Treatment of severe acute malnutrition with home-based therapeutic nutrition: A critical appraisal of efficacy and safety

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Abstract

Child malnutrition is a major public health problem since it is one of the leading causes of mortality and disability across the globe. This review looked at the evidence surrounding the effectiveness of ready-to-use therapeutic foods (RUTF), ready-to-use supplemental foods (RUSF), prophylactic antibiotic utilization, & vitamin A dietary supplements for the treatment of severe and moderate acute malnutrition (SAM) according to the current World Health Organization (WHO) guideline using facility- and community-based techniques. Following a thorough examination of relevant digital archives, we collated the resulting data. Inconclusive evidence suggests that SAM and MAM recovery rates may be increased with integrated community-based screening, identification, and management. Screening and treatment in a facility for basic SAM did not affect recovery or fatality rates, although therapeutic milk F100 used to treat SAM had effects comparable to RUTF. Recovery time as well as weight gain for MAM are similar with whey and local food RUSF compared to regular RUSF, but CSB receives greater advantages from normal RUSF. When antibiotics are given before a case of simple SAM, the patient has a better chance of making a full recovery, gaining more weight, and even living longer. Data on the effects of high-dose vit A supplements on weight growth and mortality in children with SAM are few, but they seem to be equivalent to those of low-dose vitamin A supplementation.

Keywords: Malnutrition, Children, Therapeutic nutrition, Efficacy, Treatment

Introduction

Stabilization and rehabilitation are the two possible stages that might be included in the management of severe malnourishment (SAM) in youngsters. During the first phase of stabilization, children are given therapy for dehydration, electrolyte disturbances, intercurrent infections, and other issues that may have arisen as a result of their illness (Wagh & Deore, 2015). During the rehabilitation phase, catching up on lost development is the primary goal, and the recommended calorie and protein needs are much greater. In-hospital rehab of children having SAM is rarely desired or practicable - particularly in rural areas - and home-based treatment might be a better answer (Vijay, 2018). Although RUTF are indeed a popular choice for home-based rehabilitation, data from a prior research were unclear about its effectiveness.

Malnutrition in children is a grave community health problem due to the element that it is linked to high rates of both morbidity and death. Long-term effects of baby and childhood malnutrition include subpar cognitive development, an elevated risk of sickness owing to recurrent diseases or metabolic problems, and decreased economic production. About a third of all deaths in youngsters below the age of five may be traced back to undernutrition in some form, such as stunting, severe wasting, vitamin A or zinc deficiencies, or insufficient nursing. An intricate interaction between nutrition-specific as well as nutrition-sensitive variables leads to malnutrition (Callaghan-Gillespie & Mui, 2018). Inadequate dietary and nutritional intake, as well as poor feeding, caring, and parenting habits, as well as the burden of infectious illnesses, are all factors that contribute specifically to malnutrition. Nutrition may be affected by a number of factors, including food hardship, inadequate mother, household, and community caring capacity, limited health care services, and an unsanitary environment (Banda et al., 2021). Interventions that are both nutrition-sensitive and nutrition-specific are needed to reduce childhood malnutrition.

The appearances of nutritional oedema, a really low weight in relation to height, or evident serious wasting are the three criteria that must be met in order to qualify as severe acute malnutrition. If a kid is 6–59 months old and their arm circumference is less than 110 millimetres, this is another sign that they are suffering from severe acute malnutrition (Gera, 2010). There are around 19 million children throughout the world who are thought to be suffering from severe acute malnutrition, agreeing to estimates. The WHO has projected death rates of young kids with severe acute malnutrition by using data that already exist on case fatalities in numerous countries. When compared to children who are well fed those who are malnourished face five to twenty times the risk of death, as seen in the table to the right. In children, severe acute malnutrition may be a direct cause of death, or it may act as an indirect cause of death by increasing the rate of case fatalities in children who are ill with common childhood illnesses such as diarrhoea and pneumonia. Either way, severe acute malnutrition may result in a child's passing (Chanani et al., 2019). Either way, severe acute malnutrition can result in a child's passing.

According to the latest numbers, severe acute malnutrition claims the lives of almost one million children every year. Even in regions with a high incidence rate, only a small number of nations have developed special national policies that are intended to address this issue on a comprehensive level. This is despite the fact that severe acute undernourishment is the leading reason of death among youngsters worldwide (Bhandari et al., 2016). It is now possible to address this significant factor that contributes to the death rate of children by incorporating community-based management into the facility-based strategy that has traditionally been used. Youngsters who are suffering from severe acute undernourishment may be readily identified by community health professionals or volunteers by utilizing simple colored plastic strips which are intended to size the circumference of the minor's higher arm

at the midpoint (MUAC). A MUAC of not as much of 110 mm in children aged 6–59 months is suggestive of severe acute undernourishment, which needs immediate treatment.

Community health workers may also be taught to recognize nutritional oedema of the feet, another sign of this condition. After it has been confirmed that one or more children have severe acute malnutrition, that child or children need to be assessed by a doctor who is trained in the IMCI approach to complete child assessment (World Vision, 2017). The health care professional should next decide whether or not the individual can be managed in the community by making routine trips to the health centre, or whether or not the individual needs to be sent to in-patient treatment. It is feasible to begin the care for severe acute malnutrition well before emergence of life-threatening consequences if the condition is detected early and treated in a decentralized manner.

The majority of them may be found in sub-Saharan Africa and south Asian countries. There is still debate about which of the strategies for managing childhood malnutrition have been shown to be the most effective. Priority issues and research gaps identified by the current WHO gives guidance for the planning of malnutrition include: ways to enhance strong community testing; diagnostic effect as well as cost efficiency of offering prophylactics oral antibiotics; negative impacts of offering broad-spectrum antibiotics; potency and efficiency of different RUSF as well RUTF; and potency of regular low-dose vitamin supplements (Hossain et al., 2021). There hasn't been a systematic evaluation done on the aforementioned research gaps in the WHO recommendations. Fewer evaluations exist, however, and they focus on analysing individual programs. Despite a comprehensive review of the efficacy of methods for controlling MAM and SAM in accordance with the WHO guidelines, the findings were inconclusive owing to a lack of high-quality studies. There is a lack of consistency in the criteria of undernutrition and the kinds of therapeutic or additional meals utilized in existing evaluations on the management of acute undernourishment. The

efficacy of vitamin A supplements in the administration of SAM has been evaluated, and there have been some discussions regarding the value of supplemental feeding (Sigh et al., 2018). However, a thorough review of the existing evidence for the efficacy of numerous community- as well as facility-based techniques to detect and treat MAM and SAM is required. Considering how dire the situation currently is, it is abundantly evident that the conventional standards that are now in place for the treatment of SAM in children need significant revision and improvement.

Objectives

The following are the goals of this work:

- To evaluate the efficacy of public based methods such community-based mobilisation, testing, follow-up, therapy, and training; to enhance SAM and MAM screening, identification, and treatment.
- In order to enhance the screening as well as administration of SAM and MAM, it is necessary to conduct an investigation into the efficiency of facility-based techniques, like facility-based screenings, administration, and intermittent follow-ups.
- To determine the efficacy of different RUTF and RUSF in managing SAM and MAM, as well as to compare the efficacy of these treatments to one another;
- In order to assess the efficacy of the preventative use of antibiotics in the management of SAM that is not difficult;
- In order to control SAM and MAM in children, the resolve of this study is to explore the efficacy of different dosages of vitamin A supplement.

Present Scenario

In many developing nations, the overwhelming majority of children who are suffering from severe malnourishment are never sent to a medical facility for treatment. In circumstances like these, the right care can only be provided through a strategy that incorporates a significant role for the community. Eighty percent of children diagnosed with severe acute malnutrition may be treated successfully at home, according to research. This is possible either via continuous case identification or by encouraging and organizing communities to link dispersed resources autonomously (Oakley et al., 2010). These youngsters were discovered either via the process of actively discovering new cases or through the process of sensitizing or organizing localities to use decentralized services on their own.

The therapy for this condition consists of giving children a RUTF to consume until their weight has reached the normal range. In some contexts, it may be feasible to design an effective therapeutic diet by making use of nutrient-dense foods that are readily accessible in the area in conjunction with additional micronutrient supplementation (Bhandari et al., 2016). However, since nutritional sufficiency is difficult to obtain, this strategy calls for extremely rigorous monitoring to be carried out. In contrast to the supply of RUTF, it is necessary for children to undergo a brief course of oral treatment with fundamental medicine in order to treat infections. Follow-up care, which should include the delivery of the subsequent supply of RUTF, need to be administered once every week or once every fortnight by a skilled health professional at a local hospital or in the neighbourhood.

If modern treatment methods are adopted, together with expanded access to therapy, the case-fatality rate may drop to as low as 5% both in the communities and in the health-care facilities where the disease is being treated. During times of emergency, a community-based

strategy to treating severe acute malnutrition was used as the treatment method of choice (Monval & Sfeir, 2016). This led to a significant rise in the program's overall coverage and, as a consequence, an increase in the total number of children who'd been successfully treated, which in turn led to a decrease in the overall case fatality rate. When implemented on a large scale, the same strategy may be employed in non-emergency settings when there is a high frequency of severe acute undernourishment. This strategy has the prospective to avert the lives of hundreds of thousands, if not millions, of children.

Use of RUTF and its advantages

Diets that are healthy, tasty, have huge energy content, and enough levels of minerals and vitamins are essential for youngsters who are suffering from severe acute undernourishment. RUTF are meals that are either soft or readily crushable and may be ingested by youngsters as young as six months old without the need to add any additional liquid. RUTF contain a nutritional makeup that is comparable to that of F100, which is therapeutic food that is consumed in medical facilities (Chaiken et al., 2006). However, in contrast to F100, RUTF do not contain any water, hence it is impossible for bacteria to develop in them. As a result, you don't need a refrigerator to consume these items safely at home, and you may even consume them in places where the sanitary standards are less than ideal.

In the absence of medical difficulties, a malnourished kid with an appetite who is six months or older may be given a regular dosage of RUTF that is adapted to their weight. This is the case when there is no medical emergency. Children may eat the meal in the comfort of their own homes at any stretch of the daytime or night-time, straight from the container, with as little or as much adult supervision as their appetites dictate. Due to the fact that RUTF do

not include any water, it is imperative that children have access to clean drinking water at all times. RUTF, are high-energy, stimulated, ready-to-eat meals that are appropriate for the cure of children who are suffering from severe acute undernourishment (Greiner, 2014). These meals need to be pliable or capable of being crushed, and they shouldn't require any kind of preparation for small infants to consume them. Milk and other dairy products need to account for at least half the total protein content in the diets.

Table 1: Composition of RUTF (Hossain et al., 2021)

Moisture content	2.5% maximum
Proteins	10% – 12% total energy
Energy	520 – 550 Kcal/100 g
Lipids	45% – 60% total energy
Potassium	1,100 – 1,400 mg/100 g
Sodium	290 mg/100 g maximum
Calcium	300 – 600 mg/100 g
Magnesium	80 – 140 mg/100 g
Phosphorus	300 – 600 mg/100 g
Zinc	11 – 14 mg/100 g
Iron	10 – 14 mg/100 g
Copper	1.4 – 1.8 mg/100 g
Iodine	70 – 140 µg/100 g
Selenium	20 – 40 µg
Vitamin A	0.8 – 1.1 mg/100 g
Vitamin E	20 mg/100 g minimum
Vitamin D	15 – 20 µg/100 g

Vitamin K	15 – 30 µg/100 g
Vitamin B2	1.6 mg/100 g minimum
Vitamin B1	0.5 mg/100 g minimum
Vitamin B6	0.6 mg/100 g minimum
Vitamin C	50 mg/100 g minimum
Folic acid	200 µg/100 g minimum
Vitamin B12	1.6 µg/100 g minimum
Pantothenic acid	3 mg/100 g minimum
Niacin	5 mg/100 g minimum
Biotin	60 µg/100 g minimum
n-3 fatty acids	0.3% – 2.5% of total energy
n-6 fatty acids	3% – 10% of total energy

The knowledge required to produce RUTF is straightforward, besides it can be transported to almost every nation in the world with a little amount of existing industrial infrastructure. When manufactured domestically, RUTF had a price of around $3 USD per kilogram. A kid who is being cured for severely acute undernourishment will require 10–15 kg RUTF, which will be administered over the course of six to eight weeks (Greiner, 2014). The management of severe acute undernourishment in the community with RUTF will be beneficial for the vast bulk of HIV-positive people who suffer from this condition. On the other hand, our experience has shown that the rates of gaining weight and recovery among these children are lower than the rates among HIV-negative children, and that the case fatality rate among these children is greater. It is likely that a greater prevalence of infections is to blame for the slower rate of weight increase seen in HIV-positive youngsters (Oakley et al., 2010).

It is very necessary for community-based leadership of programs for severe acute undernourishment and AIDS to have strong ties with one another. This is due to the fact that the symptoms of severe acute undernourishment, HIV infection, and AIDS in youngsters may overlap. This is particularly true in geographic locations that suffer from economic deprivation. Both the moms of people with severe malnourishment and the children themselves should have access to voluntary counselling and testing services (Mokgatle & Demisse, 2015). They should be eligible for cotrimoxazole prophylaxis to lower the chance of having pneumocystis pneumonia and other contagions if it is established that they have HIV. Additionally, they should be eligible for antiretroviral treatment if it is judged that it is required. Youngsters who are known to have HIV and who suffer from severe acute undernourishment should have access to therapeutic nurturing in order to improve their nutritive standing. This is because therapeutic feeding may help children regain or maintain a healthy weight (T.T. et al., 2013). This is something that should be done in conjunction with the previous point.

Discussion

When treating children suffering from severe malnourishment who do not suffer from any affiliated difficulties and throughout the restoration phase of treatment when protracted hospital treatment is not appropriate, using 'therapeutic nutrition products' like RUTF has been shown to be effective, according to a review of the currently available published peer reviewed literature. On this subject, published studies and controlled trial studies have shown that this therapy technique may be just as effective as the conventional treatment recommended by the WHO, which is to use F-100. In addition, the treatment of SAM using these items is more successful than using meals prepared at home that have a lower energy density. Ready-to-eat meals that have been planned and prepared locally are just as efficient as those that are commercially sold. Through the use of RUTF, the total recovery rate is more than 85%, and the death rate is much lower than 1% (Turnbaugh, 2019).

The amount of evidence that is now available does, however, have significant shortcomings that prevent the direct inclusion of such a technique into a scheme or a strategy, as well as its expandability to India. These drawbacks are as follows: To start, there is a dearth of reliable data on the subject, which is already a problem in itself since there is so little of it. The vast majority of the material is derived from observational studies that were carried out under emergency circumstances, when it was impossible to implement any other viable alternative plan (Programme, 2015). The second problem worthy of mention is the reality that all of the research that has been done up to this point was carried out in Africa. At this point, it is impossible to forecast what the outcomes would be if it is implemented in non-urgent circumstances in nations like India, where its effectiveness and acceptance are unknown.

A lot of research, particularly randomized controlled trials, which are considered to be of a high level of evidence, are carried out in carefully orchestrated settings, with the close supervision and observation of professionals in the medical field (Greiner, 2014; Mokgatle & Demisse, 2015). Although it is undeniable that this allows for the early documentation of difficulties and the initiation of early management wherever it is specified, doing so deviates from the fundamental foundation behind employing this approach in regions where the health structure is either non-existent or inadequate. The expense of managing SAM children is also increased by such monitored supervision, which is problematic. Researchers (Bhandari et al., 2016; Chaiken et al., 2006; Monval & Sfeir, 2016) predicted that the cost to recover a kid diagnosed with SAM would be $55, whereas the expense to recover a child diagnosed with HIV would be $110, based only on the price of RUTF. To put this into context, India's per capita expenditure on health care in 2006 was $39 These are significant expenditures that the healthcare system of any third world nation will need to bear, and they highlight the need of encouraging product improvement at the regional level.

Therefore, the utilization of household management, which includes the utilization of medical nutritional supplements, as a global health approach ought to be handled as a potential in its early stages (Sigh et al., 2018). Prior to suggesting that its incorporation into the existing health programs, it is essential to learn its practicability as well as cost-effectiveness in the setting of the Indian state of affairs in the context of an operations strategy arrangement. It is positive that cheaper regionally created ready-to-use meals are successful, and this should encourage the scientific community to design suitable foods that are both culturally acceptable in diverse regions of our big nation and cost-effective.

The necessity to convey to those responsible for formulating policy the critical nature of the situation with severe acute undernourishment is of the utmost importance. In midst of the statistic that acute undernourishment is frequently a comorbidity in a noteworthy number

of preventable circumstances of child death, the issue does not get the focus its merits (Gera, 2010). It must be stressed that the therapy for SAM is price effective. As a matter of element, even clinic centred care of SAM is much more price efficient in plummeting death than numerous other juvenile survival treatment ingenuities, comprising the widely noticeable vitamin A supplementation platform. It is expected that the availability of alternate solutions, such as home-based management utilizing items created locally for therapeutic nutrition, will contribute to the cost-effectiveness of the solution (World Vision, 2017). Given the geographical, cultural, and economic hurdles that exist throughout India's vast territory, the nation requires several solutions to combat the issue of severe malnutrition, and home-based care is possible to be one of those options.

Conclusions

The findings of this study show a lack of data comparing community-based therapy and facility-based therapy with other quality of healthcare for SAM or MAM, suggesting that combining community-based as well as outpatient management may offer some benefits over conventional management and hospital care in terms of promoting recovery. Treating children with uncomplicated SAM in the community or through outpatient treatment represents the most cost-effective strategy, according to the available cost statistics. Weight gain and mortality rates are similar for patients with SAM who get either RUTF or F100 therapy in a medical setting. However, compared to RUTF & F100 made from alternatives like milk or peanut butter, conventional RUTF may improve weight growth. The regular RUTF diet has been shown to be comparable to other diets in terms of rehabilitation and morbidity for SAM, according to the existing studies on RUTF. Regular RUTF may also aid in the body's recovery when contrasted to F100 and home-cooked meals that are rich in energy content. The existing data on RUSF suggest that it may improve both recuperation as well as weight gain in MAM, especially when compared to CSB. Information on preventive antibiotic treatment in children with uncomplicated SAM shows a faster recovery rate, greater weight gain, and a reduced mortality rate compared to no antibiotic therapy. Weight gain and mortality in SAM new-borns treated with high doses of vitamin A seem to be similar to those treated with lower doses of vitamin A. However, the quantity of data is quite modest.

Future research should compare the effectiveness of various community and facility-based methods for diagnostics, acknowledging, and managing SAM and MAM, such as efficient community-based surveillance; mentoring of CHWs for society testing; and schooling of health members of staff to evaluate and support patients with straightforward SAM. Research of this kind ought to compare the results of various local and institutional

interventions. - It is important to gather fresh data to examine the function that vitamin A supplements may play in the management of SAM & MAM in children at varied dosages and with varying frequency, since the existing data on the effectiveness of vitamin A consumption are equally limited. Researchers conducting future studies on the effectiveness of interventions to prevent and treat undernutrition in youngsters living in low as well as middle nations should report pertinent nutrition-specific outcomes, such as the pervasiveness of stunted growth, wasting, and underweight condition, as well as infectious diseases and potential side effects.

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