



DEMOGRAPHIC STUDY OF SEVERE ACUTE MALNOURISHED CHILDREN AT OUR INSTITUTION

Paediatrics

Dr. Sushil Kumar Bakolia	Department of Paediatric Medicine, Sardar Patel Medical College and Associated Group of Hospital, Bikaner (Rajasthan).
Dr. Renu Agarwal	Department of Paediatric Medicine, Sardar Patel Medical College and Associated Group of Hospital, Bikaner (Rajasthan).
Dr. Gajanand Singh Tanwar	Department of Paediatric Medicine, Sardar Patel Medical College and Associated Group of Hospital, Bikaner (Rajasthan).
Dr. Dinesh Kumar Barolia	Department of Paediatric Surgery, Sir Padampat Mother and Child Health Institute, SMS Medical College, Rajasthan University of Health Sciences, Jaipur, (Rajasthan,) India.
Dr. Kuldeep Singh Bithu*	Department of Paediatric Medicine, Sardar Patel Medical College and Associated Group of Hospital, Bikaner (Rajasthan). *Corresponding Author
Dr. Tara Chand Saini	Department of Paediatric Medicine, Sardar Patel Medical College and Associated Group of Hospital, Bikaner (Rajasthan).

ABSTRACT

Background – Severe acute malnutrition (SAM) among children below five years of age is a major health problem for developing countries. These malnourished children are more prone to various infections. This leads to increase burden of morbidity and mortality. So, this over all affect the capital growth of country. we tried to find out a correlation of malnutrition with exclusive breast feeding, weaning practice, socioeconomic status and infection etc. on the basis of clinical laboratory data. **Method** – This study was conducted in 178 children, at Department of Pediatrics in collaboration with Department of Pathology, Microbiology, Radiology and Pulmonary medicine, at Sardar Patel Medical College and Associated Group of Hospitals, Bikaner (Rajasthan), between 01.01.2013 and 31.12.2013. **Results** – Total 178 children were included in this study. Out of 178, 102 were male and 76 female. Non oedematous malnourished (wasted) were 147 (82.58%) children and while 31 (17.42%) children were diagnosed as having oedematous malnutrition ($p < 0.001$). exclusive breast feed were given to 106 children. Mean weight was 5.37 ± 2.78 kg in our study. Out of 178, 145 (81.46%) children had anaemia with median hemoglobin 8 gm/dl. Delayed milestone were seen in 64 (35.95%) children. SAM is common in overcrowded, lower socioeconomic, joint family with lack of sanitary facility. **Conclusion** - Malnutrition remains a major health problem among under five year children population altering physical and mental health of the nation. The most prone age group for malnutrition was below 2 years of age. Poor socio-economic status, overcrowded and unhygienic living conditions and low education level were the associated causes for malnutrition.

KEYWORDS

malnutrition, malnourished children, severe, severe acute malnutrition,

INTRODUCTION –

The definition of malnutrition given by World Health Organization is "the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions." [1]. Malnutrition is a major public-health problem throughout the developing countries in world. Around 10–11 million children die under 5 years of age each year because of preventable causes. 50% are due to malnourishment, and 1.5 million of these deaths are due to severe acute malnutrition [2]. Malnutrition being a 'Bio-Psycho-Social Disorder' not necessarily lacks of food alone rather epidemiological, biological, psychological disturbances in individuals and family and socio-cultural factors are also causative factor. Malnutrition is usually noted in the stereotypic profile of poverty, ignorance and illiteracy or natural calamities like war or famine but currently causal factors like 'man made perception' of lactation failure, abrupt breast milk withdrawal and early introduction of diluted formulae/ diets are being increasingly identified [3]. Severe Acute Malnutrition (SAM) is defined as weight for height measurement of 70% or more below the median, or 3 SD below the mean of WHO reference values, which is called wasting, the presence of bilateral pitting oedema of nutritional origin, which labeled as oedematous malnutrition or a Mid Upper Arm Circumference (MAUC) of less than 115 mm in children 1/2 year to 5 years of age Worldwide specially in developing world there are about 60 million children are affected with moderate and severe acute malnutrition and among them estimated 17.5% million about 2.4 % of under the age of five year are severely malnourished in 2012 and among these admitted to hospital face 30- 50 % case fatality rate and contributes to one million child deaths yearly [4].

MATERIAL AND METHODS -

This study was conducted in 178 children, at Department of Pediatrics in collaboration with Department of Pathology, Microbiology, Radiology and Pulmonary medicine, at Sardar Patel

Medical College and Associated Group of Hospitals, Bikaner (Rajasthan), between 01.01.2013 and 31.12.2013.

Study Design: This was a prospective observational study.

Study Sample: Children of either gender aged 0 to 60 months, meeting the WHO case definition of severe acute malnutrition (weight for length/height < -3 SD and/or bipedal oedema and/or mid upper arm circumference < 11.5 cm) and admitted in (nutritional rehabilitation centre) malnutrition treatment centre at department of paediatric medicine in P.B.M. Hospital Bikaner (Rajasthan) during 01.01.2013 to 31.12.2013, were recruited for the study.

Inclusion Criteria:

Diagnosis of severe acute malnutrition was based on WHO definition of severe acute malnutrition.

Table-1: Diagnostic Criteria For SAM In Children < 6 Months Of Age

Indicator	Measure	Cut off
W/ H Z-score	Weight for height or length	< -3 SD
Visible severe wasting	Clinical assessment	Wasting over buttocks, thigh, back of shoulders, and buckle fat pad
Bilateral pedal oedema	Clinical assessment	-
Length < 49 cm	Length	Wasting +

Table -2: Diagnostic Criteria For SAM In Children 6-60 Months Age

CRITERIA	Measure	Cut off
W/ H Z-score	Weight and height or length	< -3 SD

Mid upper arm circumference		<115 mm
Visible severe wasting	Clinical sign	Wasting over buttocks, thigh, back of shoulders, and buckle fat pad
Pedal oedema	Clinical sign	Symmetrical

Exclusion Criteria:

Children having other diseases incriminated as cause of severe malnutrition including cerebral palsy, congenital heart diseases, hemolytic anaemia, malignancies, malabsorption syndromes, chromosomal disorder, chronic renal diseases, chronic liver diseases, disseminated tuberculosis were excluded.

Aims And Objectives

1. To describe the detailed clinical and biochemical parameters of children, 0-60 month of age group.
2. To determine background information of the child and mother / caregiver.
3. To determine the anthropometrical status of malnourished children.
4. To determine immediate factors contributing to malnutrition like breast or top feeding and weaning practices, dietary intake and infectious diseases.
5. To determine underlying factors contributing to malnutrition like household factors, socioeconomic status, maternal and child care, nutrition information, healthy environment.

Data Compilation And Analysis -

All collected data were mention over excel work sheet as a master chart. And statistical data analysis was done with help of statistical software, (SPSS version 10.0 software. Then data were tabulated according to aims and objectives. Chi square test was applied for significance. The valid inferences were drawn from the information revealed and the results were thoroughly discussed with other available studies conducted in same field.

RESULTS

Total 178 children were included in this study. Out of 178, 102 were male and 76 female. Non-oedematous malnourished (wasted) were 147 (82.58%) children and while 31 (17.42%) children were diagnosed as having oedematous malnutrition ($p < 0.001$).

In our study most of the children were ≤ 2 years of age (162, 91%, $p < 0.001$) with median age of 12 month (range 1.25–60 month). The most common age group affected with SAM was 6–12 month (63; 35.4%) followed by 12–18 months (52; 29.2%), 0–6 month (32; 17.98%) and 18–24 months (15; 8.4%). Oedematous malnutrition was more commonly seen in the age group of 12–18 (16; 8.99%) while non-oedematous malnutrition was predominantly seen in 6–12 months age group (52; 29.21%).

This study showed that SAM most commonly seen in children which living in Joint families (122, 68.5%), while 31.5% were living in Nuclear families. About 115 (64.6%) children were living in overcrowded household conditions. Non-availability of sanitation facility contributed to 111 (62.4%) children of SAM.

In our study 32 children were included in ≤ 6 month old group. No one had history of exclusive breast feeding, only 18 had non-exclusive breast feeding and 14 had not received breast feed at all. Among SAM children more than 6 month old ($n=146$; 82.02%), breast feeding related causes were attributed to 40 (27.40%) children, while 106 (59.55%) children having exclusive breast feeding had SAM due to other causes like delayed our non weaning and inadequate dietary intake.

The anthropometric parameters of 178 SAM children in our study group at the time of presentation were as following. The mean weight was 5.37 ± 2.78 kg, mean length of children up to 2 years old was 56.10 ± 8.44 cm, and mean height of children more than 2 year old was 83.44 ± 6.88 cm. The mean head circumference was 41.65 ± 3.49 cm, mean chest circumference 38.46 ± 5.04 cm, and mid upper arm circumference 9.89 ± 3.05 cm.

This study showed that hypothermia (30; 16.85%), hair changes (78; 43.82%), skin change (54; 30.31%) were more common in non-oedematous malnutrition while oedema (25; 14.04%), eye changes (13; 7.30%), mouth & oral mucosa changes (11; 6.18%) and altered mental changes (17; 9.55%), NTS (14, 6.8%) were more common in

oedematous malnutrition.

In this study 145 (81.46%) children out of 178 had anaemia with median hemoglobin 8 gm% (range 1.9 – 14.7). Sixteen (9%) children were severely anaemic with hemoglobin < 4 gm / dl, while about 57 (32%) and 72 (40.45%) children had moderate and mild anaemic respectively.

Anaemia was more common in oedematous malnutrition (93.55%, $p < 0.05$) with more severity ($p < 0.01$, median hemoglobin 5.7 gm%, range 2.59 – 12.4).

This study shows that 82 (46.06%) children had gastrointestinal manifestation (diarrhoea, vomiting, abdomen distension), 73 (41.01%) children had respiratory manifestations (pneumonia), 26 (14.61%) had neurological manifestations (altered mental status, irritability, apathy, lethargy, NTS), 9 (5.05%) had renal manifestation (oliguria, UTI) and 14 (7.86%) had infections (Tuberculosis 3.93%; malaria 2.25%; measles 1.68%). None of the study group was found sero-positive for HIV.

In our study 74 (41.56% $n=178$ children,) have good weight gain during their stay at the hospital, while 60 (33.41%) and 35 (19.66%) children have got average and poor weight gain respectively. Out of 178, 9 (5.06%) had not shown weight gain at all mean hospital stay of study group was 10 days.

Table -3: Distribution Of Study Population According To Age Group

Age group (In months)	Total		Non oedematous		Oedematous	
	No.	%	No.	%	No	%
0-<6	32	17.98	32	21.77	0	-
6-12	63	35.4	52	29.21	11	6.18
12-18	52	29.2	36	20.22	16	8.99
18-24	15	8.4	14	8.43	1	0.6
24-30	3	1.7	2	1.12	1	0.6
30-36	2	1.1	2	1.12	0	-
36-42	2	1.1	2	1.12	0	-
42-48	7	3.9	5	2.81	2	1.12
48-54	0	-	0	-	0	-
54-60	2	1.1	2	1.12	0	-
Total	178	100	147	82.58	31	17.42
²	239.51		199.20		40.327	
p value	<0.001		<0.001		<0.001	
Median	12 month					
Range	1.25-60 month					

Table - 4: Distribution Of Study Population According To Socio-cultural Variables

Parameters		No.	%	χ^2	P
Family Type	Joint	122	68.5	48.94	<0.001
	Nuclear	56	31.5		
Over-crowding	Yes	115	64.6	30.382	<0.001
	No	63	35.4		
Sanitation facility	Yes	67	37.6	21.753	<0.001
	No	111	62.4		

Table – 5: Distribution Of Study Population According To Breast Feeding Status During First 6 Month Of Life

	Children 0- 6month old, (n=32)		Children 6 or more month old, (n=146)	
	No.	%	No.	%
Not given at all	14	43.75	10	6.85
Non-exclusive breast feed	18	56.25	30	20.55
Exclusive breast feed	0	-	106	72.60
Total	32	17.98	146	82.02

Table – 6: Anthropometry Parameters Of Study Group At The Time Of Admission

Parameters	Mean	SD
Weight (kg.)	5.37	± 2.78
Length (cm) 24 month, (n=162)	56.10	± 8.44
Height (cm) > 24 month, (n=16)	83.44	± 6.88
Head circumference (cm)	41.65	± 3.49
Chest circumference (cm)	38.46	± 5.04
Mid-upper circumference (cm)	9.89	± 3.05

Table – 7: Distribution Of Cases According To Signs Of Malnutrition In Relation To Nutritional Diagnosis

Signs of malnutrition	Nutritional Diagnosis				Total, n=178		χ^2	P
	Non Oedematous		Oedematous					
	No.	%	No.	%	No.	%		
Hypothermia	30	16.85	7	3.93	37	20.79	15.957	<0.001
Oedema	1	0.6	25	14.04	26	14.61	23.899	<0.001
Hair Changes	78	43.82	22	12.36	100	56.18	43.610	<0.001
Skin Changes	54	30.31	24	13.48	78	43.83	14.776	<0.001
Eye Changes	12	6.74	13	7.30	25	14.04	0.043	>0.05
Mouth & Oral Mucosa	9	5.06	11	6.18	20	11.24	0.212	>0.05
Mental Changes	13	7.30	17	9.55	30	16.85	0.582	>0.05
NTS	5	2.80	9	5.06	14	7.86	1.189	>0.05

Table – 8: Distribution Of Anaemia Among Study Group According To Hemoglobin Level With Relation To Nutritional Diagnosis

Hemoglobin Level	No.	%	Non Oedematous		Oedematous		χ^2	p
			No.	%	No.	%		
Severe (<4mg/dl)	16	8.99	9	6.12	7	22.58	8.477	<0.01
Moderate (4-7gm/dl)	57	32.02	44	29.93	13	41.93	1.695	>0.05
Mild (7.1-10gm/dl)	72	40.45	63	42.86	9	29.03	2.031	>0.05
Total	145	81.46	116	78.91	29	93.55	3.631	<0.05
Mean	8		8.48		5.70			
Range	1.90-14.7		1.90-14.7		2.50-12.40			

Table – 9: Distribution Of Co- Morbidities Associated With SAM Children

Disease	No.	%
GIT manifestation	82	46.06
Respiratory manifestation	73	41.01
CNS manifestation	26	14.61
Renal involvement	9	5.06
Infectious disease	14	7.86
- Tuberculosis	7	3.93
- Malaria	4 (PV)	2.25
-Measles	3	1.68
-HIV	00	0

DISCUSSION–

There are various useful method of assessing and defining malnutrition. In 1956, Gomez introduced a classification based on weight below a specified percentage of median weight for age [5]. Seoane and Latham then proposed calculating weight for height and height for age as a means to distinguish between wasting and stunting [6]. In 1977, Waterlow recommended the use of z-scores and SDs below the median to define underweight, wasting, and stunting [7,8]. These definitions continue to be used widely with subsequent WHO modifications. WHO adopted the United State National Centre for Health Statistics (NCHS) classification in 1983 as the international reference for weight and height of children. It has been used to classify children as underweight, wasted, or stunted based on z-scores [9,10,11]. The major issues with using NCHS criteria as the population standard are the extrapolation from an ethnically homogenous population, which likely does not represent developing world countries, inclusion of bottle-fed infants, and the assumption that all children of a given height will have the same average weight regardless of age. In 2006, a new population standard was adopted by WHO based on an international multicenter study using exclusively breast-fed children of diverse ethnic backgrounds [12]. Subsequent studies have highlighted that these new WHO growth reference curves will result in a higher measured prevalence of malnutrition when compared with NCHS standards [13,14].

In this study majority of children were ≤ 2 years of age (91%). Similar

study done by Suman RL et al. They enrolled 50 children of SAM and majority of the patients were in the age group of 6 - < 24 months (82.0%), these are compatible to our data. Early Nutrition deprivation can leads to SAM [15]. Arya AK et al. reported that maximum number of SAM children were 6-24 month age group, which is similar to our study [16].

Male female ratio of SAM in this study is 1.34:1 (102, 57.3% male and 76, 42.6% female). SAM is common in male. In other similar study done by Kumar P et al. reported SAM common in male than female (59% were males and 41% were females). [17].

Our study shows that non-oedematous SAM is common than oedematous. Non-oedematous SAM found in 147 children (82.58%) and oedematous found in 31 children (17.42%). Similar compatible data was present in other previously reported study [17,18,19]. We found that SAM is common in overcrowded, lower socioeconomic, joint family with lack of sanitary facility in our study.

Ubesie AC et al. reported that Diarrhea and malaria were the most common associated co-morbidities in SAM 72.7% and 43.9% of the children respectively in their study [20]. In our study gastrointestinal tract manifestation like diarrhoea is the most common (46.06%) associated co-morbidities in SAM children. Respiratory manifestation (41.01) is the next common associated co-morbidities. Similar common associated co-morbidities like gastrointestinal tract manifestation first and respiratory manifestation was second in study done by Syed Tariq A et al. [21].

Exclusive breast feeding provides the ideal food for the infant. Breast milk contains the proper mixture of protein, carbohydrate, fat, vitamin and minerals that provide ideal nutrition for the baby. It is the ideal complete healthy diet for the first six months of life of baby [22]. In our study exclusive breast feeding was given not even in single case. This leads to malnourishment of baby. Proper weaning with time is important factor nourishment of baby. Majority (62.30%) of mother keep continue breast-feeding as long as the mother is lactating. This is associated with random weaning of breast feeding [23]. Similarly occurs in our study. Weaning was occurred improper random pattern that leads to SAM in children.

We observed that age of parents, parental education, breast feeding behavior, socio-economic status, earning resources, family pattern (joint, nuclear) are the factors responsible for SAM in society. Similar observation was found in previously done study [24].

CONCLUSION -

Malnutrition is a major health problem among less than five year children population that altering physical and mental health of the nation. The most prone age group for malnutrition was below 2 years of age in our study (North West Rajasthan). The major socio-cultural determinant associated with malnutrition were lack of knowledge and awareness in caregivers regarding appropriate feeding practices in form of exclusive breast feeding (below 6 months age) with timely and proper weaning pattern (above 6 months), child nutrition and appropriate age immunization. Poor socio-economic status, overcrowded and unhygienic living conditions and low education level were also associated with malnutrition in our study children.

In light of our study, the government health policies should emphasize on health of children below 2 years age through motivating the caregivers for exclusive breast feeding, with timely and proper weaning practices especially in rural areas and improving the knowledge and awareness regarding child health and nutrition.

REFERENCES–

- De Onis M, Monteiro C, Clugston G. The worldwide magnitude of protein energy malnutrition: an overview from the WHO global database on child growth. Bull World Health Organ 1993; 71(6):703–12.
- Heikens GT, Bunn J, Amadi B, Manary M, Chhagan M, Berkley JA et al. Case management of HIV-infected severely malnourished children: challenges in the area of highest prevalence. The Lancet. 2008; 371 (9620):1305–1307.
- Elizabeth KE. Changing profile of under nutrition and edematous severe acute malnutrition (ESAM). Indian Pediatr. 2012 Oct; 49 (10):843. doi: 10.1007/s13312-012-0176-4.
- United Nations Children's Fund, World Health Organization, The World Bank. UNICEF-WHO-The World Bank: 2012 Joint Child Malnutrition Estimates - Levels and Trends. UNICEF, New York; WHO, Geneva; The World Bank, Washington, DC; 2013.
- Gomez F, Chavez R., Frenk S., Galvan R.R., Munoz J.C., Vazquez J. Mortality in second and third degree malnutrition. J. Trop. Pediatr. 1956; 2:77–83.
- Seoane N, Latham MC. Nutritional anthropometry in the identification of malnutrition in childhood. J Trop Pediatr Environ Child Health. 1971 Sep; 17(3):98–104.

7. Waterlow JC. Classification and definition of protein-calorie malnutrition. *Br Med J*. 1972 Sep 2; 3(5826):566-9.
8. Waterlow JC, Buzina R, Keller W, Lane JM, Nichaman MZ, Tanner JM. The presentation and use of height and weight data for comparing the nutritional status of groups of children under the age of 10 years. *Bull World Health Organ*. 1977; 55(4):489-98.
9. Lavoipierre GJ, Keller W, Dixon H, Dustin J-P, ten Dam G, eds. Measuring change in nutritional status: guidelines for assessing the nutritional impact of supplementary feeding programmes for vulnerable groups. Geneva, Switzerland: World Health Organization, 1983:86-97.
10. World Health Organization. Physical status: the use and interpretation of anthropometry. Report of a WHO expert committee. Technical Report Series No. 854. Geneva: WHO, 1995.
11. WHO Multicentre Growth Reference Study Group. WHO Child Growth Standards based on length/height, weight and age. *Acta Paediatr Suppl*. 2006 Apr; 450:76-85.
12. Seal A, Kerac M. Operational implications of using 2006 World Health Organization growth standards in nutrition programmes: secondary data analysis. *BMJ*. 2007; 334(7596):733.
13. Prost MA, Jahn A, Floyd S, Mvula H, Mwaiyeghele E, Mwinuka V, Mhango T, Crampin AC, McGrath N, Fine PE, Glynn JR. Implication of new WHO growth standards on identification of risk factors and estimated prevalence of malnutrition in rural Malawian infants. *PLoS One*. 2008 Jul 16; 3(7):e2684.
14. Kanawati AA, McLaren DS. Assessment of marginal malnutrition. *Nature*. 1970 Nov 7; 228(5271):573-5. doi: 10.1038/228573b0. PMID: 5472484.
15. Suman RL, Sharma BL, Meena P, Kumar N. Clinico-laboratory profile and outcome of edematous severe acute malnutrition in children aged 6 months to 5 years. *Int J Contemp Pediatr* 2016; 3:954-9.
16. Arya AK, Lal P, Kumar P. Co-morbidities in children with severe acute malnutrition – A tertiary care centre experience. *IJCMR*. 2017; 4: 1086-88.
17. Kumar P, Singh A, Nidhi. Outcome and comorbidities associated with severe acute malnutrition: admitted at Nutrition Rehabilitation Centre (NRC) of a tertiary care centre. *J. Evid. Based Med. Healthc*. 2018; 5 (14), 1258-1261.
18. Kumar R, Singh J, Joshi K, et al. Co-morbidities in hospitalized children with severe acute malnutrition. *Indian Pediatr* 2014; 51(2):125-127.
19. Gupta RK, Nagori GL, Nagori P, et al. Pattern of Comorbidities in children with severe acute malnutrition admitted in MTC of a teaching hospital of South East Rajasthan. *J Pharm Biomed Sci* 2015; 5(5):403-407.
20. Ubesie AC, Ibeziako NS, Ndiokwelu CI, Uzoka CM, Nwafor CA. Under five protein energy malnutrition admitted at the University of in Nigeria Teaching Hospital, Enugu: a 10 year retrospective review. *Nutrition Journal* 2012; 11:43.
21. Syed Tariq A, Naik SA, Wasim Rafiq A, Saleem R. Demographic, clinical profile of severe acute malnutrition and our experience of nutrition rehabilitation centre at children hospital Srinagar Kashmir. *Int J Contemp Pediatr* 2015; 2: 233-7.
22. Jelliffe, D. B. And Jelliffe, E. F. P. (1977). 'Breast is best: modern meanings. *N. Engl. J. Med.*, 297, 912.
23. Saunkaria ML, Barolia DK, Rachhoya P, Chahar CK, Sengar GS. A hospital based study of knowledge and attitude of expectant fathers regarding breast-feeding. *IOSR Journal of Dental and Medical Sciences* 2017; 16 (9): 38-47.
24. Bhadoria AS, Kapil U, Bansal R, Pandey RM, Pant B, Mohan A. Prevalence of severe acute malnutrition and associated sociodemographic factors among children aged 6 months–5 years in rural population of Northern India: A population-based survey. *J Family Med Prim Care* 2017; 6: 380-5.