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RESEARCH ARTICLE

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A STUDY ON HOME-BASED REHABILITATION OF SEVERELY MALNOURISHED CHILDREN

ASBTRACT

To evaluate the feasibility and outcome of home-based rehabilitation on severely malnourished children.Thirty two severely malnourished (weight for length < 70% of WHO reference) children between the ages of 6 months to 5 years were selected. Rehabilitation at home (16 weeks) following initial assessment or/and stabilization at hospital. Initial assessment of the patient was done in hospital. Those with complications or loss of appetite were admitted in hospital and managed as per WHO guidelines. After discharge, they were managed at home using home-based diets. Those without complications and with preserved appetite were directly eligible for home-based rehabilitation. Follow up was done in hospital up to 16 weeks. Dietary intake, anthropometry and morbidities were recorded during follow-up. Significant change was observed in weight gain and nutrient intake. Home-based management using home prepared food and hospital based follow up is associated with sub-optimal and slower recovery.

Keywords: Community health services, Nutritional support, Protein energy malnutrition.

INTRODUCTION

To rationalize the management of severely malnourished children, World Health Organization (WHO) proposed guidelines which state that a child with complications should be treated in hospital until the weight for length improves about 90%. However, this is seldom feasible because of bed shortage in hospitals and budgetary constraints. Prolonged hospital stay also carries the risk of nosocomial infections leading to increased mortality. Admission of all children with severe malnutrition is thus not operationally feasible, and hence home-based management is an unavoidable alternative for a significant proportion of these subjects. Preliminary evidence from Bangladesh and Africa suggests that this alternative may be acceptable, cost-effective and reduce morbidity and mortality (Ashraf *et al*., 2007, Orach *et al*., 2002, Khanum *et al*., 1994 and Bredow *et al*., 1994). In a recent statement, WHO suggested that uncomplicated forms of severe acute malnutrition can be treated in the community with ready-to-use therapeutic food (RUTF) or therapeutic diets using locally available nutrient dense foods under careful monitoring until they have gained adequate weight(WHO, 2007). However, the guidelines regarding early discharge from the hospital followed by home based management are lacking. The studies evaluating outcome of those discharged early from the hospital or those managed at home are scarce. The present study was thus conducted to evaluate the outcome and feasibility of home based rehabilitation of severely malnourished children. We hypothesized that it is possible to attain recovery and reduce mortality with home based rehabilitation.

MATERIALS AND METHODS

The study was conducted at St. Joseph's General Hospital in Guntur, Andhra Pradesh, India. The study protocol was approved by institutional research board including ethical clearance. The study procedure was fully explained to the parents/caregivers and informed return consent was obtained from the primary caregiver.

Inclusion Criteria

All consecutive children (6 months to 5 years) with severe malnutrition presenting to the pediatric out-patient department (OPD) or emergency of hospital were eligible for inclusion. Severe malnutrition was defined as weight for height (or length) < 70% of median. WHO multicentric growth standards were used as reference criteria (Deonis *et al*., 2006).

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Children were eligible for home management if: (i) mother or caretaker was not full-time employed, (ii) family was residing within 5 km of hospital premises, (iii) mother or caretaker was trainable to provide home-based diet, and (iv) family was financially able to provide the recommended home-based diet. Children having other diseases incriminated as cause of severe malnutrition, including cerebral palsy, congenital heart disorders, hemolytic anemia, malignancies, known metabolic disorders, known malabsorption syndromes, chromosomal malformations or chronic renal and hepatic disorders were excluded.

Baseline data collected included demographic details and presence of associated symptoms including fever, vomiting or diarrhea. Occupation, education and monthly income of parents were recorded and a socio-economic status was assigned based on revised Kuppuswamy classification (Mishra *et al*., 2003). General hygiene of the household was assessed in terms of source of drinking water, water storage practices and practice of hand washing. Clinical examination included anthropometry (weight, length, mid-arm circumference, chest circumference and head circumference), general physical examination and systemic examination. The weight was recorded in the nude on an electronic weighing scale (Goldtech, India) to the nearest 5 g. Length was recorded using an infantometer and head, chest and mid-upper arm circumference were recorded using non-stretchable measuring tape using standard techniques(WHO, 1995). The same observer recorded all the measurements. Venous blood was drawn for estimation of hemoglobin, blood sugar, albumin and serum electrolytes. Cultures of the blood and urine were taken. Chest X-ray and other relevant investigations were done as and when required.

Assessment and Management

Initial assessment of the patients was done in hospital. Those with complications or loss of appetite were admitted in hospital and managed as per WHO guidelines as adapted by Indian Academy of Pediatrics (IAP) (Gabouland *et al*., 2007). After discharge, they were managed at home using home based diets. Those without complications and with preserved appetite were directly eligible for home-based rehabilitation after initial assessment in hospital.

Initiation of cautious feeding: Feeding was started with starter F-75 made at hospital kitchen using whole milk, sugar, oil and water as per recommended formula (Ashworth *et al*., 2003). As no mineral mix or micronutrient mix was available potassium, magnesium and Zinc were given separately as described above. Initially enough starter was given to provide 100 kcal/kg/day and 1-1.5 g protein/kg/day with 130 ml/kg/day of fluid (when the child had severe edema 100 ml/kg/day was given). Breastfeeding was continued as usual wherever possible. Initially, the child was given feed more frequently with low volume, then gradually frequency of feeds was decreased and volume per feed was increased. As the patient started to regain appetite, the starter feed was changed with home-made food. Mother was counseled to provide type, frequency and quantity of food. Monitoring for amount of feed offered and left over, frequency of vomiting and watery stool were done.

Discharge

Child was considered for discharge when (i) the appetite had returned (easily consuming more than 80% of recommended feeds orally), (ii) child had started gaining weight (gain of at least 5 g/kg/day for 3 consecutive days), (iii) immunization had been initiated, (iv) all acute complications had been treated, (v) micronutrient supplementation was initiated and (vi) mother had been counseled for home-based care (Gupta *et al*., 2006).

Home-Based Rehabilitation

All children directly enrolled for home-based rehabilitation and those discharged from hospital were eligible for home-based rehabilitation.

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Nutritional support: home based foods were advised to provide energy 150 kcal/kg/day and 2-3 g/kg/day of proteins. A diet chart was provided using home-based energy dense foods like besan-laddu, kichidi, groundnut burffi enriching them with jaggery and oil. Energy dense feeding was gradually increased so as to provide approximately 150-220 kcal/kg/day and proteins 4-5 g/kg/day. Mother was given advice about type of food, quantity of food and feeding frequency. No external support for procuring or making food was provided to the families. Daily multivitamin supplement was continued till 16 weeks.

Sensory stimulation and emotional support: Mother was counseled to give tender loving care to the child and to provide cheerful stimulating environment. Child was provided with toys as a part of structured play therapy. Toys like ring on a string, rattle and drum, in and out toy with blocks, posting bottle and doll were given.

Follow-up

Frequency of follow-up visits were: (i) 2 contacts/week separated by at least 48 hours in first two weeks, (ii) once a week for 3-8 weeks, (iii) and from 8 weeks till 16 weeks, every 4 weeks. At each visit dietary intake was recorded by recall-method and detailed general physical and systemic examination was done. Mother was recounselled about type, quantity and frequency of food to be given. Any medical problem identified during visits was treated. Measurement of weight, length, head circumference, chest-circumference and mid-arm circumference was done at each visit. Investigations of all children were repeated at 4 weeks and at 16 weeks. The child was stated to have recovered completely if child achieved weight for length >80% at the end of 16weeks. The child was stated to be partially recovered if the weight for length remained between 70 to 80% after 16 weeks of follow-up. A weight gain of >5g/kg/d was defined as an acceptable weight gain (Bhatnagar *et al*., 2007).

Characteristics	Admitted (n=18) Mean (SD)	Directly Recruited(n=14) Mean (SD)	Total (n=32) Mean (SD)
Age (mo)	19.5 ± 10.0	22.9 ± 13.2	21.8 ± 11.0
Weight (kg)	5.3 ± 1.2	5.1 ± 1.7	5.1 ± 1.3
Weight for age (%)	47.5 ± 6.4	48.2 ± 7.4	47.8 ± 7.3
Length (cm)	70.2 ± 7.8	69 ± 9.8	69.6 ± 7.2
Length for age (%)	85.9 ± 6.2	85.4 ± 5.7	85.6 ± 6.2
Weight for length (%)	62.5 ± 6.4	65 ± 3.8	63.7 ± 5.5
Chest circumference (cm)	39.7 ± 3.6	40.1 ± 4.2	39.8 ± 3.8
Mid-arm circumference (cm)	9.3 ± 1.3	9.3 ± 0.9	9.3 ± 1.1

TABLE 1: Baseline Characteristics and Anthropometry of Study Subjects at Presentation

RESULTS

Thirty two severely malnourished children formed the subjects for present study. 41% children were <1year of age, both males and females were included. Only 3 (9.3%) were completely immunized, only 5(15.6%) children were exclusively breast fed for 6 months and around two-third were bottle fed. Nearly 14 (43.7%) had access to safe water supply and 10 (31.2%) had facility of separate toilet. Anthropometry of study subjects at presentation (n=32) is given in ***Table 1***. At first assessment, all children were anemic (Hb < 11 g/dl). Thrombocytopenia (platelet count < 150 x 10^9/dl) was observed in 6 (18.75%), hypoglycemia in 3 (9.3%), hyponatremia (Na^+ <130 mEq/L) in 4 (12.5%), hypernatremia (Na^+ <150 mEq/L) in 7 (21.8%), hypokalemia (K^+ <3.5 mEq/L) in 10 (31.2%) and hyperkalemia (K^+

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<5.5 mEq/L) in 2 (6.25%) children. Blood cultures at presentation was positive in 7 children, urine cultures was positive in 2 children and stool demonstration ova/cyst in 3 children at 16 weeks, hematological, biochemical and microbiological profile was normal in all children. Out of 32 patients, 18 were admitted and tested in hospital. The mean (±SD) duration of hospitalization was 5.4 ± 2.2 days. 2 children had odema during presentation, which settled on day 5 and 8 of admission. 25 children completed the supplementary program.

Days of enrolment	Calories (Kcal/kg/day)	Protein (g/kg/day)	Weight (kg)	Weight for height/length
Baseline	100.0 ±5.0	1.1±0.4	4.97±1.4	62.9±6.0
3 days	116.3±4.4	1.3±0.2	5.07±1.4	65.2±5.8
7 days	141.0±12.3.	1.6±0.3	5.20±1.3	66.7±5.6
3 weeks	162.5±17.9	2.4±0.3	5.45±1.2	68.7±5.6
6 weeks	184.6±18.1	3.3±0.2	5.79±1.4	72.7±5.7
12 weeks	225.2±20.6	4.4±0.4	6.36±1.4	77.1±4.5
16 weeks	243.9 ±13.4	4.8±0.3	6.70 ±1.5	80.4±5.7

Table II: Changes in calories and protein intake, weight and weight for length during follow-up (n=25).

The mean calorie and protein intake of study subjects who completed 16 weeks follow-up (n=25) at enrolment, day 3, day 7, 3 weeks, 6 weeks, 12 weeks and 16 weeks is shown in Table II. During the home-based management phase, the mean (±SD) calorie intake increased from 100±5.0 k.cal/kg/d, at enrolment to 243±13 k.cal/kg/d, at 16 weeks (P<0.001). Similarly, protein intake increased from 1.1±0.4 g/kg/d to 4.8±0.3 g/kg/d (P<0.001).

Changes in calories and protein intake, weight and weight for length during follow-up (n=25) are shown in Table II. Weight gain during hospital stay was 9.0±5.4 g/kg/d, while during home-based rehabilitation, average weight gain was 3.4±1.5 g/kg/d. During home-based rehabilitation only 3 (11.5%) children achieved weight gain of more than 5 g/kg/d, while 22(86.2%) children had weight gain of less than 5 g/kg/d. The mean (±SD) weight for length in these children at 16 weeks was 85%. The mean time needed to achieve 80% weight for length was 12±3 weeks. Out of those who recovered completely 4 children went up to achieve > 90% of weight for length. Three children were lost to follow-up (1 at 3 weeks and 2 at 4 weeks). However, all these 3 children had crossed the 70% weight for length barrier before opting out of the study and thus were classified as having partial recovery.

DISCUSSION

The present study assessed the efficacy of home-based rehabilitation after initial assessment or following discharge from a hospital. We aimed to assess the outcome of home-based management using home-based foods in real life situation as no external monetary support or food was provided during this phase. No home visits were done. Using this strategy, majority of children failed to achieve weight gain of more than 5 g/kg/d; the standard criteria for effectiveness as define by WHO (2003). Also, less than half of children achieved >80%

weight for length after follow-up of 16 weeks. The mean weight gain during home based rehabilitation was also less than weight gain during hospital stay.

The mean weight gain in our study (3.2 g/kg/d) was less than that by Gaboulaud, *et.al*, (2007) (9.7 g/kg/d), Ashraf, *et al.,* (2007) (6 g/kg/d) and Khanum *et al*., (1994)(4 g/kg/d). Also, the mean duration for achieving weight for length >80% was more in our study in comparison to earlier studies from Bangladesh. The reasons for early recovery and more weight gain in former studies could be the involvement of salaried health care workers from community in giving proper training and advice. These workers had regular home visits, whereas in our study, home visits during follow-up were not done. Non-availability of ready to use therapeutic food (RUTF) and no external support to the families in form of food or money could be a possible reason of inadequate weight gain in our study. In our patients, weight gain was inadequate during follow-up in most despite history of consuming adequate calories and proteins from home-based foods. This could be attributed to the poor reliability of dietary recall method as well as lack of a mechanism of monitoring their food preparation and techniques of feeding in our study. It is possible that the foods were not sufficiently energy dense and the adequate numbers of feedings were not provided due to social constraints. Linear programming analysis of diets from Africa and Bangladesh has suggested that several home prepared diets for severely malnourished children do not achieve the nutrient density required for successful rehabilitation (Ferguson *et al*., 2008). Persistent infections were unlikely as we could not find any such evidence during follow up and no child on home-based management died.

In a recent review by Ashworth (2006), thirty-three studies of community-based rehabilitation were examined and summarized for the period of 1980-2005; eleven (33%) programs were considered effective. The two indicators of effectiveness that were set for this review were mortality <5% and weight gain ≥5 g/kg/day. Of the sub-sample of programs reported since 1995, 8 of 13 (62%) were effective. Most effective programs utilized RUTF or provided mechanisms for procuring/preparing energy dense foods. None of the programs operating within routine health systems without external assistance was effective.

A potential limitation of our study was that we did not evaluate the outcomes in a comparative manner and thus the efficacy of the management was not directly compared with hospital care or any other effective approach. The sample size was also small to do any subgroup analysis. The strength of our study was that it was done in realistic scenario without actually providing the food or financial support. This has important operational implications as most facilities managing severely malnourished children in India currently do not provide therapeutic nutrition and only rely on nutritional advice/counseling.

CONCLUSION

We conclude that home-based management (directly or following early discharge from hospital) using home prepared food and hospital based follow up is associated with sub-optimal and slow recovery. There should be effective monitoring system and mechanism for providing energy dense foods/RUTF to strengthen the community based management of severely malnourished children. Effectiveness of community-based rehabilitation may require careful planning and additional resources including nutrition educators. Provision of RUTF might help in strengthening the implementation process but its cost, logistics of procurement and distribution, sustainability and consequences of withdrawal would need to be carefully considered. Future research should include comparative evaluation of different strategies in a controlled manner and operational research to strengthen the existing home and hospital based approaches.

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