

Study of factors influencing the recovery in children with severe acute malnutrition receiving ready to use therapeutic food

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Abstract

Background: Ready-to-use-therapeutic-foods (RUTF) was designed for the nutritional management of children with severe acute malnutrition (SAM). Previous studies on RUTF (Medical Nutrition Therapy=MNT) have shown variation in the outcome of SAM children. Hence, the present study was undertaken to assess the factors influencing the recovery in children with SAM on RUTF (MNT) treatment.

Method: Total 114 children of age 6-59 months with SAM as per WHO criteria and who presented to the NRRTC OPD and admitted in Paediatric ward were enrolled and started on MNT for total duration of 8 weeks. Anthropometric measurements at enrolment and after completion of 8 weeks of MNT, proportion of MNT consumed, and details of possible risk factors which affected the outcomes of treatment were collected.

Results: 42.98% were SAM according to weight-by-height criteria while 57.1% were SAM according to both weight-by-height and MUAC criteria and no patient had oedema. Mean weight at enrolment was 6.5kg which increased to 7.0kg in 8 weeks, mean height at enrolment

was 71.55cm which increased to 79.9cm. Mean MUAC at enrolment was 10.9cm which increased to 11.4cm at 8 weeks. There was significant weight and height gain in children at 8 weeks. Patient related factors were present in 95.6% patients, MNT related factors were in 34.2%, socio-demographic factors were in 81.5% and all three factors affected in 28.9% patients.

Conclusion: MNT i.e., RUTF must be considered as a standard of care across India. It is of great help in the management of rehabilitation phase of SAM. The study found that multiple factors contributed to poor recovery, so it is very difficult to say which factor affected the recovery more.

Keywords: Ready-to-use-therapeutic-foods; Medical nutrition therapy; Severe acute malnutrition; Anthropometric; Risk factors; Oedema

Introduction

Severe acute malnutrition (SAM) is a condition that occurs when the food intake does not meet the nutritional requirements either as a consequence of poor intake or disease [1]. In children 6–59 months of age, SAM is diagnosed when a child presents with a weight-for-height

Z-score (WHZ) $<-3SD$ and/or mid-upper arm circumference (MUAC) <115 mm and/or bilateral pitting oedema [2]. While the overall prevalence of SAM is unknown, in 2020 it was estimated that 2% of all children below the age of 5 years presented a WHZ <-3 translating to more than 13.6 million children suffering from severe wasting at any time [3]. Children with SAM have a 11.6 increased risk of mortality compared to children with no nutritional deficits living in the same contexts [4]. As part of the global nutrition targets, the world has committed to reducing and/or maintaining the level of wasting to less than 5% by 2025 [5].

However, children with SAM need safe, palatable foods with a high energy content and adequate amounts of vitamins and minerals. MNT is a form of RUTF which is calorie dense and protein rich and fortified with essential micro-nutrients required for optimal growth and weight gain. WHO recommends MNT as a gold standard for management of severely malnourished children [6]. There is no need to cook, making it practical for use where cooking fuel and zero water available. Low water activity makes it unfavorable for bacteria growth. It does not contain any preservatives or food additives/ coloring agents. It is FSSAI approved [7]. It has shown promising results in the management of children with SAM. Hence, it has become the standard of care in the rehabilitation of SAM children. It facilitates home based therapy for children. Just few spoonful of MNT 5-8 times a day achieves sufficient nutrient for complete recovery [6].

The malnutrition has multifactorial risk factors specially the non-dietary ones like socioeconomic class, education of parents, child feeding practice, cultural practice. Malnutrition during childhood can affect growth potential and risk of morbidity and mortality in later years of life. Malnutrition not only major threat to health also to wealth and economic development, so it is

beneficial to know the factors influencing recovery and plan comprehensive measures [8]. Although proven to be a very effective treatment, earlier published studies on RUTF (MNT) and unpublished data on MNT has shown inconsistency in the outcome of SAM children. Hence, the present study was done at our tertiary care center to assess the clinico-socio- demographic profile of all SAM children on MNT and difference in weight gain in SAM children with organic disease and without organic disease and ascertain other factors which affect growth and weight gain in SAM children.

Materials and Methods

After obtaining Institutional Ethical Committee approval and written informed consent from parents, this hospital based cross sectional observational study was conducted in 114 children at pediatrics ward set up of a tertiary hospital and Nutritional Rehabilitation, Research and Training center (NRRTC) during a period of 18 months from August 2019 to January 2021. All children aged 6-59 months with SAM as per WHO criteria [90] and who presented to the NRRTC OPD and admitted in Paediatric ward over a period of 18 months, were started on MNT after ruling out acute complications and stabilization, completion of transitional phase and who passed the appetite test, (to pass appetite test the intake of a RUTF has to be at least in the moderate range) [91]. Nutritional counselling was done for each caretaker before starting MNT, then weekly as per MNT chart and recommended MNT cups were given to them for total duration of 8 weeks. Those children who failed to gain target weight or failed to recover from SAM after completion of MNT for 8 weeks of treatment were enrolled in this study. Children on other nutritional supplements and MNT defaulters (Children who have taken MNT for less than 6 weeks duration) were excluded.

The sociodemographic profile, history of acute or chronic illness, birth and developmental history, dietary history, clinical examination finding, and anthropometric measurements were entered in NRRTC register at enrolment. Following details were collected from NRRTC register and entered in predesigned case record proforma. Personal details, anthropometric measurements at enrolment and after completion of 8 weeks of MNT, proportion of MNT consumed and details of other possible risk factors were asked from parents /caretaker, which could have affected the outcomes of treatment.

Statistical Analysis

Data were analysed using SPSS V15.0 package (Statistical Package for Social Sciences, Version 15.0). Data was given as Mean ± SD for continuous variable and median and range for non-normal data. Number and Percentage for categorical data. P value less than 0.05 was considered as statistically significant.

Observations and Results

Mean age of children was 1.7 years with male predominance (57.9%). 42.98% were SAM according to weight by height criteria while 57.1% were SAM according to both weight by height and MUAC criteria and no patient had oedema. 69.2% patients had some acute illness during treatment and fever was commonest one (39.4%). 41.2% patients had some chronic illness during treatment, out of which cardiovascular system was affected in 14.9%, CNS diseases in 13.1%. Most common heart disease observed was ASD with VSD. Cerebral Palsy was seen as the most common CNS disease, (Table 1).

Table 1: Distribution of acute and chronic illness in study population (N = 114)

Illness		Number	Percent
Acute illness	Fever	45	39.4
	Cough	28	24.5
	Cold	39	34.2
	Vomiting	19	16.6
	Loose motion	19	16.6
	Measles	03	2.6
	Pneumonia	06	5.2
	Total acute illness	159	69.2
	No illness	35	30.8
Chronic illness	Cardiovascular	17	14.9%
	Central nervous system	15	13.1%
	Gastrointestinal	03	2.6%
	Respiratory	03	2.6%
	Endocrine	02	1.75%
	Immunocompromised	00	0%
	Hematology	05	4.3%
	Inborn error of metabolism	01	0.8%
	Syndromic baby	07	6.1%
	PUV	01	0.8%
	No illness	67	58.8%

Development was delayed in 14.9% cases, 2.6% had chromosomal anomaly (21 trisomy), while 0.9% cases had congenital malformation. 48.2% patient were below normal birth weight (LBW, VLBW and ELBW) while 51.8% had normal birth weight and among 6 months to 1 year age of children 41.66% patients were below normal birth weight.

Table 2: Distribution of birth weight among children between 6 months to 1 year and 1 to 2 years

Birth weight	6 months to 1 years	1 to 2 years
< 1000 gm ELBW	02 (5.5%)	02 (4.5%)
1000-1499 gm VLBW	04 (11.0%)	04 (9.0%)
1500-2499gm LBW	09 (25.0%)	17 (38.63%)
2500 or above Normal	21 (58.33%)	21 (47.7%)
Total	36 (100%)	44 (100%)

Mean duration of exclusive breast feeding (EBF) was 5.73±2.20 months while mean duration of breast feeding (BF) was 13.63±7.64 months. EBF till 6 months was done in 79.8% cases, while breast feeding less than 6 months was done in 15.78% cases and 4.3 % were never breast fed (figure 1).

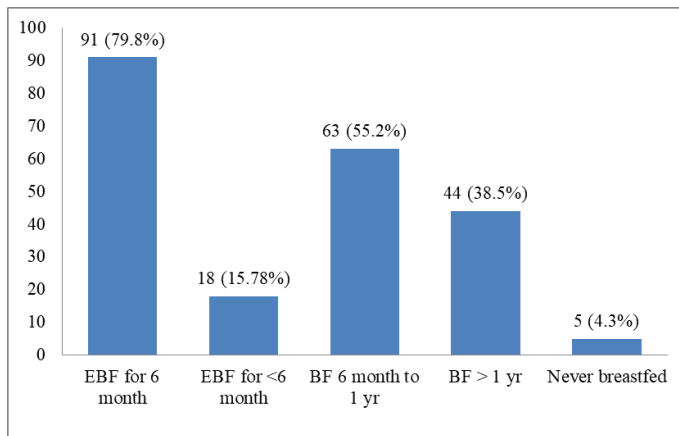


Figure 1: Distribution of breast-feeding practices

MNT was neither too salty (114) and sweet (114), nor too oily (112), with good consistency (112) and smell good (114). Figure 2 shows that 34.2% has consumed <40% of recommended MNT.

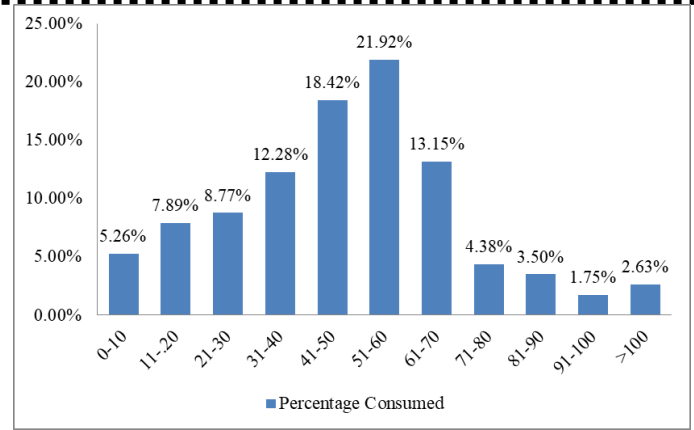


Figure 2: Distribution according to proportion of MNT consumed

Maximum i.e., 31.5% parents were educated till high school and secondary education and 7% were illiterate. However, most of the fathers were daily wage workers (27.2%). 31.5% of patients were below poverty line (Below Rs. 2250) and 68.4% had capital income of Rs. 2250 or above. Most of the cases according to kuppuswamy class were belonging to class IV (67.5%). Total of 74.5% were belonging to lower class. Kuppuswamy score was 7 in most of the cases (23%) followed by score 6 (17.7%) and score 8 (12.40%), (Table 3).

Most of the cases had 4 family size (48.7%), 28.3% had 3 family size, 15% had 5 family size. 10 (8.8%) parents felt that center was too far from their residency. Most of the cases had birth order 2 (42.5%) and birth order 1 (38.1%), followed by birth order 3 (11.50%), order 4 (3.50%), order 5 (2.70%) and birth order 6 (1.80%).

Table 3: Distribution according to education, occupation and kuppuswamy class

Education and Occupation		Father's	Number	Percent
Education of Head of Family	Illiterate		08	7.0
	Primary school		13	11.50
	Secondary school		36	31.60
	High School		36	31.50

	Intermediate	10	8.80	
	Graduate	11	9.80	
	Profession/ honour	00	00.0	
Father's Occupation	One patient each- Anganwadi worker/ Cleaner/Cleaner/Teac her /Garden/ Courier/ Electrician/Keeping/ Garment/Clerk/Hospi tal management/ Housekeeping/ Jarimaker/ Mechanic/Painter/ PaniPuri vendor/ Pharmacist/ Private job/Salesman/ Supervisor/ Watchman	01	0.90	
	Two patient each- BMC/Carpenter/ Furniture/ Helper/ Mobile repair/ Plumber	02	1.80	
	Three patient each- Auto driver/Business/Butc her/ Computer job/ Office job/	03	2.60	
	Shopkeeper	04	3.50	
	Driver	14	12.30	
	Daily wage worker	31	27.20	
	Govt Service	08	7.0	
	Tailor	10	8.80	
	Modifie	I (Upper class)	00	0.00

Kuppaswamy class	II (Upper middle class)	01	0.90
	III (Lower middle class)	27	23.70
	IV (Upper lower class)	77	67.50
	V (Lower class)	08	7.00

Figure 3 shows there was weight and height gain in children at 8 weeks with p value <0.05 which was significant.

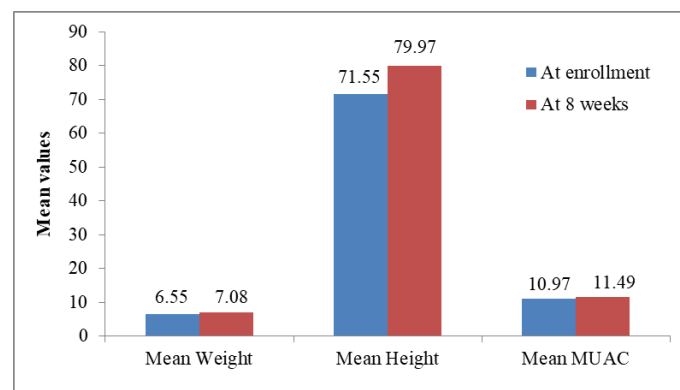


Figure 3: Mean weight, height, MUAC at enrolment and at 8 weeks (N = 114)

Patient related factors were present in 109 (95.6%) patients, MNT related factors were in 39 (34.2%), socio demographic factors were in 93 (81.5%) and all three factors affected 33 (28.9%) patients (Figure 4).

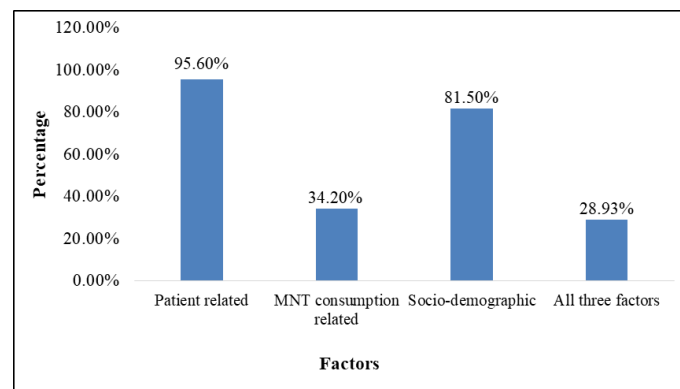


Figure 4: Distribution of factors influencing recovery (N = 114)

Discussion

In the present study, majority of patients were in younger age group with mean age of 1.7 years with male predominance (57.9%) which may be due to poor resistance power in male. This is comparable with the previous studies [6-10]. 42.98% were SAM according to weight by height criteria while 57.1% were SAM according to weight by height and MUAC criteria, no patient had pitting oedema. In contrast, Elizabeth K et al [10] found 51% oedematous SAM.

69.2% patients had some acute illness during treatment most common was fever (39.4%) followed by cold (34.2%) and cough (26.5%), vomiting and loose motion each (16.6%). This is comparable to the study conducted by Elizabeth K et al [10]. However, majority of the patients had some acute illness during MNT treatment which further decreased oral intake and malnutrition worsening and this vicious cycle continued, so parents should be counselled to bring the child to hospital and more focus on Strengthening of breastfeeding practice and immunization to be undertaken to tackle these situations. 41.2% patients had some chronic illness during treatment, out of which cardiovascular system was affected in 14.9%, CNS diseases in 13.1%. Most common heart disease observed was ASD with VSD. 5 cases had Cerebral Palsy while 1 case had hypothyroidism, GLVH was observed in 2 cases. These findings are in accordance with the study done by Derseh B et al [9] and Sanghvi J et al [11].

It was observed in the present study that development was delayed in 14.9% cases, 2.6% had chromosomal anomaly (21 trisomy), while 0.9% cases had congenital malformation. 48.2% patient were below normal birth weight (LBW, VLBW and ELBW) and 51.8% had normal birth in study population and among 6 months to 1 year age of children 41.66% patients were below

normal birth weight. Mean duration of EBF was 5.7 months while mean duration of BF was 13.6 months, and EBF till 6 months was done in 79.8% cases, while 15.78% cases were exclusively breast fed less than 6 months and 5(4.3%) children were never breastfed. This is similar to study conducted by Sanghvi J et al [11]. Breastmilk works like a baby's first vaccine, protecting infants from potentially deadly diseases and giving them all the nourishment, they need to survive and thrive. We studied parental responses for children's acceptability of MNT and found that as per majority of them MNT was neither too salty (114), nor too oily (112), with good consistency (112) and no smell complaints (114) which is correlated with the previous studies [12, 13].

In current study, 34.2% patients had consumed <40% of recommended MNT. Important cultural and behavioural factors might also play a role in the acceptance of a therapeutic nutritional product, and such factors were not assessed in this study, neither was it studied in the other studies which we reviewed. The majority of heads of family were educated up to high school (31.5%) and secondary education (31.6%) followed by primary education (11.5%). 7% were illiterate. As for the occupation, majority of the family heads were daily wage workers (27.2%) followed by driver (12.2%), followed by tailor (8.8%). This finding is comparable with the study done by Singh S et al [14]. Educated parents are more sensitised to children's needs and issues. Low-income groups have their own set of issues, one of which is poor follow-up due to loss of income with every visit to the hospital, which is most seen in daily wage workers which we have observed in current study. Majority of patients were belonging to upper lower class (IV) 67.5% followed by class (III) 23.7% followed by class(V) 7% and 0.9% were from class (II). Total 74.5 % were belonging to lower class (IV and V). Kuppuswamy score

was commonly 7 in most of the cases (23%) followed by score 6 (17.7%). It is comparable to Sanghvi J et al [11] and Jeyaseelan L et al [15]. 31.5% patients were below poverty line which corresponded with the socioeconomic distribution of our subjects. Most of the cases had 4 family size (48.7%), 28.3% had 3 family size, 15% had 5 family size, 2.7% had 6 family size, 3.5% had 7 family size and 1.8 % had 8 family size, total 22(19.2%) patients were 3 or above birth order. These findings are correlated with the other studies [11, 14]. A larger family size or high birth order is associated with an increased risk of SAM. The effect of a large family size with overcrowding leading to poor hygiene finally to recurrent infections and inadequate spacing has been implicated as a risk factor for severe malnutrition. But in present study children with 1st by birth order were more affected which can be explained by neglect of 1st child after birth of 2nd child, especially when spacing of children was improper. This would mean the first child was ignored before his nutritional status has stabilised. It was observed that 8.8% Parents felt that center was too far which indirectly affect follow up and adherence with the treatment. This was further aggravated by the Covid-19 lockdown which made travelling very difficult for the masses, especially those belonging to the lower socioeconomic classes.

The mean weight at enrolment was 6.5kg which increased to 7kg in 8 weeks mean height at enrolment was 71.55 cm which increased to 79.9 cm. Mean MUAC at enrolment was 10.9 cm which increased to 11.4 cm at 8 weeks. There is significant weight and height gain in children at 8 weeks. It was observed in current study that MNT based management is superior in promoting rapid initial weight gain and maintaining weight gain. There was significant association in mean weight gain in 8 weeks. Also mean height had significant association while mean MUAC had no significant association at 8

weeks. These findings are consistent with the studies of Jadhav A et al [6], Sanghvi J et al [11], Thakur GS et al [16].

The present study found that multiple factors contributed to poor recovery, so it is very difficult to say which factor affected the recovery more. Also, there was a significant overlap in factors influencing recovery. We have seen socio economic inequalities in patients, literacy is important factor. Literate parents are able to access and take benefit of Government facilities and opportunities and are able to provide better health care for their children. Poor socioeconomic status associated with poor hygiene and children are more prone to be affected by environmental contamination as they start crawling, walking, exploring, and putting objects in their mouths, which may increase the risk of ingesting faecal bacteria from both human and animal sources. This leads to repeated episodes of diarrhoea and intestinal worms, which in turn deteriorates the nutritional status of children. Efforts to reduce socioeconomic disparities are not lacking, but achievements are disproportionately low. There is a need to address the various socio-economic and demographic factors along with improving health infrastructure.

Conclusion

Indigenously prepared MNT is definitely superior in promoting rapid initial weight gain and maintaining the rate of weight gain for hospital based followed by home based management. Hence MNT i.e., RUTF must be considered as a standard of care across India. RUTF is of great help in the management of rehabilitation phase of SAM. The present study found that multiple factors contributed to poor recovery, so it is very difficult to say which factor affected the recovery more.

Limitations

- We did not account for the immunization status of the children, which significantly reduce morbidity and mortality of major childhood illnesses, and by extension reduce the incidence of malnutrition.
- In view of Covid-19 related restraints we could not provide a reasonable solution to sociodemographic issues faced by our subjects, the most important being difficulty in reaching the hospital due to distance and transport related problems.
- We could not reliably study vast cultural and behavioural factors affecting child's recovery.
- Including a control group (with adequate weight gain post treatment with MNT) would've allowed us to compare the patient factors as well as sociodemographic factors more reliably.
- Regarding MNT acceptance-Important cultural and behavioural factors might also play a role in the acceptance of a therapeutic nutritional product, and such factors were not assessed in this study, neither was it studied in the other studies which we reviewed.

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