357**		**0.081**	**0.24**

Age of the mother or care taker is linked to the nutrition status of the child; p-value 0.001 (95% C.I 0.1579-0.312) which is significant. 166(32%) of the mothers were teenagers and 49(29.52%) of their children were malnourished with p-value of 0.0347 and OR 1.62 (95% C.I 1.06-2.47) which was significant and linked to the malnutrition of children 6-59 months. 133 (25.8%) of the mothers were in the age bracket of 20-29 while 144(27.9%) of the mothers or care takers were in the age category of 30-39 with 29(20%) of the children malnourished with P-value of 0.387 and OR 0.79 (95% C.I 0.49-1.27) which was not significant. 65(12.6%) of the mothers were between 40-49 age group and only 8 (2%) were above 50 years (table 17: section 7).

At household level the 7 day household dietary diversity score was calculated with an average of 125 (24%) of the households had consumed various food types 4-7 times 7 days prior to the day of the questionnaire. The commonest foods consumed by the family were milk and milk products by 200 families, fish by 148 families, and fruits by 141 followed by cereals consumed by 136 families. Meanwhile the least food consumed were tubers and roots consumed by 97 families.

Household dietary diversity score

Number of days in past 7 days household had consumed the group of foods-household dietary diversity score(HDDS)

Food group	Never	1-3times	4-7 times	HDDS
Cereals	5	375	136	26%
Legumes/nuts	53	350	113	22%
Roots & tubers	39	380	97	19%
Meat/poultry	50	309	107	21%
Fish & sea food	103	272	141	27%
Milk & milk products	16	300	200	39%
Vegetables	84	320	112	22%
Fruits	108	260	148	29%
Eggs	172	240	104	20%
Oil / fats	174	226	116	22%
Sugar & honey	106	310	100	19%
Average	**83**	**304**	**125**	**24%**

Discussions

The findings were consistent with publication of another study done by WHO staff at catastrophic level of 33.3 % by 2015 (Adrianopoli M and Mpairwe A 2017). Neighboring Sudan state of North Darfur GAM prevalence was at 27.9 per cent (WHO 2017). Very high burden of infectious diseases at 94.5% with p-value 0.00022 (95%C.I, 0.1667-0.291). 225 (43.7%) suffered from a febrile illness & 30 (25.1%) suffered from diarrhea.

Prevalence of stunting based on height/length-for-age z-scores was 8.7% (95% CI, 6.5- 11.6). The prevalence of stunting was much lower than expected-associated genetic factors- tall people - Dinka tribe

Accessibility to basic services hampered by flooding during the rainy season. Infrastructure development at the Payam level will increase accessibility to basic services. Early diagnosis and treatment of infectious diseases will reduce rate of childhood malnutrition in South Sudan. Need for strategic change in the approach to malnutrition to include the associated factors.

Limitation: the study was cross-sectional done in May; hence it did not reflect the seasonal variation of malnutrition during the pre-harvest, harvest and hanger gaps. There is need for further research on the etiology of febrile illness in Aweil.

GAM rate was 23.2% (95% CI, 19.0- 27.9) >WHO threshold of 15% despite nutrition programs calls for change of strategy rather than food Aid. Access to community based distributors CBDs) associated with lower rates of malnutrition p-value 0.032 and OR 0.62 (95% CI 0.41-0.94).

ICCM program has to be scaled up to cover all the villages including the hard to reach areas and to include malaria chemoprophylaxis for malnourished children 6-59 months who are at higher risk of severe malaria.

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    a. I hereby declare that I have completed this form truthfully Signature Dricile

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