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Effectiveness of Home-Based Administration of Ready to Use Therapeutic Formula (RUTF) in the Management of Severe Acute Malnutrition (SAM)

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Author`s Contribution	A B S T R A C T
	Objective: To evaluate the growth of children with uncomplicated Severe Acute Malnutrition (SAM) treated with Ready-to-Use Therapeutic Formula (RUTF) on an outpatient department basis. **Methodology:** This prospective observational study was conducted on 66 children at the Outpatient setting of the MCH Centre, Federal Government Polyclinic Hospital, Islamabad, Pakistan, from January 2023 to June 2023. Children aged 6-59 months suffering from severe acute malnutrition (SAM) were selected for nutritional rehabilitation with Ready-to-Use Therapeutic Formula (RUTF) after meeting the selection criteria defined by WHO. RUTF is a nutrient mixture formulated primarily for the therapy of severe acute malnutrition without complications. **Results:** The mean age of patients was 16.98±6.12 months. Out of 66 patients, 26 (39.3%) were male, and 40 (60.6%) were female. The mean weight before RUTF treatment was 6.53±1.21 kg, mean Height/Length was 71.65±7.01 cm, mean MUAC was 10.88±0.36 cm, mean BSR was 91.21±2.32 mg/dL, and mean weight after RUTF treatment was 9.17±1.53 kg. There was a significant difference in the weight of children after RUTF treatment (6.53±1.21 vs 9.17±1.53, p=0.0001) with no side effects. The weight increased after treatment with RUTF. **Conclusion:** According to WHO recommendations, we conclude that RUTF is helpful in enhancing weight gain in children with uncomplicated severe acute malnutrition under the age of five. **Key Words:** Growth of children, uncomplicated SAM, Ready-to-use therapeutic food, outpatient department basis.

Introduction

Malnutrition is a very serious issue affecting children, especially in developing and underdeveloped countries. Globally, over 19 million children are affected by this illness.[1] Of these, 2.14 million or so reside in Pakistan. [2.] Loss of muscle and fat, as well as an increase in systemic inflammation and vulnerability to the infections, are symptoms of the condition.[3] Depending on diagnosis of medical complications (such as loss of appetite, high-grade fever, severe edema, severe anemia, severe

dehydration, hypothermia or hypoglycemia), SAM is classified as complicated (20%) or uncomplicated (80%).[4]

Severe Acute Malnutrition (SAM) is diagnosed when a child has one of following criteria: "weight for height Z (W/HZ) score < -3SD, mid upper-arm circumference (MUAC) <115mm, bipedal edema or visible severe wasting".[5] Additionally, according to WHO recommendations, only children with the complications of malnutrition must be hospitalized; otherwise, SAM-positive children who are clinically healthy, alert, and with a good appetite should receive care at home or in a community setting.[6]

Malnutrition adversely affects a child health. A child who lacks essential nutrients is not only physically affected in the form of loss of body mass, fat and protein increasing the risk of infection and mortality but also have long term effects on his development affecting all aspects of functioning, including social, motor, cognitive, hearing and speech. Children who survive acute episode of SAM are most likely to have physical and developmental problems which are long lasting.[7] Adult economic output has shown to be negatively impacted by negative effects on academic performance.[8] Therefore, it is important to identify and address severe wasting as soon as possible. Nutritional therapies may promote children's growth and development, guarantee a healthy immune system, and raise their chances of survival.[9]

RUTF is a subcategory of the therapeutic foods that are soft, crushable, or drinkable, energy-dense, micronutrient-enriched, and may be given to patient right away without cooking. It is primarily a peanut-based spread with measured levels of micronutrients, delivering 520–550 Kcal/100g of energy, which is the equivalent of WHO recommendation. It is convenient to store in a warehouse because of shelf life of two years without refrigeration. [10,11]

Except for those who have difficulties, all children with severe acute malnutrition do not need to be admitted to the hospital. It has been found that home-based management with Ready to Use Therapeutic Food (RUTF) is linked to better results than traditional treatment in a hospital. Home-based treatment has several benefits, including continuity of care after release and lower exposure to hospital-acquired illnesses for the kids.[12]

The two possible stages of managing SAM in children are stabilization and rehabilitation. Children who suffer from dehydration, inter-current infections, electrolyte imbalances and other problems are treated first during stabilization phase. After stabilization of complications in a patient with SAM, catch-up growth is the primary goal, and substantially higher suggested calories and proteins are needed. For children with SAM, in-hospital rehabilitation may not always be desired or feasible, particularly in rural areas. Instead, home-based treatment may be a preferable option. Although ready-to-use therapeutic food (RUTF) is a popular choice for home-based rehabilitation, the results of our earlier analysis were not entirely conclusive.[13]

It also helps mothers by giving them more time to spend with their families and lowering the possibility of neglecting younger siblings. Mothers may also do other family tasks at the same time. Administration of RUTF is a crucial part of home-based care for children with severe acute malnutrition in order to satisfy their regular nutritional needs and encourage catch-up growth. According to WHO recommendations, each nation should manufacture such Ready-to-use therapeutic food (RUTF) domestically while keeping in mind international standards.[14] The aim of our current study was to assess the growth of children with uncomplicated SAM treated with RUTF on outpatient department basis. In this way, we can treat more children without exposing them to nosocomial infections. It will decrease the number of admissions and the hospital staff would be able to focus more on the rehabilitation of children with severe acute malnutrition with complications. The objective was to prove that children gain significant weight on RUTF therapy so that more nutrition stabilization centres are established with the aim of treating a larger number of malnourished children without imposing burden on the hospitals in developing countries.

Methodology

This is a prospective observational study which was conducted on 66 children at Outpatient setting of MCH Centre Federal Government Polyclinic Hospital, Islamabad, Pakistan from January 2023 to June 2023 after approval from hospital's ethical committee.

Children aged 6-59 months and suffering from SAM were selected for nutritional rehabilitation. The inclusion criteria was severe wasting assessed by WHO protocols "weight for height <-3SD and MUAC <11.5 cm", which is not accompanied by any complications of the malnutrition.

Children with learning and physical disabilities, or who are clinically unfit with diarrhea, fever, chest infection or any other complicated illness which requires hospital admission were excluded from study. Children with secondary causes of malnutrition were also excluded from the study. Children were assessed at MCH center on fortnightly bases for a period of twelve weeks to asses for any medical and nutritional complications.

An appetite test on children included giving them a little sample of RUTF (Ready to use therapeutic food) and seeing how much of it they ate. A child was considered to have weak appetite after three feeding attempts if they did not finish at least one-third of a pack of RUTF (Ready to use therapeutic food). These kids were moved to the hospital and were not included in the trial, as per procedure.

Before enrollment and the commencement of therapy, the children had a physical examination in accordance with national and WHO criteria to evaluate their alertness, hydration, severe palmar paleness (anemia), severe edema, hyperpyrexia, and hypoglycemia. In cases where these issues were present, the kids were sent to a hospital for more intense care and were not included in the research.

Sample size of current study was calculated by using WHO sample size calculator with 5% level of the significance, 90% power of the test, 5.08 kg estimated population average weight before RUTF and estimated population average weight gain 3.3 kg.[15] Children were enrolled after fulfilling selection criteria. They were followed regularly on two weekly bases for a period of twelve weeks to check weight gain according to standard guidelines.

The information collected included the age (in months), gender, family income, breastfeeding, hygiene conditions, weight before and after RUTF, Height/length, and Blood sugar random (BSR). Mid arm circumference was done initially only to classify patients as SAM according to WHO definition as it has higher specificity of 99% to identify more children with malnutrition.[5] Breastfeeding was categorized into either no breastfeeding or yes which included both exclusive breastfeeding for 06 months or both breast feed and supplemental feed. Poor hygiene practices mean poor maintenance of self-hygiene or sanitation. Informed consent from the patients' caregivers was taken. SPSS version 23 was used for data analysis.

Results

We enrolled 66 patients in current study with mean age was 16.98±6.12 months. Consent was taken from their parents to include them in the study. Out of 66 patients, 26(39.3%) patients were male and 40(60.6%) patients were female. Out of 66 patients 34(51.5%) had low family income, 26(39.4%) had middle range family income and 6(9.1%) had high family income. Also 45(68.2%) patients had no breast feeding and 42(63.6%) had poor hygiene condition. (Table I)

The mean weight before RUTF was 6.53±1.21 kg, mean Height/Length was 71.65±7.01 cm, mean MUAC was 10.88±0.36 cm, mean BSR was 91.21±2.32 mg/dL and weight after RUTF was 9.17±1.53 kg. According to WHO guidelines, the target was to achieve the median weight.

We found a significant difference in weight of children after RUTF treatment (6.53±1.21 vs 9.17±1.53, p=0.0001) with no side effects. The weight was increased after treatment with RUTF. P value was 0.0001 which shows a significant increase in weight after Ready to use therapeutic food (RUTF).

Table I: Results of Qualitative variables.

Variables		N	%
Gender	Male	26	39.3
	Female	40	60.6
Family Income	Low (<30000)	34	51.5
	Middle (30000-50000)	26	39.4
	High (>50000)	6	9.1
Breastfeeding	Yes	21	31.8
	No	45	68.2
Hygiene conditions	Good	24	36.4
	Poor	42	63.6

Table II: Results of Quantitative variables.

Variables	N	Mean	SD
Age (Months)	66	16.98	6.12
Weight before RUTF (kg)	66	6.53	1.21
Height/Length (cm)	66	71.65	7.01
MUAC (cm)	66	10.88	0.36
BSR (mg/dL)	66	91.21	2.32
Weight After RUTF (kg)	66	9.17	1.53

Table III: Results of effect of RUTF on children weight.

Pair	N	Mean	SD	p value
Weight before RUTF (kg)	66	6.53	1.21	0.0001
Weight After RUTF (kg)	66	9.17	1.53	

Discussion

According to this research, RUTF effectively promotes gain of weight in children under the age of five. The efficacy of the Community based management of severe acute malnutrition (CMAM) has previously been the subject of several researches. But until now, there hasn't been much information on how well RUTF works to increase weight gain. When it comes to treating children who are really critically malnourished, the government of Pakistan has approved the CMAM program. CMAM program in 2010 endorsed the first development of the national rules ,which were updated in 2015 according to the fresh available data at that time.[16]

Because children with poor nutritional status are not able to reach their full growth potential in the order to lead productive lives, previous researches have shown a direct impact of nutritional status on child's growth.[9, 17, 18]

The children under 5 years of age are more adversely affected by malnutrition. [1] In our study the children under 2 years of age were more affected as compared to a study

done in southern Punjab where most patients were less than 12 months.[19] A female child is three times more stunted than a male, in our study the majority of the patients were females as observed by Aguayo VM in a community based study in Pakistan.[16]

Reduced brain growth, negative effects on cell development leading to abnormalities in child's performance, and a delay in social and personal development are only a few of the abnormalities that may emerge from insufficient food availability.[17] The key factors causing delayed development in malnourished children are shortages in both macronutrients and micronutrients, since iron, zinc, calcium, vitamin D, vitamin A, and folate are essential for cognitive function as well as achieving motor and linguistic milestones.[19]

Early in life, there is a considerably larger chance of developmental delay. A baby that is malnourished in first few months of life may be at an elevated risk of developmental delay. It also indicates serious health or behavioral problems. Early life is a time of fast development, which makes it easy for sociodemographic and environmental variables to have an impact.[17, 20]

We used a peanut based RUTF containing peanut butter and milk powder as compared to cereal based RUTF, non-dairy and soya based RUTF used in different studies.[21,22,23] The outcome of the different RUTF in these studies showed no difference in effectiveness as compared to standard RUTF. In the study in Sierra Lione, oat based RUTF was superior to standard RUTF due to its beneficial bioactive components or the lack of hydrogenated vegetable oil in oat-RUTF.[23] Nevertheless, the cost of locally produced RUTF was less and easily available making the locally made RUTF more sustainable. Therefore, measures should be taken to produce RUTF from locally made ingredients as in Indonesia and Africa.[21,22] not only to avoid the cost of importing the standard WHO peanut – based RUTF but also to make it more accessible and palatable.

Effectual community-based therapy for acute malnutrition, including RUTF, has a strong recognition for treating kids with uncomplicated SAM. Our research showed that if given effectively with proper follow-up and counselling , RUTF therapy can lead to significant weight gain and these results agreed with those of a qualitative study that evaluated the obstacles to SAM therapy in Pakistan and Ethiopia.[24]

Gameil et al[25] conducted a study in Egypt to check the effectiveness of home based treatment with RUTF in malnourished children. In Egypt, childhood malnutrition is a serious health concern. Compared to children who received conventional treatment, children who got home-based therapy with RUTF had a higher likelihood of achieving a weight-for-height z score < -2 (85.7% vs. 57.2%; P = 0.037). Additionally, there were no adverse effects linked to the administration of RUTF. At eight weeks of treatment, children receiving RUTF-based home-based therapy exhibited higher rates of weight gain (5.08 vs 3.37 g/kg/day). Compared to standard treatment, children who get home-based RUTF therapy acquire more weight. These results matched with findings of our current study.

In order to treat children under the age of five who suffer from uncomplicated SAM, Saleem et al[26] evaluated the effectiveness of standard therapy using therapeutic food that is ready to use. They found a significant positive relation (r = 0.961; p 0.001) between beginning weight and weight at the most recent visit. If given in the accordance with WHO guidelines, ready-to-use therapeutic food is beneficial in increasing weight gain potential and growth potential in children under the age of five with uncomplicated SAM. These results matched with the findings of current study.

We found that children with uncomplicated SAM exhibited significant progress compared to their baseline parameters after twelve-week follow-up with RUTF therapy. All the micronutrients and macronutrients needed for children's catch-up growth and brain development are present in RUTF in therapeutic amounts. Thus, it is clear that children may grow to their full potential with prompt identification and care, but treatment delays run the risk of causing irreparable harm.[17, 19]

According to UNICEF only 48% of children are exclusively breastfed in Pakistan.[27] In our study only 31.8 % of the children were breastfed further highlighting the importance of breastfeeding to prevent malnutrition in children. In a study conducted in an urban setup by Mahmood R[28] also observed that the use of complementary feeding in the form of fresh milk (cows and goat) and formula milk and early introduction of solid food in children is contributing to greater risk of malnutrition.

In accordance with WHO recommendations, effective use of RUTF is essential for achieving the necessary weight gain and full recovery. We have discovered that children significantly improve in mean weight following a twelve week RUTF therapy. These results are consistent with other researches from Ethiopia, Ghana, and Pakistan,

where children get RUTF and eventually reach the requisite weight. [19,27]

Currently available facilities for hospitals in Pakistan are limited if they were to be utilized exclusively for rehabilitation of children with SAM. Limited hospital facilities make community management of SAM a priority. A ready-to-use therapeutic food (RUTF) that can be given to children of SAM in their homes or community is the first step in preventing these children from developing medical complications.

The short duration of the research period is one of our study's weaknesses. Due to the little time frame, we were unable to assess if children were able to sustain their weight increase in order to benefit the most over long run. Another drawback was the absence of a control group, which prevented the identification of actual differences since the control group may have shown comparable results. To enhance and replicate these encouraging findings, more research with an expanded sample size, length, and efficacy of therapy other than RUTF, as well as biochemical testing in other places, is needed. In addition, a control group and a randomized controlled research design is required.

Conclusion

The study concluded that Ready-to-Use Therapeutic Formula (RUTF) is beneficial in improving weight gain in children with SAM under the age of five, provided it is administered promptly and according to WHO-recommended doses. Encouraging and supporting more community-based programs can lead to improvements at the population level, representing a significant step forward in achieving the Sustainable Development Goals.

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