Research Article

The Outcome of the Treatment of Malnourished Children Treated by Ready-To-Use Therapeutic Food and Ready to Use Supplementary Food in Wad- El-Bashir Heath Center, 2021

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***Abstract*:**
Introduction: Malnutrition includes both undernutrition and overnutrition. Child undernutrition is a major global health problem that is more common in low-income countries like Sudan, it can cause childhood morbidity, mortality, and impaired intellectual development. ***Objective***: This study was conducted to assess the outcome of malnourished children treated with ready to-Use Therapeutic Food (RUTF), and ready to-Use Supplementary Food (RUSF) in Wad Elbasheir Health Centre in Ombada Locality ***Methods***: This is an analytical Cross-Sectional facility-based Study conducted at Wad Elbasheir Health Centre. A convenient nonprobability sampling technique was used in this study. Data were collected using a datasheet after being pretested. Data were collected from secondary data from the records of malnourished children treated by the RTUF and RUSF. ***Results***: The majority of the participants of this study were aged between 6 to 23 months (84%) and most of the participants were females (56%). This study showed that 70 (24%) of the participants were classified as severe Acute Malnutrition (SAM), while 218 (76%) were classified as moderate Acute malnutrition (MAM). This study showed that having a smaller number of children in the family and middle Upper Arm Circumference (MUAC) between 11.5-12.5 cm were more associated with recovery. Moreover, this study showed that children who use amoxicillin or anti-worms were more likely to be recovered from malnutrition. ***Conclusion***: RUTF was designed for the nutritional management of children with uncomplicated acute malnutrition treated as outpatients. In this study, most of the children recovered. In addition, this study found that several factors were associated with better outcomes including fewer children in the family, MUAC between 11.5-12.5 cm, having MAM (compared to having SAM), and using amoxicillin or anti-worms.

Keywords: Malnourished, Outcome, Children, Treatment**,** Therapeutic, Food, Supplementary.

Background:

Malnutrition includes both under nutrition and over-nutrition. undernutrition is associated with acute and chronic malnutrition. while nutrition is associated with obesity and overweight. Acute malnutrition is due to a sudden reduction in food intake or quality, this is usually accompanied by pathological conditions. Acute malnutrition includes protein-energy malnutrition, wasting, Kwashiorkor, and Marasmus. Chronic malnutrition is due to inappropriate intake or absorption of essential nutrients for a long time. Stunting (short stature for age) is the indicator used for chronic malnutrition. Child undernutrition is a major global health problem causing childhood morbidity, mortality, and impaired intellectual development. also, may result in an increased risk of the disease and suboptimal capacity of the adult **[1].**

According to global estimates in 2018, there is 7.3% or 49 million children under five were severely wasted **[2].** Children with Sever Acute Malnutrition (SAM) are diagnosed by measuring their Mid-Upper Arm Circumference MUAC **[3].** In children, six to 59 months, AMUAC of less than 11.5cm is diagnostic for SAM. Also, a weight for height –Z score of more than three standard deviations diagnose, as well as nutritional edema **[4].** Moderate acute malnutrition (MAM) for moderate wasting, diagnosed by MUAC<12.5 cm and more than 11.5cm, also Z score > -2 standard deviations **[5].**

SAM with complications will be treated in the hospital, while uncomplicated SAM will receive outpatient treatment. Also, MAM patients will receive outpatient treatment. The management of complicated SAM is classified into three phases. This includes the Stabilization phase; Milk-based formula is used which is called F75 (low protein, low energy diet), Transitional phase (In this stage feed change gradually from F75 to F100 and Rehabilitation phase; during this phase milk-based formula, F100 (high protein, high energy) is used. If available, children could be transitioned from F75 to RUTF according to the updated WHO guidelines **[1]**. According to the knowledge of the researcher there is no published studies done in Sudan regarding outcome of treatment of uncomplicated malnutrition, all published studies done about outcome of treatment of complicated malnutrition admitted to hospitals.

Materials and methods:

Study design:

This is an analytical Cross-Sectional facility-based Study

Study area:

This study was conducted in Wad Elbasheir Health Centre, Hara 52 in Um-bad Locality in Omdurman city in Khartoum State. The center provides many services to the population since 2014. The nutritional services program started in 2016. The health center provides the service to El-hara 52, Elhara51, Elhara43, Elhara42, abused58,

and Elmoalih. The population with different cultures and different tribes. Most of them migrated to Ombada Locality from outside, especially the southern Sudan, and settled in Wad Elbasheir camp. The population of low socioeconomic status. These services include a family medicine clinic (two family doctors), there is a general medicine clinic (one consultant of medicine), an ultrasound department, a general lab for investigations, a department for children to provide vaccination and nutritional services, a department for anti-natal care and dental department. Work days in the nutritional department are four days per week. Sixty children attend every work day. The treatment is offered for both SAM and MAM Children. SAM IS treated with RUTF, MAM is treated with RUSF. Follow up and offer RUTF for SAM every one week, and follow up and offer RUSF for MAM every two weeks. RUTF is offered according to the first presentation weight. USF's offer does not differ, regardless of the weight, two packages are daily offered to MAM children. In the first visit, Amoxil is provided according to weight, Mebendazole is provided in the second visit to children of age above one year according to age, both given only for SAM. The work team includes doctor and nutritionist cadres and assistants, assistants usually are volunteers. All children in the program have follow-up records. The resulting outcome is classified either as recovery (when reaching 80% of the expected weight), default (when missed three consecutive visits), transfer (when the child's weight is constant for three consecutive visits or child weight decreases for two consecutive visits), and death**.**

Study duration:

This study was conducted during the period from September 2021 to March 2022.

Study population:

Records of Children under five years attending Wad Elbasheir health center during the study period and diagnosed with uncomplicated severe acute malnutrition and moderate acute malnutrition

Data collection:

Data were collected using a data sheet after being pretested. Data were collected from secondary data from the records of malnourished children treated by the R.T.U.F and R.U.S.F in Wad Elbasheir health center. Data were collected by the researcher.

Data analysis:

Data were reviewed ordered then coded and analyzed by the Statistical Packages for Social Sciences Software (SPSS) Version 26. Categorized variables were presented by figures and tables. Comparison between groups was done using the Chi-square test and test of significance. P-value - ≤0.05 was considered as significant.

Ethical Consideration:

Ethical consideration was obtained from the Sudanese Medical Specialization Board (SMSB). Family Medicine Council. Khartoum ministry Of Health research department. The management of wad el-

Bashir health center. Educational developmental center (E.D.C). Primary health director of Ombada locality. Written consent was obtained. The research purpose and objectives were explained to participants in clear simple words. Participant has the right to voluntary informed consent. Participant has the right to withdraw at any time without any deprivation. Participant has the right to no harm (privacy and confidentiality by using coded data cheat. Participant has the right to benefit from the researcher's knowledge and skills. Data cheat was filled by the researcher using participant records at a suitable time for the participant. All precautions against COVID-19were taken including wearing face masks and hand sterilization solutions at and suitable distance and not shaking hands

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Results:

Table-1: Anthropometric measurements among the study participants.

Presentation measures		N	%	Mean	S.D.	Min	Max
Weight (in Kg)				7.1	1.2	3.9	12.1
Height or length (in Cm)				72	7	56	123
Z score	More than negative 1	2	0.70%				
	Negative 1	1	0.30%				
	Less than negative 1	72	25.00%				
	Negative 2	22	7.60%				
	Less than negative 2	141	49.00%				
	Negative 3	16	5.60%				
	Less than negative 3	34	11.80%				
MUAC (in mm)	Less than 115	70	24.30%				
	115-125	218	75.70%				

Table-2: Shows the time of arrival to the center of the study participants.

Time of arrival to the center	Frequency	Percent
30 minutes to 1 hour	264	91.7
More than 1 hour	19	6.6
More than 2 hours	5	1.7
Total	**288**	**100**

Table-3: Findings on examination among the study participants.

Examination findings		N	%
Bilateral edema	Yes	1	0.30%
	No	287	99.70%
Chronic cough	Yes	0	0.00%
	No	288	100.00%
Chronic diarrhea	Yes	0	0.00%
	No	288	100.00%
Fever	Yes	0	0.00%
	No	288	100.00%

Table 4: Used medications among the study participants.

Medications		N	%
Amoxicillin	Yes	59	84.3.%
	No	11	15.7%
Anti-worms	Yes	48	68.5%
	No	22	30.5%

Table-5: Status of the participants in the follow-up visits.

Follow up visits		N	%
First visit	Improved	262	96.70%
	Not improved	5	1.80%
	Constant	4	1.50%
Second visit	Improved	242	95.70%
	Not improved	7	2.80%
	Constant	4	1.60%
Third visit	Improved	226	96.60%
	Not improved	6	2.60%
	Constant	2	0.90%

Table-6: Time of recovery (in weeks) among the study participants.

Time of recovery (in weeks)	
N	202
Mean	6.71
Median	6
Mode	6
Std. Deviation	2.544
Minimum	3
Maximum	16

Table-7: Association between the outcome and age (in months) among the study participants.

Age (in Months)		Outcome			Total	*P-Value*
		Recovery	Transfer	Default		
6 – 23	N	167	4	71	242	**0.872**
	R%	69.0%	1.7%	29.3%	100.0%	
	C%	84.8%	80.0%	82.6%	84.0%	
24 – 59	N	30	1	15	46	
	R%	65.2%	2.2%	32.6%	100.0%	
	C%	15.2%	20.0%	17.4%	16.0%	
Total	N	197	5	86	288	
	R%	68.4%	1.7%	29.9%	100.0%	
	C%	100.0%	100.0%	100.0%	100.0%	

Table-8: Association between the outcome and gender among the study participants.

Gender		Outcome			Total	*P-value*
		Recovery	Transfer	Default		
Male	N	83	2	41	126	**0.679**
	R%	65.9%	1.6%	32.5%	100.0%	
	C%	42.1%	40.0%	47.7%	43.8%	
Female	N	114	3	45	162	
	R%	70.4%	1.9%	27.8%	100.0%	
	C%	57.9%	60.0%	52.3%	56.3%	
Total	N	197	5	86	288	
	R%	68.4%	1.7%	29.9%	100.0%	
	C%	100.0%	100.0%	100.0%	100.0%	

Table-9: Association between the outcome and the time of arrival to the center among the study participants.

Time of arrival to the center		Outcome			Total	*P-value*
		Recovery	Transfer	Default		
30 mintues to 1 hour	N	192	5	67	264	< 0.001
	R%	72.7%	1.9%	25.4%	100.0%	
	C%	97.5%	100.0%	77.9%	91.7%	
More than 1 hour	N	3	0	16	19	
	R%	15.8%	0.0%	84.2%	100.0%	
	C%	1.5%	0.0%	18.6%	6.6%	
More than 2 hour	N	2	0	3	5	
	R%	40.0%	0.0%	60.0%	100.0%	
	C%	1.0%	0.0%	3.5%	1.7%	
Total	N	197	5	86	288	
	R%	68.4%	1.7%	29.9%	100.0%	
	C%	100.0%	100.0%	100.0%	100.0%	

Table-10: Association between the outcome and the socioeconomic Status among the study participants.

Socioeconomic status		Outcome			Total	*P- value*
		Recovery	Transfer	Default		
Low	N	193	5	86	284	0.216
	R%	68.0%	1.8%	30.3%	100.0%	
	C%	98.0%	100.0%	100.0%	98.6%	
Moderate	N	4	0	0	4	
	R%	100.0%	0.0%	0.0%	100.0%	
	C%	2.0%	0.0%	0.0%	1.4%	
Total	N	197	5	86	288	
	R%	68.4%	1.7%	29.9%	100.0%	
	C%	100.0%	100.0%	100.0%	100.0%	

Table-11: Association between the outcome and the number of children in the family among the study participants.

Number of children in family		Outcome			Total	*P-value*
		Recovery	Transfer	Default		
1 – 3	N	15	0	16	31	< 0.001
	R%	48.4%	0.0%	51.6%	100.0%	
	C%	7.6%	0.0%	18.6%	10.8%	
4 – 5	N	113	1	25	139	
	R%	81.3%	0.7%	18.0%	100.0%	
	C%	57.4%	20.0%	29.1%	48.3%	
More than 5	N	69	4	45	118	
	R%	58.5%	3.4%	38.1%	100.0%	
	C%	35.0%	80.0%	52.3%	41.0%	
Total	N	197	5	86	288	
	R%	68.4%	1.7%	29.9%	100.0%	
	C%	100.0%	100.0%	100.0%	100.0%	

Table-12: Association between the outcome and breastfeeding among the study participants

Breast feeding		Outcome			Total	*P-value*
		Recovery	Transfer	Default		
Yes	N	143	3	63	209	0.824
	R%	68.4%	1.4%	30.1%	100.0%	
	C%	72.6%	60.0%	73.3%	72.6%	
No	N	54	2	23	79	
	R%	68.4%	2.5%	29.1%	100.0%	
	C%	27.4%	40.0%	26.7%	27.4%	
Total	N	197	5	86	288	
	R%	68.4%	1.7%	29.9%	100.0%	
	C%	100.0%	100.0%	100.0%	100.0%	

Table-13: Association between the outcome and weight (in Kg) among the study participants.

	Weight (in Kg)	N	Mean	S.D.	95% C.I.	
					Lower	Upper
Outcome	Recovery	197	7.146	1.165	6.982	7.31
	Transfer	5	6.38	1.047	5.08	7.68
	Default	86	7.155	1.414	6.851	7.458
	Total	288	7.135	1.243	6.991	7.28
F		**0.941**				
P-value		**0.392**				

Table-14: Association between the outcome and Height (in Cm) among the study participants.

	Height or length (in Cm)	N	Mean	S.D.	95% C.I.	
					Lower	Upper
Outcome	Recovery	197	71.84	6.436	70.94	72.75
	Transfer	5	69.00	5.958	61.60	76.40
	Default	86	72.93	9.553	70.88	74.98
	Total	288	72.12	7.499	71.25	72.99
F		**1.070**				
P-value		**0.344**				

Table-15: Association between the outcome and the anthropometric measurements among the study participants.

Presentation measures			Outcome result			*P-value*
			Recovery	Transfer	Default	
Z score	More than negative 1	N	2	0	0	**0.007**
		R%	100.0%	0.0%	0.0%	
		C%	1.0%	0.0%	0.0%	
	Negative 1	N	1	0	0	
		R%	100.0%	0.0%	0.0%	
		C%	0.5%	0.0%	0.0%	
	Less than negative 1	N	56	1	15	
		R%	77.8%	1.4%	20.8%	
		C%	28.4%	20.0%	17.4%	
	Negative 2	N	22	0	0	
		R%	100.0%	0.0%	0.0%	
		C%	11.2%	0.0%	0.0%	
	Less than negative 2	N	86	2	53	
		R%	61.0%	1.4%	37.6%	
		C%	43.7%	40.0%	61.6%	
	Negative 3	N	7	0	9	
		R%	43.8%	0.0%	56.3%	
		C%	3.6%	0.0%	10.5%	
	Less than negative 3	N	23	2	9	
		R%	67.6%	5.9%	26.5%	
		C%	11.7%	40.0%	10.5%	
MUAC (in mm)	Less than 115	N	48	4	18	**0.024**
		R%	68.6%	5.7%	25.7%	
		C%	24.4%	80.0%	20.9%	
	115-125	N	149	1	68	
		R%	68.3%	0.5%	31.2%	
		C%	75.6%	20.0%	79.1%	

Table-16: Association between the outcome and the classification of malnutrition among the study participants.

Classification		Outcome			Total	*P-value*
		Recovery	Transfer	Default		
MAM	N	149	1	68	218	**0.021**
	R%	68.3%	0.5%	31.2%	100.0%	
	C%	75.6%	20.0%	79.1%	75.7%	
SAM	N	48	4	18	70	
	R%	68.6%	5.7%	25.7%	100.0%	
	C%	24.4%	80.0%	20.9%	24.3%	
Total	N	197	5	86	288	
	R%	68.4%	1.7%	29.9%	100.0%	
	C%	100.0%	100.0%	100.0%	100.0%	

Table-17: Association between the outcome and the presence of bilateral edema among the study participants

Bilateral edema		Outcome			Total	*P-value*
		Recovery	Transfer	Default		
Yes	N	1	0	0	1	**0.683**
	R%	100.0%	0.0%	0.0%	100.0%	
	C%	0.5%	0.0%	0.0%	0.3%	
No	N	196	5	86	287	
	R%	68.3%	1.7%	30.0%	100.0%	
	C%	99.5%	100.0%	100.0%	99.7%	
Total	N	197	5	86	288	
	R%	68.4%	1.7%	29.9%	100.0%	
	C%	100.0%	100.0%	100.0%	100.0%	

Table-18: Association between the outcome and the used medications among the study participants.

Medication			Outcome result			*P-value*
			Recovery	Transfer	Default	
Amoxicillin	Yes	N	42	4	13	**0.007**
		R%	71.2%	6.8%	22.0%	
		C%	21.3%	80.0%	15.1%	
	No	N	155	1	73	
		R%	67.7%	0.4%	31.9%	
		C%	78.7%	20.0%	84.9%	
Anti-worms	Yes	N	34	4	10	**0.003**
		R%	70.8%	8.3%	20.8%	
		C%	17.3%	80.0%	11.6%	
	No	N	163	1	76	
		R%	67.9%	0.4%	31.7%	
		C%	82.7%	20.0%	88.4%	

Discussion:

This study showed that the recovery rate was 68.4%, the default rate was 29,9% and transfer rate was1.7%. The mean recovery time was 6,7 weeks. Factors related to recovery were having a smaller number of children and MAM classification and use of Amoxicillin and anti-warms. The recovery rate is less than the standard expected rate which is >75%, this is higher than the recovery rate found in a study conducted in Ghana which was 34.5% **[14].** and lower than the recovery rate found in a study conducted in Ethiopia which was 70% **[13].** The default rate is higher than expected which is>10% also it is higher than the default rate in Ethiopia which was 0% and lower than that of Ghana which was56%. This study found a significant association between the outcome and the number of children in the family, where having a smaller number of children in the family was more associated with recovery from malnutrition. This finding is consistent with another study conducted by Monsurul Hoq et al, which found that a large family number is associated with malnutrition and poor outcome **[15].** This study found no association between the outcome and breastfeeding among the study participants. This finding is different than a study conducted by Binyam Atnafe et al, which found that children who were being breastfed were more likely to recover faster **[13].** This study found an association between the MUAC and the outcome, in which MUAC between 11.5cm-12.5 cm was more likely to be associated with recovery (*P-value* =0.024). Furthermore, this study found that children with MAM were more likely to have a favorable outcome when compared to those with SAM (*P-value* = 0.021). These are expected outcomes, as a less severe form of malnutrition is expected to recover more rapidly. This study showed that children who use amoxicillin or anti-worms were more likely to be recovered from malnutrition. This finding is similar to another study conducted by Binyam Atnafe et al, which found that the use of amoxicillin was associated with a higher rate of recovery from malnutrition **[13].**

Conclusion:

Ready-to-use-therapeutic-food was designed for the nutritional management of children with uncomplicated acute malnutrition treated as outpatients. In this study, most of the children recovered. In addition, this study found that several factors were associated with better outcomes including a smaller number of children in the family, MUAC between 115-125 mm, having MAM (compared to having SAM), and using amoxicillin or anti-worms.

Recommendations:

1. To raise awareness among doctors and the general population regarding malnutrition and its effective management. Nutrition education should be introduced and enhanced among mothers.
2. More care should be devoted to

qualitative and quantitative complementary feeding.

3. To conduct a further study with a larger sample size to assess the outcome of malnourished children treated with RUTF and RUSF.

Sources of Funding:

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of Interest:

The author has declared that no competing interests exist.

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