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Original Research Article

# An Observational Research to Determine the Co-morbidities Associated with Severe Acute Malnutrition

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**Abstract**

**Aim:** to evaluate the spectrum of co-morbidities in severe acute malnutrition with unexpected dyselectrolytemia in diarrhea. **Material and Methods:** The study was an observational study which was carried in the Department of Pediatrics, Nalanda Medical College and Hospital, Patna, Bihar, India, for the period of 1 year. Total 300 Children below 6 year age were included in this study. Various co morbid conditions in study population were identified. All the laboratory examination was done with standard method. **Results:** out of 300, 94% were associated co-morbid conditions in SAM. Majority of children with SAM were having co-morbidity in the form of Anaemia (85%), Diarrhoea (63%) followed by pneumonia (30%), Rickets (28%), Tuberculosis (15%), Otitis media (14%), UTI (10%), Celiac (5%), Hypothyroidism (3%), & HIV (2%). Mean age (SD) of the diarrheal cases was 37(6) months (95% C.I. 23.7- 26.5) of which 37 were male (58.73%). Mean age (SD) of non-diarrheal cases was 28(6). (95% C.I. 16.6 – 19.4) of which 75.67% were male. Among 300, 189 (63%) SAM children presented with diarrhea of which 184 had dysnatremia in the form of Hyponatremia & Hypernatremia. No statistically significant difference was found with hyponatremia in diarrheal or non-diarrheal cases of SAM (P value of 0.08). Serum Potassium levels of 100 SAM children were analysed. It was found that 22% SAM children were having hypokalemia. Hypokalemia was found in 13% of diarrheal cases & 9% in non- diarrheal cases. A statistically significant difference was found with hypokalemia in SAM (P value of 0.023) between Diarrheal & Non diarrheal cases. **Conclusion:** we conclude that dyselectrolytemia is high in complicated SAM and mainly sodium disturbances in form of hyponatremia are common in different co-morbid conditions. Hence, we recommend that due care is to be given for management of dyselectrolytemia in complicated SAM children.

**Keywords:** Co-morbidities, Dyselectrolytemia, Potassium, Severe acute malnutrition, Sodium



## Introduction

Malnutrition is a major global problem which interacts with diarrhea in a vicious cycle leading to high morbidity and mortality in children and it is as well as a complicating factor for other illness in developing countries. Malnourished children have long lasting, severe and recurrent diarrhea. The prevalence of

diarrhea is 5-7 times more in malnourished as compared to normal children.[1,2] In malnutrition various abnormalities occur in body electrolytes which become more pronounced with diarrheal incidence since electrolytes conduct an electrical current, helps to balance pH and facilitate the passage of fluid between and within cells through process of osmosis imparting in regulation of the function of neuromuscular, endocrine and excretory systems.[3,4] Children with SAM are categorized into "complicated and uncomplicated cases" based on clinical criteria. SAM children with complications require inpatient management and those without complications can be treated on a community basis. World Health Organization (WHO) states this as a strong recommendation with low-quality evidence.[5] As per the WHO, serum electrolytes are measured and supplemented (potassium and magnesium) only in SAM children with complications. SAM children without complications are managed in community with Ready to Use Therapeutic Food (RUTF) which is enriched with minerals and micronutrients.[6] In our country, as RUTF is not available, children are advised home-based energy dense food along with micronutrient supplements. Hence, their diet may still be deficient in minerals. Diarrhea and pneumonia accounts for approximately half the under-five deaths in India and malnutrition is believed to contribute to 61% of diarrheal deaths and 53% pneumonia deaths. 3Malnutrition increases the risk and worsens the severity of infections.[7] SAM children are more prone to severe infections that culminates into different co-morbid conditions and consequentially leads to electrolyte derangement due to reductive adaptation Na+ , K+ , ATPase systems of the body begin to 'shut down'. Regulation of Na+/K+ depends upon excretion, intake, absorption occurs through gastro intestinal system. Disorders of Na+/K+ homeostasis can occur due to excessive loss, gain or retention of the Na+/K+ or H2 O. A vigorous imbalance of these two ions causes hyponatremia/hypokalemia and hypernatremia/hypokalemia. Remarkably, hypokalemia and hyponatremia are seen more frequently in diarrheal population than non-diarrheal.[8] The aim of the study to evaluate the spectrum of co-morbidities in severe acute malnutrition with unexpected dyselectrolytemia in diarrhea.

## Material and methods

The observational study which was carried in the Department of Pediatrics, Nalanda Medical College and Hospital, Patna, Bihar, India, for the period of 1 year, after taking the approval of the protocol review committee and institutional ethics committee.

## Methodology

Total 100 Children below 6 year aged, admitted in Nutritional Rehabilitation Centre of Department of Paediatrics, were include in this study. Various co morbid conditions in study population were identified. All the laboratory examination was done with standard method.

## Results

Total 300 cases were included in study of which 94% were associated co-morbid conditions in SAM. Table 1 showed that majority of children with SAM were having co-morbidity in the form of Anaemia (85%), Diarrhoea (63%) followed by pneumonia (30%), Rickets (28%), Tuberculosis (15%), Otitis media (14%), UTI (10%), Celiac (5%), Hypothyroidism (3%), & HIV (2%).

**Table 1: Comorbid conditions in SAM**

| Co-morbidity | No. of cases | % Percentage |
|---|---|---|
| Diarrhea | 189 | 63 |
| Tuberculosis | 45 | 15 |
| Pneumonia | 90 | 30 |

| | | |
|---|---|---|
| Otitis media | 52 | 14 |
| UTI | 30 | 10 |
| Rickets | 84 | 28 |
| Anaemia * | 255 | 85 |
| Celiac disease | 15 | 5 |
| Hypothyroidism | 9 | 3 |
| HIV | 6 | 2 |

Mean age (SD) of the diarrheal cases was 37(6) months (95% C.I. 23.7- 26.5) of which 37 were male (58.73%). Mean age (SD) of non-diarrheal cases was 28(6). (95% C.I. 16.6 – 19.4) of which 75.67% were male.

Table 2 shows that 189 (63%) SAM children presented with diarrhea of which 186 had dysnatremia in the form of Hyponatremia in 180 cases & Hypernatremia in 6 cases. No statistically significant difference was found with hyponatremia in diarrheal or non-diarrheal cases of SAM(P value of 0.08)

**Table 2: Dysnatremia in SAM children in diarrheal & non diarrheal groups**

| Serum Sodium | No diarrhea (%) | Diarrhea (%) | Total (% of the total cases) |
|---|---|---|---|
| Hyponatremia | 60 (32.26%) | 126 (67.74) | 186 (62%) |
| Normonatremia | 48 (44.45%) | 60 (55.55%) | 108 (36%) |
| Hypernatremia | 3 (50%) | 3 (50%) | 6 (2%) |
| Total cases | 111 | 189 | 100 |

Serum Potassium levels of 300 SAM children were analysed. It was found that 22% SAM children were having hypokalemia. Hypokalemia was found in 13% of diarrheal cases & 9% in non-diarrheal cases.

Table 3 shows that Potassium levels of children with diarrheal & non diarrheal children with SAM. A statistically significant difference was found with hypokalemia in SAM (P value of 0.023) between Diarrheal & Non diarrheal cases.

**Table 3: Hypokalemia in SAM children**

| Serum Potassium | No diarrhea | Diarrhea | Total |
|---|---|---|---|
| Normokalemia | 84 | 180 | 264 |
| Hypokalemia | 27 | 39 | 66 |
| Total | 111 | 189 | 300 |

## Discussion

In the present study among 300 cases 94% were associated co-morbid conditions in SAM. Majority of children with SAM were having co-morbidity in the form of Anaemia (85%), Diarrhoea (63%) followed by pneumonia (30%), Rickets (28%), Tuberculosis (15%), Otitis media (14%), UTI (10%), Celiac (5%), Hypothyroidism (3%), & HIV (2%) in the present study. In

present study anaemia was found in 85% which is higher than 51% from Columbia as reported by Bernal C et al 2008.[9] It was further observed that children with SAM was having 51% moderate anaemia followed by 35% severe anaemia in present study which is contrary to the study from Delhi as reported by Thakur et. al.[10] This can be contributed to nutritional deficiency as majority of the patients had dietary deficiency.

63% of children with SAM in present study was admitted with diarrhea as a co morbid state which is in accordance with 60% from Bangladesh as reported by Khanum et. al 1998[11] but lower than 67% from Zambia as reported by Irena et. al 2011,[12] 68% from Columbia as reported by Bernal C. et al 2008,[9] 70% from Kenya as reported by Nzioki et. al 2009[13] which may be due to geographical factor while higher than 54% from Madhya Pradesh as reported by Kumar et al 2013,[14] 49% from Kenya as reported by Talbert et.al 2005[15] and 11% from Bangladesh as reported by Hossain et.al 2009.[16] It may be because of low socioeconomic status, bottle feeding & unhygienic feeding can be contributed to this high prevalence of diarrhea in present study. In our study hypokalemia was found associated with diarrhea and hyponatremia was found not associated which is comparable to other studies.[17-19] This dyselectrolytemia may present with significant neurological outcomes.[17,20,21] Further studies are needed establish the exact understanding of electrolyte changes in SAM. 30% of children with SAM in present study was admitted as a pneumonia based on the clinical findings & Chest X Ray which is higher than 10% in Ethopia as reported by Berti et. al 2008[22] which may be because of late admission in NRC. However it is lower than 33% and 58% from Bangladesh as reported by Hossain et al[16] and Kahnum et al 1998[11] respectively.

15% of Children with SAM were diagnosed as a Pulmonary tuberculosis in a present study which is higher than 2%, 5.6%, 6.6%, 9% and 9.3% from Karnataka, Madhya Pradesh, Ethiopia, Bangladesh and Uttar Pradesh as reported by Bhat et al,[23] Gangaraj 2013,[24] Berti et al 2008,[22] Hossain M et al,[16] & Kumar et al[25] respectively. The high prevalence tuberculosis in present study may be because of children with SAM are belonging to low socio economic class. The high prevalence can be contributed to the more cases having history of contact positive. So screening of all SAM children with Tuberculosis is a must to find the actual disease burden in SAM.

10% of children with SAM were diagnosed UTI in present study which is lower than 11%, 17%, 30%, 31% from Nigeria, Delhi, Turkey and Mexico as reported by Rabasa et al 2002,[28] Bagga et al 2003,[29] Caksen et al 2000,[27] Berkowitz et al 1983[26] respectively.

5% of children with SAM were diagnosed with Celiac disease in the present study based on clinical features suggestive of celiac disease, which is lower than 13% from Delhi as reported by Kumar et al 2012.[25]

28% SAM children in our study had ricketic features, and this is comparable with the previous reports.[30] This can be contributed to dietary deficiency and Vitamin D supplementation in early period of life. 3% of children with SAM were diagnosed with hypothyroidism in the present study based on clinical features suggestive of hypothyroidism. Exact prevalence of hypothyroidism was not found because selected cases were investigated.

2% of children with SAM were diagnosed HIV positive in the present study which is lower than found in previous studies.[25,31] This may be because of low prevalence of HIV in present study. However high prevalence of HIV infection in children with SAM in African country may be associated with nutritional

deficiencies secondary to decreased nutrient intake, impaired nutrient absorption, increased nutrient losses and increased nutrient demand. This is due to direct effect of HIV and the myriad of opportunistic infections precipitated by HIV induced immunodeficiency.

## Conclusion

We conclude that dyselectrolytemia is high in complicated SAM and mainly sodium disturbances in form of hyponatremia are common in different co-morbid conditions. Hence, we recommend that due care is to be given for management of dyselectrolytemia in complicated SAM children.

## Reference


1. Müller O, Krawinkel M. Malnutrition and health in developing countries. CMAJ. 2005 Aug 2;173(3):279-86.
2. Ferdous F, Das SK, Ahmed S, Farzana FD, Latham JR, Chisti MJ, Ud-Din AI, Azmi IJ, Talukder KA, Faruque AS. Severity of diarrhea and malnutrition among under five-year-old children in rural Bangladesh. Am J Trop Med Hyg. 2013 Aug;89(2):223-8.
3. Afridi HI, Kazi TG, Kazi N, Kandhro GA, Baig JA. Evaluation of status of calcium, magnesium, potassium, and sodium levels in biological samples in children of different age groups with normal vision and night blindness. Clin Lab.2011;57: 559-574.
4. Adelman RD, Solhang MJ. Pathophtysiology of body fluids and fluid therapy in Behrman RE, Kleigman RM, Jenson HB (eds) Nelson text book of Pediatric 16th ed. California WB Saunders, USA.2000.
5. WHO Guideline: Updates on the Management of Severe Acute Malnutrition in Infants and Children. Geneva: World Health Organization; 2013.
6. Indian Academy of Pediatrics, Dalwai S, Choudhury P, Bavdekar SB, Dalal R, Kapil U, et al. Consensus statement of the Indian academy of pediatrics on integrated management of severe acute malnutrition. Indian Pediatr 2013;50:399-404.
7. Müller O, Krawinkel M. Malnutrition and health in developing countries. Can Med Assoc J. 2005;173:3.
8. Inpatient Care Training Materials | Module 2. Principles of Care |FANATA-2. Government of Sudan. 2011:24.
9. Bernal, C., Velasquez, C., Alcaraz, G. et al. Treatment of severe malnutrition in children: experience in implementing the WHO guidelines in Turbo, Colombia. J Ped Gastr Nutr, 2008 March;46(3):322-328.
10. Neha Thakur, Jagdish Chandra, Harish Pemde, & Varinder Singh: Anemia in severe acute malnutrition Nutrition April 2014 Volume 30, Issue 4, Pages 440–442.
11. Khanum et al Growth morbidity & mortality in SAM at Dhaka: prospective study, Am J Clin Nutr 1988;67:940-5.
12. Irena AH, Mwambazi M, Mulenga V. Diarrhea is a major killer of children with severe acute malnutrition admitted to inpatient set-up in Lusaka, Zambia. Nutr J. 2011;10:110.
13. Nzioki C., Irimu G., Musoke R. et al. Audit of care for severely malnourished children aged 6-59 months admitted at K.N.H. Inter Health. 2009 Sept; 1(1):91-96.
14. Kumar et al. Department of Pediatrics, Gandhi Memorial Hospital, Shyam Shah Medical College, APS University, Rewa, MP. India. July 19, 2013Indian Pediatr 2014;51:125.
15. Talbert A, Thuo N, Karisa J, Chesaro C, Ohuma E, Ignas J, et al. Diarrhoea complicating severe acute malnutrition in Kenyan children: A prospective descriptive study of risk factors and outcome. PLoS One. 2012;7:1.
16. Hossain M.I, Dodd N.S, Ahmed T. et al. Experience in managing severe malnutrition in a government tertiary treatment facility in Bangladesh. J

Health Popul Nutr 2009 Feb;27(1):72-80.
17. Sunil Gomber and Viresh Mahajan, clinic-biochemical spectrum of hypokalemia, Indian Pediatrics 1999;36:1144-1146.
18. Zin-Thet-Khine, Khin, Maung U. Sodium balance during acute diarrhea in Malnourished Children (Burma). J Trop Pediatr 2000;20(3):53-7
19. Yasmeen Menon, Rehana Majeed, Mohammas Hanif Ghani, Salman Shikh. Serum electrolytes changes in a malnourished children with diarrhea. Pakistan journal of medical science, Oct-December 2007 (part I). Volume 23.
20. K. Zaman, M.R. Islam, A.H. Baqui & Md. Yunus, Hypokalaemia in children in Bangladesh 1984.Indian J Res 81, February 85.
21. Manary MJ, Brewester DR. Potassium supplementation in kwashiorkor. J Pediatr Gastroenterol Nutr. 1997 Feb;24(2):194-201.
22. Berti A, Bregani ER, Manenti F, Pizzi C. Outcome of severely malnourished children treated according to UNICEF 2004 guieline: a one year experience in a zone hospital in rural Ethiopia. Trans R Soc Trop Med Hyg. 2008;102:939-944.
23. Bhat PG Tuberculosis Control Unit, World Health Organisation, Country Office for India, New Delhi, India Intensified tuberculosis case finding among malnourished children in nutritional rehabilitation centres of Karnataka, IndiaPLoSONE 8(12):e84255.
24. Gangaraj et al. Electrolytes and Blood Sugar Changes in Severely Acute malnourished Children & its association with diarrhoea and vomiting. International Journal of Pharmaceutical Science Invention May 2013;33-36.
25. Praveen Kumar et al Should We Screen Children with Severe Acute Malnutrition for Celiac Disease? Department of Pediatrics, Kalawati Saran Children's Hospital, Lady Hardinge Medical College Indian Pediatr 2012;49:330-331.
26. Berkowitz FE. Infections in children with severe protein- energy malnutrition. Ann Trop Paediatr 1983:3:79-83.
27. Caksen H, Cesur Y, Uner A, Arslan S, Sar S, Celebi V, et al. Urinary tract infection and antibiotic susceptibility in malnourished children. Int Urol Nephrol 2000;32:245- 247.
28. Rabasa Ai, Shattima D. Urinary tract infection in severely malnourished children at the University of Maiduguri Teaching Hospital. J Trop Pediatr 2002;48:359-361.
29. Bagga A, Tripathi P, Jatana V, Hari P, Kapil A, Srivastava RN, et al. Bacteriuria and urinary tract infection in malnourished children. Pediatr Nephrol 2003;18:366-370.
30. Ejaz MS, Latif N. Stunting and micronutrient deficiencies in malnourished children. J Pak Med Assoc. 2010;60:543-7.
31. Tim De Maayer, Haroon Saloojee Clinical outcomes of severe malnutrition in a high tuberculosis and HIV setting. Archives of Disease in Childhood 02/2011;96(6):560-4