

Original Research Article

Serum iron and serum retinol level of severe acute malnourished children on therapeutic intervention with WHO/UNICEF recommended therapeutic food and home based therapeutic food

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ABSTRACT

Background: The prevalence of anaemia and vitamin A deficiency among children with severe acute malnutrition (SAM) and their correction during nutritional rehabilitation are not well documented. This study assessed serum iron and serum retinol levels, effect of ready-to-use therapeutic foods (RUTF) and home based treatment on levels of serum iron and serum retinol level in SAM children.

Methods: This was a simple randomised controlled trial in 6-59 months old children with SAM. Two groups of 70 each were divided, one was given RUTF and other home based food comparable to RUTF. Serum retinol and serum iron were measured on day 1 and 6 weeks of therapy.

Results: Home based food was found better in terms of increase in serum iron than RUTF while there was no difference in rise of serum retinol in both the groups. There was no significant difference between day 1 value of serum iron in both the groups as p value was 0.82 but the level of serum iron at 6 weeks has shown significant difference in both the groups as p value was 0.0014 so there was significant increase in serum iron in group B in comparison to group A; the serum retinol value in both the groups has not shown any significant improvement.

Conclusions: It was concluded home based food is better in correcting iron deficiency in SAM children as it is cheap, easily available, palatable, and acceptable than RUTF.

Keywords: Home based food, Iron deficiency, Ready-to-use therapeutic food, Vitamin A deficiency severe acute malnutrition

INTRODUCTION

Malnutrition in children is the consequence of food insecurity, which stems from poor food quality and quantity, severe repeated infections or combinations of all three. They are related to the standard of living and basic needs. Severe acute malnutrition (SAM), though the least prevalent form of malnutrition is associated with high mortality risk.¹ These children are undernourished and susceptible to disease.

RUTFS are fortified energy-dense pastes designed to fulfil all the nutritional needs of children during recovery from SAM. The cost of therapeutic food is very high, which is not affordable by the poor families. Whereas home-made food are cheap, locally available, socially acceptable, easily prepared at home and sustainable.² The aim of the treatment is to enable a rapid regain of lost body tissues while providing sufficient micronutrients to restore diminished body stores. However, little evidence exists on the success of the treatment to restore sufficient micronutrient status by recovery.

Micronutrients are of known public health importance include vitamin A, zinc and iron. These deficiencies can lead to serious health problems, including wasting, reduced resistance to infectious diseases, iron deficiency anemia, blindness, lethargy, reduced learning capacity, mental retardation and in some cases, to death. Infants and young children are the most adversely affected by iron deficiency because they are growing and developing at such a fast rate. IDA causes impaired psychomotor and physical development, as well as poor immune structure.

Similarly, vitamin A helps to regulate the immune system, which helps prevent or fight off infections by producing white blood cells that destroy harmful bacteria and viruses. If children have insufficient vitamin A, their ability to resist diseases such as diarrhea, measles and acute respiratory infections is greatly hampered.

The objective of this paper was to assess the change in vitamin A and iron status of children treated for SAM with RUTF, and home based food and explore the effect of a RUTF and home based food on the vitamin A and iron status of recovered children.

METHODS

A randomized control trial was done in a tertiary care center (BRD medical college Gorakhpur) in which two groups of severely malnourished children over a time period of 1 year from 2013 to 2014. One group received WHO/UNICEF recommended therapeutic food and other group received home based therapeutic food for 10 weeks to each child.

Inclusion criteria

All SAM children (6 month to 5 years) presented in pediatric OPD or admitted in pediatric ward.

Exclusion criteria

Children with other comorbidities, congenital diseases, HIV, immunodeficient and children on immunosuppressants drugs.

Study procedure

SAM children (WHO defined SAM) fulfilling the inclusion criteria were enrolled in group I and group II by computer generated random number table, whether they were taken from pediatric ward or OPD. SAM children with associated complications and failed appetite test were admitted till they get stabilized and/or their appetite returns. If SAM child is having good appetite and no complications, he was directly admitted in ward. Here group I received F-100 and locally made therapeutic food (TF) and group II received F-100 and homemade TF. Both groups were given multivitamins and minerals as recommended by WHO. Breastfeeding was continued in both the groups. Calories and protein content of food of

two groups was same as it was calculated by nutritionist. Lactose free was given to children with lactose intolerance. Baseline characteristics of both the groups were compared which showed no significant difference.

WHO/UNICEF recommended food

F-75, F-100, locally made therapeutic food (TF), lactose free F-75, lactose free F-100.

Home based therapeutic food

Milk dalia with oil, Vegetable dalia, Suji-halwa and kheer, Besanhalwa, Atta halwa, Sago kheer, Banana shake with oil, Rice+dal+vegetable+coconut oil, Sattu paratha, aloo paratha, aloo puri.

All the SAM children were underwent routine investigations Hb, TLC, DLC, Chest x-ray/abdomen x-ray, urine- routine and microscopy, urine culture and sensitivity, Montoux test, stool examination, RBS, RDT-MP, LFT, RFT.

Sample size was calculated 60 for each group. Adding 20% to minimum sample size for adjusting presumed dropouts, the sample size for each group is calculated as 70. The total sample for study will be 140.

Assessment of outcome

To assess vitamin A and iron level in SAM children on admission and after 6 weeks of treatment.

Tests for biochemical markers included serum iron and serum retinol.

Serum iron was measured by taking serum sample of 2 ml (free from hemolysis) was taken on day 1 of admission and 6 weeks after admission. A wavelength filter of 57 nm/yellow with reagent volume: 1.05 ml were used. A standard value of serum iron 100 microgram/dl was taken.

For serum retinol serum/plasma EDTA specimen of 2.0 ml volume: (specimen to be protected from light. Wrap tube in aluminium foil) was taken on day 1 of admission and 6 weeks after admission. A high performance liquid chromatography method was used.

Reference values of serum retinol for infants: 20-50 microgram/dl and for older children: 30-225 microgram/dl were used.

Statistical analysis

Fisher's exact test was applied to compare the proportions of two groups. Unpaired t-test was used to compare the means of two groups. P value <0.05 was taken as significant, p<0.01 denotes the test is highly significant, and p<0.0001 denotes test is most significant.

Ethical approval and consent

The study was approved by Institutional Ethical Committee. Written Consent was taken from patient's parent by explaining them nature and purpose of study in their language.

RESULTS

There was no significant difference between day 1 value of serum iron in both the groups as p value was 0.82 but the level of serum iron at 6 weeks has shown significant difference in both the groups as p value was 0.0014 so there was significant increase in serum iron in group B in comparison to group A; the serum retinol value in both the groups has not shown any significant improvement.

Table 1: Serum iron level on day 1.

Biochemical markers	Day 1		P value
	Group A	Group B	
Serum iron ($\mu\text{g/dl}$)	42.6 \pm 13.3	42.1 \pm 12.8	0.82
Serum retinol ($\mu\text{g/dl}$)	31.23 \pm 12.1	28.04 \pm 5.6	0.9

Table 2: Serum iron level on week 6.

Biochemical markers	6 weeks		P value
	Group A	Group B	
Serum iron ($\mu\text{g/dl}$)	74.4 \pm 14.3	82.2 \pm 13.7	0.0014
Serum retinol ($\mu\text{g/dl}$)	54.05 \pm 12.1	58.58 \pm 8.9	0.0712

Mean rate of increase of serum iron in group A was 5.3 microgram/dl/week, while mean rate of increase in serum iron in group B was 6.6 microgram/dl/week. Rate of serum iron was significantly high in group receiving home based therapeutic food ($p < 0.0001$).

Table 3: Rate of increase of biochemical parameters.

Biochemical markers	Group A	Group B	P value
Mean rate of increase in serum iron ($\mu\text{g/dl/week}$)	5.3 \pm 1.5	6.6 \pm 1.7	<0.0001
Mean rate of increase in serum retinol ($\mu\text{g/dl/week}$)	3.8 \pm 1.7	5.0 \pm 1.3	0.0931

Mean rate of increase in serum retinol in group A was 3.8 microgm/dl/week, while mean rate of increase in serum retinol in group B was 5.0 microgm/dl/week. Rate of serum retinol was high in group receiving home based therapeutic food but not significantly high ($p < 0.0931$).

DISCUSSION

Our study indicated in the present data, the mean levels of serum iron were significantly decreased in the both the

study groups that was 42.6 microgram/dl for group A and 42.1 microgram/dl for group B (Table 1). Severely malnourished children had reduced mean serum iron profile. Parasitic infestation influenced the marked reduction of mean serum iron concentration and transferrin saturation level.⁴ One study also noted wide distribution of concentrations of iron in the malnourished children is probably due to haemolysis and rapid catabolism.⁵ there is a study showing anaemia and iron deficiency are common among children with SAM.² They also compared FSMS-RUTF is more efficacious in treating anaemia among this group than pm-rutf.³ little is known about vitamin A deficiency in malnutrition; in our study the level of vitamin A is not much significantly reduced in each group (Table 2). As children have regular vitamin a supplementation with immunization so not showing the lower figure. Only few studies available showing that vitamin A deficiency is common among children with malnutrition. Studies are showing low vitamin A level in children.⁶ Co-assessment of iron, vitamin A and growth status and has shown iron deficiency in 15% and vitamin A deficiency in 6.3% preschool children.⁷ A study done in Africa compared the vitamin A and iron status in RUTF and reduced dose of RUTF among SAM children, which showed reduced dose of RUTF did not result in poorer vitamin a and iron status. Only haemoglobin seemed slightly lower at recovery among children treated with the reduced dose. While improvement was observed, the vitamin a and iron status remained sub-optimal among children treated successfully for SAM with rutf.¹

One more interesting finding in our study was that children receiving home based TF also had rate increase of serum iron more than the children receiving WHO-RUTF although there was no significant difference was noted in rate of increase in serum retinol (Table 3). There are no such studies done till date to support findings of our study.

CONCLUSION

So it shows malnourished children are deficient in essential micronutrients which are very essential for their growth and to combat infections. So a vicious cycle will go one if we do not supplement these nutrients by giving supplements and by diet which are rich in these micronutrients.

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