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A Clinical Study on Catch up Growth and Outcome of Severe Acute Malnourished Children of 6 Months to 5 Years age Group on F100 Formulae Feeds

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ABSTRACT

Severe acute malnutrition (SAM) among children below five years of age remains a major embarrassment and impediment to optimal human capital development in India. India is home to greatest population of severely malnourished children in the world and accounts for over 20% of underweight deaths and 2.1 million children do not survive up to 5 years of age The present study was undertaken to evaluate the outcome and weight gain of severe acute malnutrition (SAM) children on F-100 feeds during hospital stay in tertiary care centre. 198 Children, in the age group of 6-60 months satisfying WHO criteria for defining Severe Acute Malnutrition (SAM) admitted in Nutrition Rehabilitation Centre, Department of Pediatrics, Govt. General Hospital were included in the study. All the cases enrolled in the study and a detailed history and physical examination findings and anthropometric measurements were recorded in presented proforma at the time of admission. After admission, necessary medical investigations were done as and when required. In the phase of initial stabilization, initially F75 diet was offered to the child if they failed appetite test (definition) and or had medical complication. After stabilization phase, they were shifted to the transition phase in which F100 was started without increasing the volume of feeds gradually, then the volume of feeds was increased and the patient were shifted to rehabilitation phase with F100 diet. Children were discharged as per discharge criteria given by WHO guidelines. After discharge children were called for follow-ups every 15 days until cured during follow ups children were assessed for weight for height, oedema and MUAC. Mean age of study population is 19.12±12.08. Prevalence of malnutrition was more in rural area than urban area. Majority of the malnourished children were lower and lower middle class of modified Kuppuswamy scaling. 87.8% children were remained admitted for 2 weeks with mean duration of hospital stay was 11.8±5 days. In the study overall weight gain of patients who had WHZ score $\leq$ 4 SD was more as compared to patient who had WHZ score -2 SD, -3SD, -1SD. weight gain during 1st and 2nd weeks were significantly more than 3rd and 4th weeks. Weight gain in 6-12 months of age children was more than other age groups. Most common morbidity in our study were gastrointestinal infection, respiratory infection, UTI. The discharge rate was 86.36%, defaulter rate was 11.6% and the death rate was 0.5%. 55% patients attended any follow up most of patients attended to at least 2 follow ups. During hospital stay on F100 feed children improved weight, their WHZ score changed from their admission, 70% children were cured. Most of the children gained in range of good and moderate weight gain. Weight gain related to morbidity score was significant i.e.; weight gain in less morbidity score patients was more.

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Key Words

Severe acute malnutrition, children, F-100 feeds formulae, outcome, weight gain

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INTRODUCTION

Severe acute malnutrition (SAM) among children below five years of age remains a major embarrassment and impediment to optimal human capital development in India. India is home to greatest population of severely malnourished children in the world and accounts for over 20% of underweight deaths and 2.1 million children do not survive up to 5 yrs of age[1]. Malnutrition is the one of the leading causes of morbidity and mortality in children throughout the world. In India, 6.4% of children under the age of 5 years are suffering from SAM. Median Case fatality rate in children under 5 years is approximately 23.5% in SAM[2] which may reach 50% in edematous malnutrition. This fatality rate can be brought down to 7-10% by standard case management protocol[3]. The levels of child under nutrition is unacceptably high in almost all states, even though some states like Goa, Kerala, Manipur, Mizoram, Punjab and Sikkim have lower levels[4]. In view to manage the children suffering from SAM, the state governments of different states have begun opening specialized inpatient facilities called as Nutrition Rehabilitation Centers (NRCs) or Malnutrition Treatments Centers (MTCs) to treat SAM and manage underlying complications. An NRC is a unit for in-patient, centre-based care of children with SAM or those at high risk of SAM. NRCs function along the lines of the WHO[5] and revised Indian Association of Pediatrics (IAP) protocols. Besides increasing risk of mortality, under nutrition leads to growth retardation and impaired psychosocial and cognitive development. To prevent death, feeding should begin as soon as possible with Starter (F-75) diet, the "starter formulas used until the child is stabilized. Starter (F-75) Diet Contains 75 Kcal and 0.9 gm. Protein Per 100 mL. Starter (F-75) Diet is Low in Protein, Sodium and high in Carbohydrate, which is more easily handled by the child and provides much-needed glucose. Some children are Lactose intolerant, for them lactose free formulas are available. When the child is stabilized (usually after 2-7 days), "catch-up" formula Catch-up (F-100) diet is used to rebuild wasted tissues. Catch-up (F-100) diet contains more calories and protein: 100kcal and 2.9 gm protein per 100 mL. It has been shown that case fatality rates have reduced form over 30% to less than 5% in hospitals that have used these formulas. Outcome of SAM children depends on failure to gain weight or treat an infection. Implementation of WHO feeding guidelines can result in an adequate weight gain of impatient malnourished children if the feeds are palatable to children, acceptable to caregivers and children have adequate hospital stay and early clearance of infections. Hence the present study was undertaken to evaluate the outcome and weight gain of SAM children on F-100 feeds during hospital stay in tertiary care centre.

MATERIALS AND METHODS

Type of Study: This was a Hospital Based Prospective Observational Study.

Sample Collection: All Children in the age group of 6-60 months satisfying WHO criteria for defining Severe Acute Malnutrition (SAM) admitted in Nutrition Rehabilitation Centre, Department of Pediatrics, Govt. General Hospital were included in the study.

Sampling Methods: Consecutive sampling.

Inclusion Criteria: Children of age group 6 months to 60 months with.

- Weight for Height[6]>3 SD Below mean AND/OR
- Visible severe wasting AND/OR
- Bipedal edema[7] AND/OR
- Mid upper arm Circumference[8]<11.5 cm

Exclusion Criteria:

- Children <6months and >60 months
- Causes of oedema other than SAM
- Children with any medical complications or social issue needing more detailed assessment

Statistical Methods: Data were entered into a computer using Microsoft Excel 2007 spreadsheet and analyzed using SPSS version 22 categorical data was analyzed using percentages and student t-test was used to study comparison between two means. Two tailed p-value <0.05 was considered significant.

Ethical Approval: Approval was taken from the Institutional Ethics Committee prior to commencement of the study.

RESULTS

A total of 198 children were admitted in the NRC during study period there were 104 (52.5%) males, 94 (47.5%), females about 81.5% children were <2 years of age. Mean age of males 18.60±8.48 months, Mean age females 19.69±2.84 months, mean age of total sample 19.12±12.098 months. Malnutrition was more prevalent in males (52.5%). One hundred and twenty one (61.1%) children were came from the rural area. Seventy seven (38.9%) children were came from the Urban area. One hundred and twenty six (63.7%) children belonged to the lower socio-economic class.

Distribution of Patient according To Weight for Height Z score At the Time of Admission: At the time of admission the weight for height z score -2SD to -3SD was about 75.55% (139), ≤-4SD was 20.65% (38) (Table 1).

Table 1: Distribution of patient according to weight for height Z score At the Time of Admission

Weight for height (WHZ)	Number	Percentage
-1 SD	7	3.8
2-3SD	139	75.55
<-4 SD	38	20.65
Total	184	100

Table 2: Distribution of patients according to edema

Character	Number	Percentage
Oedematous	14	7.07
Non-Oedematous	184	92.93
Total	198	100

Table 3: Distribution of patients according to morbidity score

Score	Number	Percentage
0	30	15.1
1	99	50
≥2	69	34.9
Total	198	100

Table 4: DistribuTION OF PATIENTS ACCORDING TO WEIGHT GAIN

Character	Number
Good Weight Gain >10 gm/kg/day	105 (53%)
Moderate Weight Gain 5-10 gm/kg/day	50 (25.3%)
Poor Weight Gain <5 gm/kg/day	10 (5.05%)
No of Gain	20 (10.10%)
Weight loss	12 (6.06%)

Table 5: WHZ Score for distribution of weight gain

S. No.	Weight for height (WHZ)	MEAN weight gain in GMS/kgG/day
A	-1 SD	5.76±9.89
B	-2 to -3 SD	12.19±11.5
C	-4 SD and less	13.92±7.77

Statistical analysis, A v/s B p 0.04, A v/s C p 0.03

Distribution of Patients According to Edema: In the present study, at the time of admission approximately 93% of the children were non-oedematous and 7% oedematous (Table 2).

Distribution of Patients According to Morbidity Score: At the time of admission 99 (50%) of children were with one morbidity score, 34.9% (69) children were with ≥2 morbidity score and 15% (30)children were with 0 morbidity score (Table 3).

Distribution of Patients According io Weight Gain: During hospital stay on F-100 feeds, the rate of weight gain was good in 53% (105) patients, moderate in 25.3% (50) of patients, poor in 5.5% (10) of patients, No weight gain was observed in 10.10% (20) of patients and weight loss was observed in 6.06% (12) of patients due to associated morbidities and co-morbidities (Table 4).

WHZ Score for Distribution of Weight Gain: Weight gain of patients those who had weight for height Z score ≤-4 SD more as compared to other groups with mean weight gain of 13.92±7.7 g/kg/day. Weight gain of WHZ score -2 SD to -3 SD patients was more than WHZ score -1 SD patients which is statistically significant p = 0.04. Weight gain of WHZ score ≤-4 SD patients was more than WHZ score –1 SD patients which is statistically significant p = 0.03 (Table 5).

Table 6: Week wise distribution of weight gain

Sr. No.	Weeks	No. of patients	Weight gain gm/kg/day
A	1st	198	11.18±11.36
B	2nd	173	9.99±7.67
C	3rd	34	7.15±5.83
D	4th	8	5.26±2.16

Statistical analysis	p-value
A vs. B	0.24
A vs. C	0.04
A vs. B	0.14
B vs. C	0.04
B vs. D	0.08
C vs. D	0.37

Table 7: Week wise distribution of weight gain according To morbidity score

S. No.	Score	1st week	2nd week	3rd week	4th week
A	0	15.09±6.34 (30)	15.09±6.34 (30)	10.22±3 (12)	5.86±2.86 (2)
B	1	10.37±8.85 (99)	9.95±6.36 (86)	6.36±2.7 (8)	5.5±2.6 (4)
C	≥2	10.65±15.4 (69)	7.3±8.8 (57)	3.19±7.7 (11)	4.13±0.29 (2)
Statistical analysis (p-value)					
A vs. B		< 0.001	<0.0002	0.4	0.4
A vs. C		0.02	<0.001	0.99	0.27
B vs. C		0.44	0.09	0.1	0.8

Week Wise Distribution of Weight Gain: Rate of weight gain was good in initial 1st and 2nd weeks. With compared to 3rd week. Weight gain in 1st and 2nd weeks was more than 4th week. Weight gain in 1st week was 11.18±11.36 gms/kg/day which is more as compared to 3rd week with statistically significance p = 0.04. Weight gain in 2nd week was 9.99±7.67 gm/kg/day was more than 3rd week with statistically significance p = 0.04 (Table 6).

Week Wise Distribution of Weight Gain According To Morbidity Score: Weight gain during 1st and 2nd week with zero and single comorbidity score was more than other groups. Which is statistically significant (P value <0.01, <0.02). In present study as the morbidity score increases weight gain was decreases. Weight gain patients with 0 morbidity score was more than weight gain of patients with 1 morbidity score and ≥2 more morbidity score patients. Similarly weight gain of patients with 1 morbidity score more than weight gain of patients with ≥2 morbidity score patients weight gain was more in patients with 0 morbidity score during 1st and 2nd weeks as compared to patients with 1 and ≥2 morbidity score which is statistically significant, p = 0.01, 0.02, <0.002, <0.001, respectively (Table 7).

Distribution of Study Subjects According To Grade of Malnutrition: During hospital stay patients who were falls on WHZ Score ≤-4 SD and -3 SD were became -1 SD and -2 SD and some patient's falls on median. Patients who had edema over 2-4 days of period they became non-oedematous, at the time of discharge oedematous patients loses their oedema and falls on WHZ score -1 SD (4), -2 SD.

Table 8: Distribution of study subjects according to grade of malnutrition

Weight for height (WHZ)	No. of children at the time of admission	No. of children at the time of discharge
-1 SD	7	68
-2 SD	9	70
-3 SD	130	34
-4 SD	38	12
Median	0	13
Edema	14	0

Table 9: Distribution of study subject according to follow ups

No. of follow ups	Number	Percentage
1	20	21
2	13	13.7
3	50	52.6
4	12	12.7

Distribution of Study Subject According To Follow Ups: In the present study 55.5% (95) patients were attended any fallow up. Among these 21% (20) patients were attended for 1 fallow up, 13.7% (13) were attended for 2 fallow ups , 52.6% (50) were attended for 3 fallow ups and 12.7% (12) were attended for 4 fallow ups (Table 9).

DISCUSSION

Severe acute malnutrition is a global burden. SAM is the leading cause of death in developing countries. Prompt and proper management if complications associated with SAM and then after rehabilitation by using proper feeding protocol in hospital setting and at home is the key to success. Thus, present study was conducted in NRC of tertiary care hospital to find out the weight gain in a case of severe acute malnutrition with F100 feeds. In our study total 198 children with severe acute malnourishment were admitted in the NRC during study period. Among them 37.9% (75) children were 6-12 months, 43.9% (87) children were 13-24 months, 9.1% (18) children were 25-36 months, 4% (8) children were 37-48 months, 5.1% (10) children were 49-60 months of age. Overall malnutrition was more prevalent in <24 months of age. Similar to other studies like NAGAR *et al*.[9], <24 months of children 96%. Sharma *et al*.[10] <24 months children 34%. Mamidi *et al*.[11] <24 months of children 71.1%. In the present study prevalence of malnutrition was more in males 52.5% as compared to females 47.5%.which is similar to other studies as Mourya *et al*.[12], Mittal *et al*.[13] and Singh *et al*.[14]. In our study most of the children resided in rural areas which was similar to other studies Choudary *et al*. and Ashraf *et al*.[15]. In the present study 63.7% children were belongs to upper lower and lower socioeconomic status, similar to present study Mittal *et al*.[13], noticed 55% patients were belong to below poverty line. Mean duration of hospital stay was 11.8±5 days which is similar to other studies like Nagar *et al*.[9], Mourya *et al*.[12], Mittal *et al*.[13], Singh *et al*.[14]. In the present study the mean weight gain of the patients during hospital stay in males was 10.27±10.63 gm/kg/day, in females 12.18±12.08 gm\kg\day, over all it was 11.18±11.36 gr\kg\day. similar to present study other studies like Nagar *et al*.[9], Mourya *et al*.[12], Mittal *et al*.[13], Singh *et al*.[14], Savadago *et al*.[16] and Teneja *et al*.[17]. In the present study mean weight gain during first week was 11.18±11.36 gm/kg/day and second week 9.99±7.67 gm/kg/day which are more than 3rd and 4th weeks. Similar to present study Nagar P *et al*.noticed that weight gain during 2nd week more than other weeks. Overall weight gain in patients of 6-12 months of age was significantly more as compared to patients of 13-24 months. According to weight for height Z score at the time of admission most of patients in our study falls between -2SD, -3SD, -4SD. About 75.55% falls in between -2SD to -3SD, 20.65% falls ≤-4SD. Similar to present study Mittal *et al*.[13] noticed 0.6% of patients was in between -2 SD to -3SD, 25.6% of patients falls in between -3 SD to -4 SD and 73.7% of patients falls ≤-4SD. During hospital stay on F100 feeds children improved weight. So that their WHZ score was changed from their admission. In the present study at the time of discharge 6.58% children falls on median, 34.4% on -1SD, 35.4% -2SD, 17.20% on -3SD and only 6% on -4SD because of associated morbidity and edema. Similar results noticed Nagar *et al*.[9]. 55.4% falls above -3SD, Mittal *et al*.[13]. 35% falls on -1SD, 30% falls on -2SD, 2O% falls on -3SD. In present study out of 198 patients 7.07% (14) had edema, 92.93% (184) are non edematous. Near Similar to present study Nagar *et al*.[9], Mourya *et al*.[12] and Singh *et al*.[14] noticed similar result. The weight gain related to morbidity score was statistically significant (p<0.001). Compared to present study, Nagar *et al*.[9], Mamidi *et al*.[11] reported similar results as they concluded that higher the mordbidity score is associated with lower the rate of weight gain. During hospital stay on F-100 feeds, the rate of weight gain was good in 53% (105) patients, moderate in 25.3% (50) of patients, poor in 5.5% (10) of patients, No weight gain was observed in 10.10% (20) of patients and weight loss was observed in 6.06% (12) of patients due to associated morbidities and co-morbidities, almost similar results were observed in Nagar *et al*.In the present study total 198 patients were enrolled out of these 86.36% (171) patients were discharged. Similar to present study discharge rate in various studies like Nagar *et al*.[9], Mittal *et al*.[13], Mourya *et al*.[13] and Singh *et al*.[14] noticed. The defaulter rate was 11.61% (23) similar results were seen in other studies Nagar *et al*.reported the defaulter rate was 16%, Mittal *et al*.[13] 1.9%, Mourya *et al*.[12] 4.4% Singh *et al*.[14] 47.2%. The mortality rate in present study is 0.5% similar to other studies like Nagar *et al*.[9] 1.3%, Singh *et al*.[14] 1.2% and Mourya *et al*.[12] 2.2%. In present study out of 171 discharged patients 55.5% (95) were attended for any follow-ups. Among them

11.6% (20) attended for 1 follow-up, 7.6% (13) for 2 follow-ups, 29.2% (50) for 3 follow-ups and 7% (12) attended for 4 follow-ups. 44.5% of patients were not attended any follow-up.

CONCLUSIONS

During hospital stay on F100 feed children improved weight, their WHZ score changed from their admission, 70% children were cured. Most of the children gained in range of good and moderate weight gain. Weight gain related to morbidity score was significant i.e.; weight gain in less morbidity score patients was more. We recommend adequate immunisation of children as malnutrition and infections both have a vicious cycle relationship, that all eligible women should be counseled regarding nutrition and breast feeding and ASHA, AWW, ANM other health care professionals should be counseled to identify malnourished children and send them to NRC's and also check their follow ups.

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