Original Research :

Use of Indigenous 'Ready to Use Therapeutic Food' (RUTF) and Outcome of Under-five Children with Severe Acute Malnutrition

Elizabeth K. E*, Deepa James**

*Former Professor & Head, Dept. of Pediatrics, **Junior Resident, SAT Hospital, Government Medical College, Thiruvananthapuram, Kerala, India-695011

Corresponding Author: Dr. Elizabeth K E, Mangalathumannil, Nalanchira, Thiruvananthapuram, Kerala, India -695015 EMAIL:drelizake@gmail.com

Received: July 7,2017; Reviewed- August 11, 2017; Accepted-October 23,2017.

Abstract -

Introduction: Severe acute Malnutrition (SAM)is a major contributor to mortality among under-five children. As per the International standard care of SAM, a cure rate of at least 75% with <10% mortality has been set as the minimum goal. But, in practice, this is a difficult goal. Studies on the availability and acceptance of indigenous ready to use therapeutic food (RUTF) in the management are scanty. Hence, this study was undertaken.

Objectives: To assess the outcome of treatment of under-five children with SAM, using indigenous RUTF.

Materials and Methods: All consecutive cases of under-five children with SAM as per WHO Diagnostic Criteria, who attended a tertiary care teaching hospital over a period of 18 months were enrolled. They were managed using the WHO Treatment protocol and an indigenously developed RUTF. They were kept under follow up for 6 months and the outcomes were assessed with respect to cure, not cured, lost to follow up or died.

Results: There were 67 children with SAM; majority 60 (89.6%) were <36 months of age; and 36 (53.7%) were infants. The male: female ratio was 1.8:1. 34 (51%) children had edematous SAM(E- SAM) and two third of them were infants (P <0.05). 47.4% had acute/persistent respiratory infection, 17% had acute/persistent diarrhea, 22% had congenital anomalies and one had HIV infection. 19% were preterm and 45% were low birth weight (LBW) babies, 52% were born by CS 27% had NICU admission. And 36% had developmental delay. 40% were not fully immunized. The infant and young child feeding (IYCF) practices were suboptimum in the majority; only 49% were breast fed within an hour of birth and 9% were breastfed beyond 6 months of age. Early introduction of complementary feeding was noted in 91%. 55% had serious medical complications and 64% >6 months of age failed the appetite test. 65% had severe stunting, 25% had severe anemia and 27% had severe hypoalbuminemia <2.5 g/dl.Three died before initiating treatment and were excluded in the analysis of outcome. The acceptance of the indigenous RUTF was good.33 (51.6%) achieved cure, 18 (28.1%)were not cured, 9 (14.1%)lost to follow up and 4 (6.25%) died. The cure rate was less than the goal of 75%, but the mortality was <10%. Mortality was due to severe infection with septic shock and multiorgan dysfunction syndrome in five and aspiration of feed in two children. The factors that correlated with mortality were the presence of edema, skin changes, danger signs and severe hypoalbuminemia (P <0.01).

Conclusion: Both SAM and E-SAM were more in

the younger age group, especially infants, in males, LBW and CS babies and those with suboptimum IYCF practices. The cure rate was more than 50% and mortality was <10%.Mortality was more in E-SAM and those with serious medical complications like skin changes, danger signs, hypoalbuminemia and septic shock. The use of indigenous RUTF was promising. Strengthening of IYCF practices, early diagnosis, optimum treatment of SAM and use of indigenous RUTF are recommended.

Keywords: *Severe Acute Malnutrition (SAM), Edematous SAM (E-SAM), IYCF practices, Ready to use Therapeutic Food (RUTF), Indigenous RUTF*

Introduction:

Severe acute malnutrition (SAM is reported to account for more than one million preventable child deaths (1,2,3). The reported mortality was as high as 20-30%. As per the WHO Diagnostic criteria for diagnosis and the International standard care of SAM, a cure rate of 75% with <10% mortality has been set as the minimum goal (3). Commercial Ready to use therapeutic food (RUTF) is suggested for management of cases SAM (4). However, many centres have reported a lesser cure rate and the difficulties in using the commercial RUTF (5). Many experts have suggested the use of indigenous RUTF. Studies on the availability and acceptance of indigenous ready to use therapeutic food (RUTF) are scanty. Hence, this study was undertaken to assess the outcome of treatment of under-five children with SAM, using indigenous RUTF.

Materials & Methods:

All consecutive cases of under-five children with SAM diagnosed as per the WHO Diagnostic Criteria (7), who were admitted in SAT Hospital, Govt. Medical College, Thiruvananthapuram, Kerala, South India over a period of 18 months were enrolled. Institutional Research and Ethics Committee approval and informed consent from mothers were obtained prior to study.

Anthropometric measurements were undertaken using standard procedures and equipment's and were compared with WHO growth charts. Socio Demographic profile, IYCF practices, Anthropo-metric measurements and all co-morbidities were recorded. They were managed using the 10 steps of WHO Treatment protocol. Appetite test was performed in those > 6 months of age. Indigenously developed RUTF was used for appetite test and management. SAT Mix and gluten free ELIZ mix were used as per tolerance and acceptance. SAT Mix is a ready to eat roasted and powdered mixture with rice: wheat: black gram: sugar in the ratio 1:1:1:2 and ELIZ mix substituted ragi for wheat with the same composition (6). The above mixtures were enriched with skimmed milk powder and coconut oil in the ratio 3:1:1 and made into a paste prior to feeding. Thus, the calorie and protein content were raised from 350 Kcal and 8 g protein to 500Kcal and 15 g per 100 g of mix. F75 and F100 were prepared indigenously using milk based and cereal- milk based formula. F 75 with 75 Kcal and 1 g protein/100 ml constituted; Cow's milk or equivalent - 30 g, sugar- 9 g and coconut oil- 2 g or Cow's milk or equivalent - 30 g, sugar- 6 g, cereal flour (puffed rice)- 2.5 g and coconut oil- 2.5 g or Cow's milk or equivalent - 25 g, sugar- 3 g, cereal flour (puffed rice)- 6 g and coconut oil- 3 g with water up to 100 ml. F 100 with 100 Kcal and 3 g protein/ 100 ml constituted; Cow's milk or equivalent - 95 g, sugar- 5 g and coconut oil- 2 g or Cow's milk or equivalent - 75 g, sugar- 2.5 g, cereal flour (puffed rice)- 7 g and coconut oil- 2 g with water up to 100 ml. They were discharged after correcting the medical co-morbidities and after attaining 10-15% of the trough weight after clearance of edema. They were kept under follow up for 6 months and the outcomes were assessed with respect to cure, not cured, lost to follow up or died. Cure was defined as weight for height > 90% of the expected. The data was computed and analyzed using SPSS Version 16. Descriptive statistics was used for participant characteristics and univariate analysis was done for significance at P value <0.05.

Results:

There were 67 children with SAM; majority 60 (89.6%) were <36 months of age, those <6 months old were 19 (28.4%), 6-12 months old were 17 (25.3%), 12-36 months were 24 (35.8%), and the rest were >36 months of age. The male: female ratio was 1.8:1. 34 (51%) children had edematous SAM and 64.7% of edematous SAM were infants and this observation was statistically significant (P <0.05).The distribution is presented in table 1. Majority belonged to middle and low Socio-Economic status. 31% had acute respiratory infection, 16% had persistent respiratory infection, 13% had acute diarrhea, 4% had persistent diarrhea 22% had congenital anomalies and one was HIV infected. 81% were born full term and the rest were preterm babies. 45% were LBW and 52% were CS babies, 27% had NICU admission and 36% had developmental delay. 40% were not fully immunized. The infant and young child feeding (IYCF) practices were suboptimum in the majority; only 49% were breast fed within an hour of birth and 9% were breastfed beyond 6 months of age. Early introduction of complementary feeding was noted in 91%. 55% had serious medical complications and 64% of them > 6 months of age failed the appetite test. 65% had severe stunting, 25% had severe anemia and 27% had severe hypoalbuminemia <2.5 g/dl. The co-morbidities are detailed in table 2. The acceptance of the indigenous RUTF was good. Out of 67, there were 7 mortalities, 3 died before initiating treatment and were excluded from the analysis of outcome.33 (51.6%) achieved cure, 18 (28.1%) were not cured, 9 (14.1%) lost to follow up and 4 (6.25%) died. The cure rate was > 50%, but it was less than the goal of 75%. The mortality after initiating treatment was < 10%, as per the international goal. Mortality was due to severe infection with septic shock and multiorgan dysfunction syndrome in five and aspiration of feed in two children. The factors that correlated with mortality were edema (E-SAM), skin changes, severe medical complications with danger signs and severe hypoalbuminemia (P <0.01).

Discussion:

Majority of cases of SAM were in the younger age group, <36 months and more than half were infants. This is in accordance with other observations (8). Males were more compared to females. This may be due to the poor resistance power in males coupled with prevailing health seeking behaviors. The mothers belonged to middle or low socio-economic status and only 49.6% had secondary education. This reflects the type of population seeking health care in government settings. More prevalence of SAM in low socio-economic status and lower maternal education has been reported (1). Half of them (51%) had edematous SAM, which is equivalent to Kwashiorkor. There are other reports of this being the predominant type and up to 68% prevalence has been reported (9). This is a known factor that determines outcome including mortality. 64.7% of edematous SAM was infants and this observation was statistically significant. This denotes a recent changing profile, as against the classical description of kwashiorkor in toddlers (8). Strengthening of IYCF practices including breast feeding are to be undertaken to tackle this situation (10). Perinatal issues like LBW, delivery by CS, NICU admission, developmental delay were noted as significant associated factors in SAM. Immunization coverage was also incomplete in 40% of cases, which may be one of the reasons for the high co-morbidities and the missed opportunity for early intervention during immunization visits. IYCF practices were suboptimum as observed in other studies (9). The co-morbidities noted in the study were like comparable to reports (11).

Regarding the outcome, those who were cured, achieved >90% of weight for height within 3 months period. The cure rate was 51.6% as against the goal of > 75%. Most workers have reported a cure rate <75%, comparable to the present study. The mortality after initiation of therapy was <10%, on par with the International goal. A mortality of > 20% is considered unacceptable. The dropout rate was also < 20%, which is also acceptable. The

determinants of mortality were presence of E-SAM with edema, skin changes and severe hypoalbuminemia and serious medical complications. This is in accordance with studies from other developing countries (12, 13, 14). In a recent study from Uganda on 251 patients (15), the treatment outcome was successful in 66.9 %, unsatisfactory in 21.2 %, mortality in 11.9 %and dropout rate was 8.0 %. Hypothermia and HIV infection were the leading causes of death unlike in the present study. The region wise causes of mortality are variable (16, 17, 18). In a previous study from the same centre, biochemical markers of mortality in malnutrition have been reported (19). Other workers also have highlighted the various anthropometric and biochemical factors for outcome (20). The acceptance of the indigenously prepared F 75, F 100 and the RUTF were promising. No one had to be shifted to commercial formula due to feed intolerance. The success of community based approach and use of indigenous RUTF have been endorsed by other workers (5,21, 22). Community based approach and locally prepared supplements are recommended, as these are cost effective (23, 24). The changing profile of SAM with more incidence in infants is an eye opener to strengthen IYCF practices (8,10). Early identification and optimum intervention with a holistic approach referral are pivotal in the outcome (25). The acceptance of indigenously prepared F75,F100 and RUTF was good and these are recommended for success, when commercial preparations are unavailable, unacceptable or unaffordable (26).

Conclusion:

SAM was more in the younger age group, especially infants,male gender and those with suboptimum IYCF practices. More than half had serious medical complications, two third had severe stunting and one-fourth had severe anemia. The cure rate was >50% and the mortality was <10%. The acceptance of indigenous RUTF was promising. The significant factors associated with mortality were presence of danger signs, edema, skin changes and severe hypoalbuminemia. Strengthening of IYCF practices, early diagnosis and optimum treatment of SAM utilizing indigenous RUTF are recommended.

Acknowledgment & funding: The financial support from SAT Endowment Scheme is gratefully acknowledged.

Contributors: EKE conceived the study, was the consultant and drafted the paper. DJ participated in recruitment, management and analysis of data. **Conflict of Interest :**Nil

Table 1: Age Distribution of Children with Severe Acute Malnutrition (SAM)

Age	Edematous SAM No. (%)	Non-Edematous SAM No. (%)	Total No. (%)
2-6 months	11 (16.42) *	8 (11.9)	19 (28.4)
6-12 months	11 (16.42) *	6 (8.96)	17 (25.4)
12-36 months	6 (8.96)	18 (26.87)	24 (35.8)
36-60 months	6 (8.96)	1 (1.5)	7 (10.4)
Total	34 (50.7)	33 (49.3)	67 (100)

*** P <0.05 (Significant)**

Table 2: Co-morbidities and Associated Conditions in Children with Severe Acute Malnutrition (SAM)

Condition	No.	%
Acute Respiratory Infection	21	31.3
Persistent Cough > 1 mo.	11	16.4
Acute Diarrhea	9	13.4
Persistent Diarrhea>2 weeks	3	4.4
Urinary Tract Infection	2	3
Septicemia	5	7.5
Skin Infection	2	3
Edema	25	37.3
Skin Changes	23	34.3
Hair Change	39	58.2
Anemia	61	91
Mucosal changes/ Candidiasis	48	71.6
Hepatomegaly	30	44.8
Hypoglycemia	21	31.3
Hypothermia	6	9
Electrolyte Imbalance	8	11.9
Dehydration	9	13.4
Hypoalbuminemia < 2.5 g/dl	18	26.9
Stunting	64	95.5
Congenital Heart Disease	7	10.45
Cerebral Palsy	1	1.5
Other Anomalies*	3	4.5
HIV	1	1.5
Prematurity	13	19.4
Low Birth Weight	30	44.7
CS Delivery	35	52.2
NICU Admission	25	37.3
Developmental Delay	24	35.8
Partially Immunized	27	40.3
Not Breastfed within an Hour	34	51
Non-Exclusive Breast feeding during 1st 6 months of age	61	91
Early initiation of Complementary Feeding before 6 months of age	55	82.1

* Ano-rectal malformation-1, Hirschsprung's diasease-1, Pierre Robin sequence-1

References

1. UNICEF Global Database on Child Malnutrition. 2005. Available at: http://www.childinfo.org/areas/malnutrition/wasting.php.
2. Black RE, Morris SS, Bryce J. Where and why are 10 million children dying every year? Lancet 2003;361:2226–34.
3. Jones G, Steketee RW, Black RE, Bhutta ZA, Morris SS; Bellagio Child Survival Study Group. How many child deaths can we prevent this year? Lancet 2003;362(9377):65–71.
4. WHO. Management of the child with a serious infection or severe malnutrition: Guidelines for care at the first-referral level in developing countries. [Geneva]: World Health Organization, 2000. 197
5. Kapil U. Ready to Use Therapeutic Food (RUTF) in the management of severe acute malnutrition in India. Indian Pediatr. 2009 May;46(5):381-2.
6. Elizabeth K.E. Triple burden of malnutrition. In: Elizabeth KE eds. Nutrition and Child Development, Paras Medical Publishing, Hyderabad, 5th Edition. 2015, PP: 239-41 (ISBN 978-81-8191-429-3).
7. WHO Child Growth Standards and the Identification of Severe Acute Malnutrition in Infants and Children. A Joint Statement by the World Health Organization and the United Nations Children's Fund, 2009
8. Elizabeth KE.Changing Profile of Undernutrition and Edematous Severe Acute Malnutrition (E -SAM). Indian Pediatrics, Oct 2012, Vol.49(10), pp.843-844
9. Puett C, Coates J, Alderman H, Sadler K. Quality of care for severe acute malnutrition delivered by community health workers in southern Bangladesh. Maternal & Child Nutrition, 2012. DOI: 10.1111/j.1740-8709.2012. 00409.x

10. Elizabeth K E. Crusade against malnutrition: Nutrition Education Programme. Indian Pediatr. 2016, 53: 203-206 (ISSN0019-6061)

11. Bachou H, Tumwine JK, Mwadime R, et al. Risk factors in hospital deaths in severely malnourished children in Kampala, Uganda. BMC Pediatrics. 2006;16(6):7. Google Scholar

12. Bhutta ZA. Treating acute malnutrition where it matters. Lancet 2009, 374(9684), 94-96.

13. Collins S, Dent N, Binns P, Bahwere P, Sadler K, Hallam A. Management of severe acute malnutrition in children. Lancet 2006; 368(9551):1992-2000.

14. Briend A. Management of severe malnutrition: efficacious or effective? J PediatrGastroenterolNutr. 2001;32:521–22. PubMedGoogle Scholar

15. Richard Nyeko, Valeria Calbi, Boniface Otto Ssegujja and Grace Flona Ayot. Treatment outcome among children under-five years hospitalized with severe acute malnutrition in St. Mary's hospital Lacor, Northern Uganda. BMC Nutrition BMC series – open, inclusive and trusted2016. 2:19 DOI: 10.1186/s40795-016-0058-6 © Nyeko et al. 2016

16. Nael L, Andrea M, Ali D, et al. Mortality risk among children admitted in a large-scale nutritional program in Niger. PLoS One. 2009;4(1):e4313. Google Scholar

17. Gernaat HB, Dechering WH, Voorhoeve HW. Mortality in severe protein-energy malnutrition at Nchelenge, Zambia. J Trop Pediatr. 1998;44:211–7. PubMedGoogle Scholar

18. Elizabeth K E. Why do children die in Kerala? Experiences from a Tertiary Care Hospital, Pediatric Companion, IAP Kerala. 2016, 12: 6-7

19. Sathy N, Elizabeth K.E, Lethadevi G, Bai J. Biochemical predictors of mortality in children with PEM. Indian Pediatr. 1993, 20: 251-253.

20. Erinoso HO, Akinbami FO, Akinyinka OD. Prognostic factors in severely malnourished hospitalised Nigerian children: Anthropometric and Biochemical factors. Trop Geogr Med.1993;45:290–3. PubMedGoogle Scholar

21. Diop el HI, Dossou NI, Ndour MM, Briend A, Wade S. Comparison of the efficacy of a solid ready-to-use food and a liquid, milk-based diet for the rehabilitation of severely malnourished children: a randomized trial. Am J ClinNutr. 2003 Aug;78(2):302-7.

22. Moges T, Haidar J. Management and outcome of severely malnourished children admitted to Zewditu Memorial Hospital, Ethiopia. East Afr J Public Health. 2009;6(2):162–7. PubMedGoogle Scholar

23. Elizabeth K E. Editorial. Nutrition rehabilitation centres and locally prepared therapeutic food in management of severe acute malnutrition. Indian Pediatr. 2014, 51: 19-20

24. Bachmann MO. Cost effectiveness of community-based therapeutic care for children with severe acute malnutrition in Zambia: decision tree model. Cost Eff ResourAlloc. 2009; 7:2.

25. Elizabeth K E. ELIZ Modified IMPACT- A Tool for Undernutrition & Obesity- The Dual Burden of Malnutrition. Mini Review. BIOACCENT, BOAJ Pediatr. 2017, 3: (1), 33-36

26. Steeve C, Kate S, Nicky D, et al. Key issues in the success of community based management of severe malnutrition. Food Nutr Bull. 2006;27(3):S49-82.