Heinz

In Touch

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Contents

MESSAGE FROM Mr. HERVE LE FAOU,

MANAGING DIRECTOR AND CHAIRMAN HEINZ INDIA PVT LTD
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I am happy to reach you through **In Touch** once again. This journal, over the years, has given readers insight into various deficiencies, complications of deficiency disorders, remedies and treatments. Deficiency of individual nutrient mostly micro-nutrients like iron, zinc, vitamins A or D, or a macronutrient like protein were topics of discussion. There is a strong belief that India is comfortable on food security, India is the largest producer of milk, etc., but the topic by Dr. Bharati Kulkarni, in this issue talks about the severity of malnutrition and malnourishment prevalent in the country, leading to quite a significant number of children suffering from Severe Acute Malnutrition (SAM).

Severe Acute Malnutrition (SAM) is a major public health issue. It appears that it afflicts an estimated 8.1 million 'under-five' children in India. In view of the economic and social burden that hospitalization entails on families, which are already battling poverty, SAM child adds to their misery. The improved understanding of pathophysiology of SAM as well as new internationally accepted growth charts have made IAP take a relook at newer modalities of integrated intervention. Concerned about 20 million children worldwide who are suffering from SAM, the World Health Organisation (WHO) had issued new treatment guidelines for children 'under-five' who have severe acute malnutrition.

In this issue the author is covering the topic from various aspects like identification, management and remedial measures. The author is evaluating the treatment procedure separately for a) Community based managementof children and for b) Hospital based management of children with SAM using local energy dense foods- NIN experience. It is an absorbing article and our readers must benefit from it and participate in alleviating this condition which can be avoided with some integrated approach from all spheres.

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Nutrition rehabilitation of children with severe acute malnutrition

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EXTENT AND CAUSES OF THE PROBLEM

Undernutrition during childhood is a major public health problem in India. As per the National Family Health Survey-III (2005-2006) data, about 48% of children under 5 are stunted (too short for their age), 42.5% are underweight (too light for their age) and 19.8% are wasted (too thin for their height) (1). Among these, about 6.4% of children below the age of 5 are estimated to be suffering from severe acute malnutrition (SAM). With the current estimated total population of India at 120 crores, it is expected that there would be about 15 crores of under-five children and amongst these about 6.4 % or 96 lakhs are likely to be suffering from SAM.

Severe acute malnutrition is a potentially life-threatening condition and a major underlying cause of mortality in under-five children, in India. It is well-known that undernutrition increases child mortality due to common morbidities including diarrhea, acute respiratory infections, malaria and measles. It is estimated that the mortality rates in SAM children are about nine times higher than those in well-nourished children, who suffer from infectious illnesses (2). Apart from contributing to childhood mortality, severe malnutrition has long-term impact on the health and well-being of an individual. A number of studies have shown that malnourished children tend to become stunted adults and malnutrition in childhood is associated with impairment of brain development, compromised intelligence quotient and poor scholastic performance (3).

Severe malnutrition is attributed to a myriad of causes including maternal undernutrition resulting in low birthweight, lack of breastfeeding, inadequate dietary intakes both in terms of quantity and quality etc. Dietary intakes of infants and young children in the country are grossly sub-optimal both in rural and urban areas. Surveys carried out in the rural areas by the National Nutrition Monitoring Bureau (NNMB) in nine states in India show that the energy intake among children in the age group of 1-6 years is deficient by about 600 kcal per day (4). The foods eaten by children from the low-income group are mostly cereal based and are grossly deficient in important micronutrients such as vitamin A, zinc and iron. In addition, the proteins are of low quality in terms of essential amino acid content. Recurrent infections and infestations observed in children in low-income settings further aggravate undernutrition, pushing a moderately malnourished child towards severe acute malnutrition. There is no doubt that poverty is the overarching cause for SAM and children presenting with SAM belong to the poorest stratum of the society. It is therefore acutely embarrassing that millions of children die every year due to SAM in a country that is marching forward on the economic and development fronts. The economic gains have certainly not translated into nutritional benefits for the vulnerable sections of the society. The magnitude of the problem and the serious life-threatening consequences associated with this form of malnutrition underline the urgent need of reducing severe acute malnutrition in the country.

IDENTIFICATION OF SEVERE ACUTE MALNUTRITION IN CHILDREN

Identification of severe acute malnutrition has moved towards anthropometric criteria from the earlier classification of protein energy malnutrition based on two distinct clinical syndromes— marasmus and kwoshiokor. The World Health Organization (WHO) and United Nations Children's Fund (UNICEF) proposed diagnostic criteria for SAM in children aged 6 to 60 months as follows: weight for height z score (WHZ) below -3 (based on 2006 WHO reference) and/or presence of bipedal edema or mid upper arm circumference (MUAC) below 115 mm (5). These criteria are based on the observations that the risk of death increased with descending WHZ scores and quite steeply with WHZ score < -3. However, it is widely believed that the use of WHZ score may be difficult at the community level, where the health workers have minimal formal education and are ill-equipped to measure the height of the children. Many community-based management centers, therefore, favour measurement of MUAC as a screening tool. The use of MUAC is easy, fast to perform and can be done by health-care workers with limited numerical competency. Studies in Africa have indicated that MUAC is a practical screening tool that performs reasonably well in predicting subsequent inpatient mortality among severely malnourished children (6). The MUAC criteria, as a standalone indicator has been

> Severe malnutrition is attributed to a myriad of causes including maternal undernutrition resulting in low birthweight, lack of breastfeeding, inadequate dietary intakes both in terms of quantity and quality etc.

criticized because it does not correlate very well with the WHZ score criteria. MUAC criteria tends to identify relatively younger children with less severe wasting as SAM while older children with WHZ <3 may not be classified as SAM using MUAC criteria.

Apart from the anthropometric criteria, visible clinical signs of severe wasting and edematous undernutrition are also useful, but these criteria are subjective and health-care workers need elaborate training for identifying the clinical signs suggestive of severe acute malnutrition.

CURRENT STRATEGIES FOR MANAGEMENT OF SEVERE ACUTE MALNUTRITION

Review of strategies for management of SAM in different settings indicates that four delivery systems are commonly used. These include: (i) day-care, (ii) residential nutrition centers, (iii) health clinics and (iv) domiciliary care.

Though hospital-based management or residential nutrition centers may be the safest option to treat this potentially life-threatening form of malnutrition, it is not operationally feasible to treat such a large number of children in hospitals. Indian Academy of Pediatrics (IAP), therefore, recommends categorisation of SAM children into "complicated" and "uncomplicated" cases to decide the need for treating children in hospital or community set-up.

1 **Complicated cases-** Many advanced cases of SAM are complicated by concurrent infective illness, particularly acute respiratory infection, diarrhoea and gram-negative septicaemia. Some of them have severe electrolyte imbalance. The risk of mortality is high in these children and hospital-based treatment is essential for these complicated cases. In addition, all children less than six months and children who do not fulfill the criteria for uncomplicated cases mentioned below should be considered as complicated, because of the high risk of mortality.

2 **Uncomplicated cases-** Children with SAM above the age of six months who satisfy the following conditions may be labelled as "uncomplicated". Child should be (i) alert, (ii) have good appetite, (iii) clinically assessed to be well (absence of general danger signs such as cough and difficult/ fast breathing, cold to touch and severe dehydration) and absence of severe anemia (iv) living in a conducive home environment. Home-based management could be feasible, acceptable, and a cost-effective option for children categorised as "uncomplicated".

Management of complicated cases- The WHO/ IAP guidelines for hospital-based management of complicated cases of SAM are divided into ten essential steps in two phases (stabilization and rehabilitation) (7, 8). These are as follows:

1 Treat/prevent hypoglycemia (low blood glucose levels)
2 Treat/prevent hypothermia (low body temperature)
3 Treat/prevent dehydration
4 Correct electrolyte imbalance
5 Treat/prevent infection
6 Correct micronutrient deficiencies
7 Start cautious feeding
8 Achieve catch-up growth
9 Provide sensory stimulation and emotional support
10 Prepare for follow-up after recovery

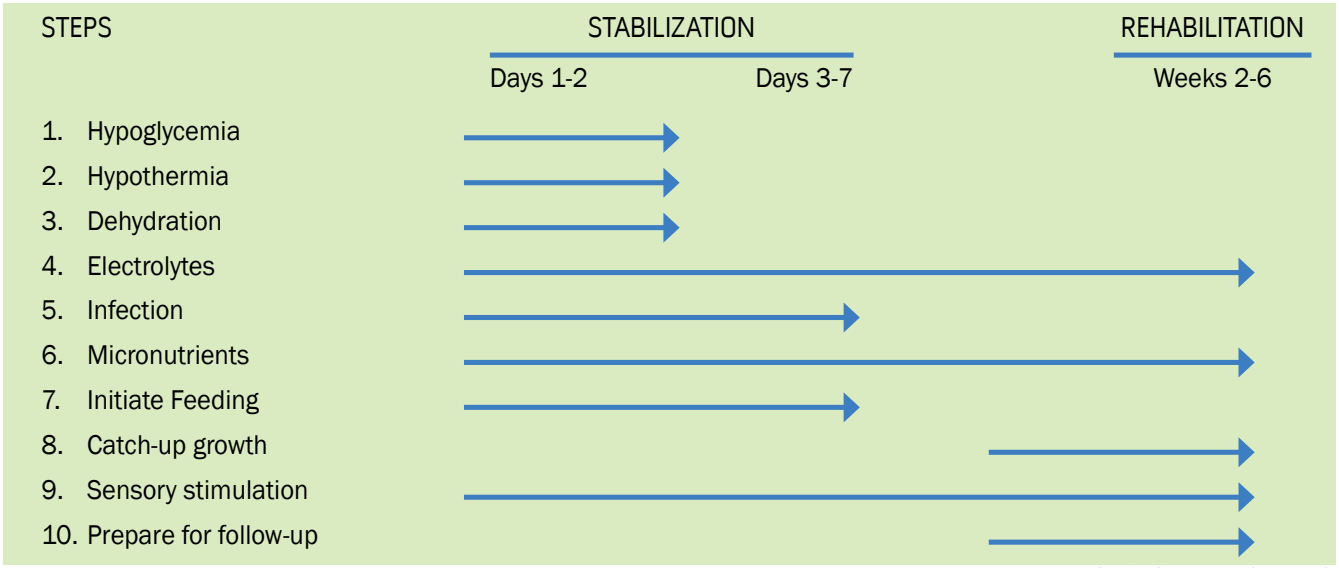
The time frame for initiating and achieving theses ten steps is indicated in table 1.

All severely malnourished children with complications are at risk of low blood sugar levels which is associated with high mortality in these children. Assessment of low blood glucose levels and prompt correction using glucose solution and early feeding is utmost important. Similarly, these children should be kept warm and dehydration and electrolyte imbalance should be carefully corrected. All the SAM children are likely to be immune-compromised and need treatment with appropriate broad-spectrum antibiotics. (7)

Correction of electrolyte imbalance- All severely malnourished children have excess body sodium and are deficient in potassium and magnesium. Correction of the electrolyte imbalance is utmost important and potassium and magnesium supplementation should be given for at least two weeks. WHO recommends preparation of an electrolyte-mineral solution containing potassium, magnesium, zinc, copper, selenium to be added to the feeds (7).

Correction of micronutrient deficiencies - All severely malnourished children

TABLE 1 – TIME TABLE FOR THE MANAGEMENT OF CHILD WITH SEVERE MALNUTRITION (3)



NOTE: (FROM REFERENCE 7 AND 8)

suffer from massive vitamin and mineral deficiencies and correction of these deficiencies is an important part of treatment of SAM. Up to twice the recommended daily allowance of various vitamins and minerals need to be used. Although anemia is common in these children, iron is withheld initially because giving iron may make the infections worse. Iron supplementation should be started when the child has a good appetite and starts gaining weight (usually by week 2). Following schedule for micronutrient supplementation is recommended by WHO:

- Vitamin A orally on day 1 (if age >1 year give 200,000 IU; age 6- 12 months give 100,000 IU; age 0-5 months give 50,000 IU) unless there is definite evidence that a dose has been given in the last month.
- Daily supplementation with multivitamin supplement containing vitamins A, C, E, B12, folic acid etc is essential. In addition, minerals such as iron, copper, zinc need to be supplemented in appropriate doses.

Role of diet- Severe acute malnutrition in children is a complex medical condition as nutrient absorption and metabolism are severely compromised in these children, due to pathological changes in the gut epithelium and other organs including liver. Appropriate feeding is therefore crucial for the successful recovery from SAM. In addition, for the rapid weight gain necessary for complete recovery from SAM, the nutrient requirements of these children are more than double than that of normally nourished age matched children. However, the pathological changes in the gut epithelium and electrolyte and mineral imbalances commonly observed in these children necessitate cautious feeding. A gradual increase in calorie intake is recommended to avoid the risk of heart failure, which can occur if children suddenly consume huge amounts of food. The most important aspect of feeding SAM children is to provide energy-dense foods as the energy intake is the most important determinant of the rate of recovery. The children are also deficient in protein and various micronutrients, including potassium, magnesium, iron and zinc. All of these must also be given in increased amounts.

WHO recommends milk-based feeds with adequate quantities of added minerals and vitamins for the complicated cases of SAM treated at health-care facilities. These formula diets are labelled as F75 (formula providing 75 KCal/100 ml) in the initial stabilization phase and F100 (formula providing 100 KCal/100 ml) in later rehabilitation phase for rapid recovery. IAP has recommended a modified feeding protocol for feeding of SAM children. Table 2 summarizes composition of IAP recommended formulae.

DIETS CONTENTS (PER 100 ML)	F75	F100
Cow's milk or equivalent (ml)	30	75
(approximate measure of one katori)	(1/3)	(1/2)
Sugar (g)	6	2.5
(approximate measure of one level teaspoon)	(1)	(1/2)
Cereal: Powdered puffed rice* (g)	2.5	7
(approximate measure of one level teaspoon)	(3/4)	(2)
Vegetable oil (g)	2.5	2.5
(approximate measure of one level teaspoon)	(1/2)	(1/2)
Water: make up to (ml)	100	100
Energy (kcal)	75	100
Protein (g)	1.1	2.9
Lactose (g)	1.2	3

(FROM REFERENCE 8)

Appropriate quantities of concentrated electrolyte-mineral solution (7) containing potassium, magnesium, zinc, copper, selenium should be added to these formulae for the replenishing the electrolyte-mineral balance.

HOSPITAL-BASED MANAGEMENT OF CHILDREN WITH SAM USING LOCAL ENERGY DENSE FOODS- NIN EXPERIENCE

Treatment of SAM has been an important area of research at the National Institute of Nutrition (NIN), Hyderabad. A large number of studies on rehabilitation of SAM children have been carried out by NIN in collaboration with Niloufer Hospital (a state-run tertiary care hospital in Hyderabad) to assess the efficacy of various diets in PEM rehabilitation (9, 10, 11). The protocols on optimal diet, based on these studies, are in practice since late 1970s.

The feeding protocol follows the WHO/ IAP recommendations on caloric and protein content of the diets, but it is modified to include locally available foods so that it is possible for families to maintain it at home after discharge from the hospital. The diets are cooked by the nurses in the ward and mothers often participate in the preparation of feeds. A child is initially put on a maintenance diet of about 100 Kcal/ kg/day, which is slowly increased up to 170-220 Kcal/kg/day. A typical diet of a child weighing 7kg consists of 350ml of milk (fortified with groundnut oil to increase the energy density), 250g of khichdi (rice and dal in 2:1 ratio with oil added), 1-2 slices of bread, 2 eggs and a banana, which provides around 170 to 200kcal/kg/day and 3 to 4grams of protein/kg/day. Children are fed every two hours initially and once appetite improves, they are fed ad libitum. The children receive a massive dose of vitamin A as per the WHO guidelines and multivitamin supplementation. Micronutrients are provided in the form of multivitamin-multimineral syrups containing zinc sulphate, nicotinamide, thiamine hydrochloride, riboflavin, pyridoxine, copper sulphate, potassium iodide, selenium, cyanocobalamin, Vitamin A, cholecalciferol and calcium. Potassium chloride is also given daily as per the recommended dose. Folic acid is given regularly but iron is withheld during the initial phase of rehabilitation. Iron supplementation is started once the child starts gaining weight.

FEEDING SESSION AT NUTRITION WARD OF NILOUFER HOSPITAL, HYDERABAD

Appropriate medical care is provided to children during their stay at the nutrition ward. All the children are weighed each morning on an electronic weighing scale (SECA, Hamburg, Germany) to the nearest gram. Length/ height is measured on admission and discharge. Dietary intakes and weight gains of the children are carefully monitored and appropriate changes are done in the diets of children, who fail to achieve adequate caloric intakes and weight gain.

A recent retrospective study at NIN analyzed hospital records of children admitted to nutrition ward during the period of January 2001 to December 2005 (12). Data was available on 309 children who stayed in the nutrition ward for ≥ 7 days. Among them, 53% were boys, 18% had edema and 20% had severe anemia (hemoglobin<7g/dL). The characteristics are presented in table 2. The calorie and protein intake calculated in a sub sample during nutrition rehabilitation were (mean ± SD) 178 ± 54 kcal/kg/day and 4.1 ± 1.9 g/kg/day, respectively. The average rate of weight gain was about 5g/kg/day, which is similar to the reports published from other nutrition rehabilitation centers. The study thus indicated that the diet based on local energy-dense foods can be suitable for the nutrition rehabilitation of severely malnourished children. Another recent study on the children treated with the local foods assessed the composition of

CASE STUDIES

ANITA –

A two-year-old girl admitted for pneumonia at Niloufer Hospital was referred to Nutrition ward for the treatment of SAM.

On admission, her weight was 5.7 kg, height 67 cm and WHZ score -3.2.

Her average energy intake during hospitalization was about 187 Kcal/kg/ day and protein intake was about 6 g/ kg/day. After one month of nutrition rehabilitation, her weight increased to 6.8 kg and WHZ was -1.5. The rate of weight gain was about 8.2 g/kg/day.

SUPRIYA-

Aged 3years and 2 months, her diagnosis showed tuberculosis with marasmic kwashiorkor.

On admission, her weight was 7.4 kg, height was 80.2 cm and WHZ score was -3.8.

After 15 days, her weight improved to 8.6 kg with a rate of weight gain of 11 g/ kg/day. Her average energy intake during hospitalization was about 197 Kcal/kg/ day and protein intake was about 3.6 g/ kg/day.

weight gain (i.e. fat and lean mass) in these children (13). The study was carried out to address the concerns that rapid catch up growth during nutrition rehabilitation of severely malnourished children may be associated with disproportionately higher amounts of body fat deposition. Body composition was assessed using skinfold thickness measurements in 80 children admitted at the nutrition ward at baseline and after one month of intensive feeding with energy dense local foods. The study indicated that about 40% of the total weight gain was contributed by fat mass in these children. This could have long-term implications for insulin sensitivity and cardiovascular risk in later life.

Table 2 General characteristics and weight gain (g/kg/day) in children with and without edema.

COMMUNITY-BASED MANAGEMENT OF SEVERE ACUTE MALNUTRITION

Given the large number of children suffering from SAM, hospital-based treatment of all the children is not operationally feasible because of limited number of hospital beds and high costs. Community-based management is, therefore, an unavoidable alternative for a large proportion of these children. Preliminary evidence indicates that more than 85 % of total SAM cases are without medical complications and can be successfully managed at the home level.

Development of ready-to-use therapeutic food (RUTF) has made it possible to move much of the management of SAM out of hospitals. RUTF has been used as a substitute to therapeutic diets (F-75/F-100) in African settings and these foods have been found to be effective for community-based care of children with SAM in studies conducted in Africa (14,15). RUTF is a mixture of milk powder, vegetable oil, sugar, peanut butter and powdered vitamins and minerals and is energy-dense food providing 5.5Kcal/g. Almost 55-60% of calories are derived from fat and it has sufficient protein (contributing 10-12% of calories) from skimmed milk which provides most of the required essential amino acids. It does not need to be prepared in any way prior to consumption, making it practical for use where cooking fuel and facilities are limiting constraints. RUTF has a very low water activity, thus it is impossible for significant bacterial growth to occur in these foods. A severely malnourished child can consume just a few spoonfuls of RUTF 5-7 times a day, and achieve sufficient nutrient intake of all macro and micronutrients for complete recovery. The local production of RUTF using local crops has been tried in African settings which reduces the cost of RUTF. The Indian experience of using RUTF is, however, very limited and information based on well-designed studies assessing the efficacy of RUTF in weight gain and physiologic and immunological recovery is not available. Studies are currently ongoing in India to develop energy-dense therapeutic foods based on local ingredients and evaluate their efficacy for management of SAM children. Results of these studies would be helpful for guiding the strategies for community-based management of SAM in India.

TABLE 2 GENERAL CHARACTERISTICS AND WEIGHT GAIN (G/KG/DAY) IN CHILDREN WITH AND WITHOUT EDEMA.

	EDEMA PRESENT		EDEMA ABSENT	
Age in months	32 ± 13	(56)	24 ± 15 **	(253)
Duration of stay in nutrition ward in days	28 ± 20	(56)	26 ± 20	(253)
Hemoglobin gm/dl	8.3 ± 2.3	(48)	9.4 ± 2.3*	(194)
Cause of admission %				
Diarrhea	23	(13)	26	(67)
Pneumonia	5	(3)	12	(31)
Others	27	(15)	21	(53)
Tuberculosis	20	(11)	12	(31)
Undernutrition per se	25	(14)	28	(71)
Baseline WHZ score	-4.3 ± 1.2	(53)	-4.0 ± 1.3	(243)
Baseline HAZ score	-4.2 ± 1.6	(54)	-3.7 ± 1.9	(246)
Baseline WAZ score	-5.0 ± 1.1	(56)	-4.8 ± 1.3	(253)
Weight gain in g/kg/day				
Weight gain in week 1		NA	5.8 ± 7.0	(252)
Weight gain in week 2	7.0 ± 9.4	(43)	5.7 ± 7.7	(169)
Weight gain in week 3	4.1 ± 5.7	(31)	5.5 ± 6.6	(123)
Weight gain in week 4	4.8 ± 5.8	(22)	5.2 ± 5.7	(87)
Weight gain in week 5	5.2 ± 7.8	(14)	3.7 ± 6.8	(64)

All the values are Mean ± SD, n in brackets. * P< .01. ** P< .001

WHZ-weight for height Z score, HAZ- height for age Z score, and WAZ -weight for age Z score.

NA not applicable – children with edema lost weight in the first week of admission because of the loss of edema fluid. Their weight gains were therefore not calculated for the week 1. (Reference no.12)

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Severe Acute Malnutrition - Challenges and Solutions

Early recognition, prompt management, ideal rehabilitation and prevention are key points in the solution to the challenge of SAM. Growth chart with linear measurements would be ideal, but more practical and feasible is mid-upper arm circumference (MUAC) that is possible in every health facility. Fortunately most SAM children are uncomplicated and therefore managed at home with standard guidelines. Ready to use therapeutic foods facilitate ease of management. This issue of In-Touch brings you very useful article by Dr Bharati Kulkarni that also shares her experience in managing SAM.

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SITTING FROM LEFT TO RIGHT
DR. R. K. TANDON, DR. P. JAGANNIVAS, DR. KAMALA KRISHNASWAMY, MR. HERVE LE FAOU, DR. Y. K. AMDEKAR, DR. ANAND PANDIT, MS. NEELANJANA SINGH

STANDING FROM LEFT TO RIGHT
DR. J. S. PAI, MR. R. RAMESH, DR. P. H. ANANTHANARAYANAN, DR. B. SESIKERAN, DR. SARATH GOPALAN, MR. R. R. PAL, DR. DHARINI KRISHNAN, MR. YASMIN BHADHA

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