

Original Research Article

Epidemiological characteristics, clinical profile and nutritional status of hospitalized under five children

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ABSTRACT

Background: Malnutrition accounts for 68.2% of the total under-5 deaths in India, and is an important underlying risk factor for morbidity in all ages, responsible for 17.3% of the total disability-adjusted life years. Objective was to find out prevalence of moderate to severe acute malnutrition in hospitalized under 5 children and to find out socio-epidemiological characteristics and disease profile in the same group.

Methods: This observational study was conducted in a tertiary care teaching hospital on hospitalized children aged 6 months to 5 years. After obtaining informed consent and detail history including epidemiological profile, complete physical examination and anthropometry were recorded. WHO criteria were used for nutritional assessment. Disease profile of the patients was recorded.

Results: A total of 230 children were enrolled. Male: Female ratio was 1.64:1; total 153 (66.5%) children were malnourished. The prevalence of MAM and SAM was 28.7% and 20% respectively. Most common diseases were acute gastroenteritis and pneumonia. More than 80% children exhibited anemia. Low birth weight, higher birth order, incomplete immunization, lower socioeconomic status, lower maternal literacy and faulty feeding practices were significantly associated with malnutrition.

Conclusions: About 2/3rd admitted children were malnourished and 20% were suffering from SAM. Acute gastroenteritis and pneumonia were most common diseases. There was strong need to educate the family specially mother about nutritional needs of the child. Parents must be counselled about the importance of birth spacing, family planning, immunization and exclusive breastfeeding till 6 months of age.

Keywords: Breastfeeding, Birth spacing feeding practices, Severe acute malnutrition, Socio-economic status

INTRODUCTION

Malnutrition accounts for 68.2% of the total under-5 deaths in India, and is the leading risk factor for health loss for all ages, responsible for 17.3% of the total disability-adjusted life years.¹ Under 5 age group is characterized by dynamic changes in physical and mental development. Around 40% of physical growth and nearly 80% of mental development completes by the age of five.² The National Family Health Survey-4 reveals that under 5 mortality rate in India is 50

per 1000 live births, 21% under 5 children are moderately malnourished and 7.5% are severely malnourished. In the same group, 38% are stunted, 36% are underweight and 58% are anemic.³ Malnutrition, particularly under-nutrition, is one of the most common risk factors for susceptibility to infectious diseases. Maternal education, socioeconomic status, family size, faulty feeding practices are important determinants of malnutrition.⁴ Though problem of malnutrition and associated risk factors has been assessed in different community studies, however limited studies have been done in hospitalized children.

Usha et al have reported that 19.8% children aged 6 months to 5 years admitted in the hospital were suffering from severe acute malnutrition and that maternal education was significantly related to malnutrition status of the children.⁵ Hence, present study was planned with the primary objective to find out prevalence of moderate to severe acute malnutrition in indoor children aged 6 months to 5 years. The secondary objective/s was to find out socio-economic characteristics of the parents and disease profile of admitted children.

METHODS

This observational study was conducted in a tertiary care teaching hospital from February 2019 to October 2019 on 6 months to 5 years old children admitted in pediatric ward. Before enrolling the patient, Institutional Ethical Committee approval was taken. Informed consent was obtained from the parents. The epidemiological data was recorded in a proforma.

Sample size was based on a study by Nandini et al.⁶ The prevalence of underweight, stunting and wasting was 34.3%, 41.5% and 18.9% respectively. The sample size was calculated by the formula $N = Z\alpha^2 pq/L^2$. Where 'p' was the average (%) of underweight, stunting and wasting, 'q' was 100-p, 'α' was type I error (5%), 'L' was allowable error which was 20% of 'p' for detecting results with 80% power of study. Considering data loss of 10% it was revealed that recruitment of 230 children in the study would achieve the desired objectives.

All children of both sexes, aged 6 months to 5 years, admitted in the pediatric ward of the teaching hospital and parents willing to participate in the study, were included. However, children requiring care in pediatric intensive care unit, genetic diseases like thalassemia etc were excluded.

Detail history was taken and vital signs of the patient were recorded. General and systemic examination was also done including all body measurements. Weight, Length/Height, Head circumference and mid upper arm circumference were taken using standard methods.⁷ Dietary history was

taken using 24 hours dietary recall method. Socio-economic status was assessed using modified Kuppaswamy scale.⁸ Complete blood count, general blood picture, serum sodium, serum potassium, serum calcium, and serum magnesium was estimated. Other relevant investigations were done as per the need for making diagnosis and treatment.

Demographic questions were asked from the parents according to the predesigned working proforma. Information was obtained on birth weight, birth order, age interval between immediate sibling, past morbidities, immunization status etc. History of feeding practices, parent's education, distance of government hospital and information given by health care worker was also enquired.

Moderate acute malnutrition (MAM)-Identified by moderate wasting (weight for height <-2z score and ≥-3z-score or MUAC <125 mm and ≥115 mm).⁹

Severe acute malnutrition (SAM)- Identified by anyone of the criteria- Weight for height <-3 z-score, MUAC <115 mm or presence of bilateral pitting edema.⁹ Weight for height/length, weight for age, length/height for age, Head circumference for age were assessed according to WHO growth charts.¹⁰ Clinical signs of vitamin A and D deficiency were recorded; if present.^{11,12}

Statistical analysis

The data was analyzed using statistical package for social sciences, version 21.0. Data has been represented as number and percentages and mean±SD. Chi-square test and ANOVA were used. A 'p' value less than 0.05 indicated a statistically significant association.

RESULTS

Among 230 children majority of cases (n=114) were aged 13 months to 36 months. Sex ratio (M: F) was 1.64:1. In almost all cases mother was the primary caretaker. Majority of the cases belonged to upper lower or lower middle socioeconomic strata (Table 1).

Table 1: General profile of the children enrolled in the study (n=230).

Variable	Category	N (%)
Age (months)	6-12	67 (29.1)
	13-36	114 (49.6)
	37-60	49 (21.3)
Sex	Male	143 (62.2)
	Female	87 (37.8)
Area	Rural	114 (49.6)
	Urban	116 (50.4)
Birth weight	Normal	125 (54.3)
	LBW	74 (32.2)
	VLBW	4 (1.7)
	ELBW	1 (0.4)
	Not known	25 (11.3)

Continued.

Variable	Category	N (%)
Birth order	First	83 (36.1)
	Second	50 (21.7)
	Third	30 (13)
	Fourth or above	67 (29.2)
Age interval between immediate sibling	<2 years	62 (27)
	≥2 years	99 (43)
	Only child	69 (30)
Primary caretaker	Grandmother	3 (1.3)
	Mother	227 (98.7)
Institutional delivery	-	209 (90.9)
Consanguinity among parents	-	24 (10.4)
Type of family	Joint	81 (35.2)
	Nuclear	149 (64.8)
Socioeconomic status	Lower	1 (0.4)
	Upper lower	112 (48.7)
	Lower middle	82 (35.7)
	Upper middle	35 (15.2)
	Upper	0
Sanitation facility present	-	187 (81.3)

Table 2: Nutritional status of admitted patients (n=230) (WHO criteria).

Variable	Category	N (%)
Nutritional status	Normal	77 (33.4)
	Mild malnutrition	41 (17.8)
	Moderate acute malnutrition	66 (28.7)
	Severe acute malnutrition	46 (20)
Weight/ height for age	Normal	135 (58.7)
	Moderate wasting	45 (19.6)
	Severe wasting	46 (20)
	Overweight	2 (0.9)
	Obesity	2 (0.9)
Weight for age	Normal	104 (45.2)
	Moderate Underweight	58 (25.2)
	Severe Underweight	68 (29.6)
Height/ length for age	Normal	128 (55.6)
	Moderate stunting	44 (19.1)
	Severe stunting	58 (25.2)
Head circumference for age	Normal	209 (90.9)
	Microcephaly	21 (9.1)
Mid upper arm circumference	<11.5 cm severe malnutrition	27(11.7)
	11.5-12.5 – moderate malnutrition	39 (17)
	>12.5 cm – normal	164(71.3)

History of ear discharge and worm infestation was revealed in 10% and 1.3% cases respectively. Signs of vitamin A and D deficiency were seen in 3.5% and 4.3% cases respectively. A total of 85 (36.9%) cases had

incomplete immunization and 6 (2.6%) children were not immunized at all.

We used WHO criteria for nutritional assessment. Out of 230 enrolled children, 66 (28.7%) had MAM and 46 (20%) were suffering from SAM (Table 2).

Educational status of parents is shown in Table 3. In our study almost all mothers have received breastfeeding and nutritional advice from the elders in the family or health workers. Half of the families (50.9%) had Govt. hospital within 2 km from their place of living, however 53 (23%) families reported distance between government health facility and their residence to be >10 km. Information given by health care worker included immunization, hygiene, diet and family planning. Information regarding National Health Programs was provided to only 10 mothers.

Table 3: Parental characteristics of admitted children (n=230).

Variable	N (%)
Mother's education	
Illiterate	48 (20.9)
Primary	50 (21.7)
Middle	42 (18.3)
High School/Intermediate	55 (23.9)
Graduate and above	35 (15.2)
Father's education	
Illiterate	38 (16.5)
Primary	39 (17)
Middle	48 (20.9)
High School/Intermediate	62 (27)
Graduate and above	43 (18.7)

Table 4: Feeding history of admitted children (n=230).

Variable	Category	N (%)
Initiation of breastfeeding within 1 hour of birth		99 (43.2)
Exclusive breastfeeding till 6 months		125 (54.6)
H/o mixed feeding till 6 months of age		106 (46.1)
Type of Mixed feeding	Animal	55 (23.9)
	Formula	42 (22.6)
Initiation of complementary feeding	Early	4 (1.7)
	Delayed	101 (43.9)
	No delay	125 (54.3)

In less than half of the cases breastfeeding was initiated within 1 hour of birth. Exclusive breastfeeding till 6m was done by 54.3% (n=125) mothers only (Table 4).

The diseases were clustered in systems involved (Table 5) children having more than one morbidity. Some children had multiple morbidities. Most common disease was acute gastroenteritis followed by pneumonia. In gastrointestinal system, few children (not shown in the table) suffered from liver abscess (n=2), pseudo pancreatic cyst (n=2), infantile cholestasis (n=2), dysentery (n=2), cow milk protein allergy (n=1) and EHPVO with grade III esophageal varices (n=1). Similarly, in respiratory system, other diseases included, WALRI (n=4), pneumothorax (n=2), recurrent wheezer (n=3) and hydropneumothorax (n=1). In CNS, other diseases were, infantile spasm (n=2), partially treated pyogenic meningitis (n=2), TBM (n=2), hydrocephalus (n=2), viral meningitis (n=1), NCC (n=1), pyogenic meningitis (n=1) and myoclonic seizures (n=1). There were 7 cases of ALL and 1 case of Hodgkin lymphoma.

Other conditions encountered were ITP (n=1), Down syndrome (n=2), Hirschsprung disease (n=1), congenital hypertrophic pyloric stenosis (n=1), congenital rubella syndrome (n=1) and congenital ichthyosis (n=1). Skin conditions were scabies (n=2), erythema multiforme (n=1) and varicella (n=1). Kerosene and phenytoin poisoning was seen in one case each. Miscellaneous conditions were bacterial suppurative lymphadenitis (n=1), PUO (n=1), staphylococcus pyomyositis (n=1), cellulitis (n=1), CSOM (n=1), chronic tonsillitis (n=1), hydrocele (n=1) and obesity (n=1).

Fluids culture was done in 88 children and in 23 cases it was reported positive (Figure 1).

There was no association between nutritional status and age, sex, rural/urban domicile and type of family. However, low birth weight, higher birth order, less birth spacing, incomplete/unimmunized status were significantly associated with malnutrition (Table 6).

Delayed initiation of breastfeeding, not exclusive breastfeeding up to 6 months of age and delayed

complementary feeding were significantly associated with MAM and SAM (Table 7).

Table 5: Morbidity profile of the admitted children (n=230).

Disease	N	%
Anemia	186	
Mild	42	18.3
Moderate	104	45.2
Severe	40	17.4
Gastro-intestinal system		
Acute gastroenteritis*	68	29.5
Chronic diarrhea	4	1.7
Chronic constipation	3	1.3
Subacute intestinal obstruction*	3	1.3
Persistent diarrhea	2	0.8
Chronic liver disease	2	0.8
Others	13	5.6
Respiratory system		
Pneumonia*	29	12.6
Pulmonary tuberculosis	6	2.6
Empyema thoracis*	4	1.7
Pleural effusion*	4	1.7
Others	11	4.7
Cardiovascular system		
Congenital heart disease*	4	1.7
Hypertension*	2	0.8
Transient pulmonary arterial hypertension*	1	0.4
Renal system		
Urinary tract infection (UTI)*	11	4.7
Nephrotic syndrome*	6	2.6
Hydronephrosis*	3	1.3
Central nervous system		
Cerebral palsy*	16	6.9
Febrile seizures*	9	3.9
Seizure disorder*	7	3
Breath holding spells	2	0.8
Others	13	5.6
Malignancy	8	3.4
Bleeding disorder	1	0.4
Congenital conditions	10	4.3
Skin	6	2.6
Poisoning	2	0.8
Other infectious diseases		
Malaria*	10	4.3
Enteric fever*	5	2.1
Tubercular lymphadenitis	3	1.3
Miscellaneous	13	5.6

Proportion of mothers educated up to primary standards was significantly higher in SAM group ($p<0.001$). No significant association of father's education was observed with child's nutritional status. Proportion of lower and upper lower socioeconomic class was significantly higher in MAM and SAM groups (Table 8).

Table 6: Association of nutritional status of children with general profile.

Variable	Category	Normal (n=118)	MAM (n=66)	SAM (n=46)	Statistical significance	
		N (%)	N (%)	N (%)	χ^2	P
Birth weight	Normal	89 (75.4)	30 (45.5)	6 (13)	65.044	<0.001
	LBW	15 (12.7)	28 (42.4)	31 (67.4)		
	VLBW	2 (1.7)	0	2 (4.3)		
	ELBW	0	1 (1.5)	0		
	Not known	12 (10.2)	7 (10.6)	7 (15.2)		
Birth order	First	54 (45.8)	24 (36.4)	5 (10.9)	47.5	<0.001
	Second	33 (28)	11 (16.7)	6 (13)		
	Third	17 (14.4)	7 (10)	6 (13)		
	Fourth or above	14 (11.9)	24 (36.4)	29 (63)		
Age-interval between immediate sibling	<2 years	5 (4.2)	24 (36.4)	33 (71.7)	86.64	<0.001
	≥2 years	73 (61.9)	18 (27.3)	8 (17.4)		
	only child	40 (33.9)	24 (36.4)	5 (10.9)		
	Complete	103 (87.3)	30 (45.5)	6 (13)		
Immunization status	Incomplete	12 (10.2)	34 (51.5)	39 (84.8)	88.87	<0.001
	Unimmunized	3 (2.5)	2 (3)	1 (2.2)		
Type of family	Joint	36 (30.5)	24 (36.4)	21 (45.7)	3.38	0.184
	Nuclear	82 (69.5)	42 (63.6)	25 (54.3)		

Table 7: Association of nutritional status of children with feeding history.

Variable	Normal (n=118)	MAM (n=66)	SAM (n=46)	Statistical significance	
	N (%)	N (%)	N (%)	χ^2	P
Initiation of breastfeeding within 1 hour of birth	64 (54.2)	23 (34.8)	13 (28.3)	11.1	0.004
Exclusive breastfeeding till 6 months	100 (84.7)	23 (34.8)	2 (4.3)	100	<0.001
Initiation of complementary feed					
Early	0	1 (1.5)	3 (6.5)	66.311	<0.001
Delayed	25 (21.2)	41 (62.1)	35 (76.1)		
No delay	93 (78.8)	24 (36.4)	8 (17.4)		

Table 8: Association of parental characteristics with nutritional status.

Variable	Normal (n=118)	MAM (n=66)	SAM (n=46)	Statistical significance	
	N (%)	N (%)	N (%)	χ^2	P
Mother's education					
Illiterate	10 (8.5)	17 (25.8)	21 (45.7)	101.78	<0.001
Primary	7 (5.9)	22 (33.3)	21 (45.7)		
Middle	39 (33.1)	2 (3)	1 (2.2)		
High School/ Intermediate	37 (31.4)	18 (27.3)	0		
Graduate and above	25 (21.2)	7 (10.6)	3 (6.5)		
Father's education					
Illiterate	14 (11.9)	14 (21.2)	10 (21.7)	14.49	0.07
Primary	15 (12.7)	11 (16.7)	13 (28.3)		
Middle	25 (21.2)	12 (18.2)	11 (23.9)		
High school/intermediate	38 (32.2)	16 (24.2)	8 (17.4)		
Graduate and above	26 (22)	13 (19.7)	4 (8.7)		
Socioeconomic status					
Lower	0	0	1	75.263	<0.001
Upper lower	29 (24.6)	43 (65.2)	40 (87)		
Lower middle	68 (57.6)	10 (15.2)	4 (8.7)		
Upper middle	21 (17.8)	13 (19.7)	1 (2.2)		

Among children in whom serum electrolytes could be assessed, no significant association of sodium, potassium and magnesium levels could be seen with nutritional status, however, serum calcium levels showed a significant decreasing trend from normal to SAM group.

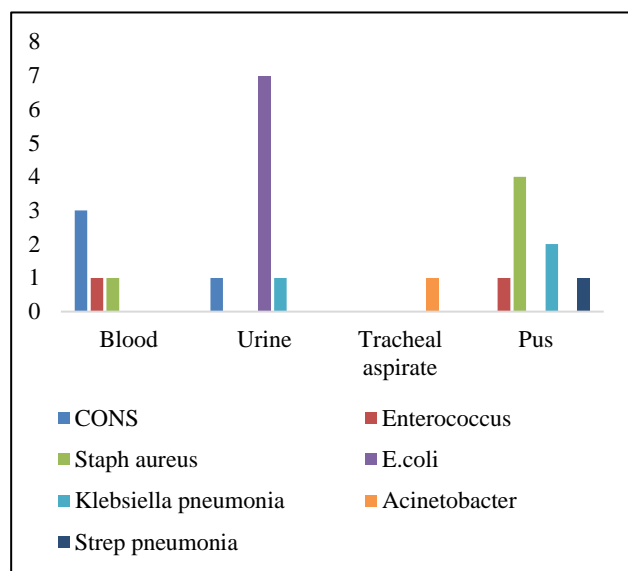


Figure 1: Fluid cultures.

DISCUSSION

Our study on 230 indoor children aged 6 months to 5 years revealed malnutrition in more than half of them (66.5%). MAM and SAM were present in 28.7% and 20% cases respectively. Stunting was seen in 44.3% cases and 54.8% cases were underweight. Acute gastroenteritis, pneumonia, anemia alone or in combination with other illnesses were most common cause for admission in the children ward. Low birth weight, higher birth order, large family size, incomplete immunization status, lower socio-economic status, faulty feeding practices and lower maternal education were significantly associated with malnutrition.

Prevalence of malnutrition in different studies on admitted children have shown a considerable variability. Joosten et al and Mohammadinia et al reported the prevalence of malnutrition among hospitalized children to be only 19% and 11% respectively while Santafé et al reported it as 27% using underweight criteria.¹³⁻¹⁵ In countries with less per capita income, malnutrition rates are higher as observed by Marginean et al and Kapçı et al, who reported the prevalence of malnutrition to be 37% and 52.7% respectively.^{16,17}

The rate of significant degree of malnutrition in the present study was in consonance with other Indian studies that reported almost half or more of the patients as malnourished. In present study 66.5% children were malnourished and 20% of them had severe acute malnutrition. Chakraborty et al and Yellanthoor and Shah

reported severe malnutrition in more than 50% of under five-year children.^{18,19}

The prevalence of malnutrition in different studies also depended on the criteria used for defining the normal nutritional status. In present study, we used WHO proposed criteria for determining moderate and severe malnutrition. Santafé et al reported underweight, stunting, wasting and overweight/obesity in 27%, 22.4%, 16.6% and 6.3% children respectively.¹⁵ Tadesse and Mekonnen reported 22.1% prevalence of stunting among 6-59m children.²⁰ Kittisakmontri and Sukhosa showed prevalence of stunting and wasting in 24.8% and 10.5% children respectively.²¹ Chhetri et al reported prevalence of stunting, wasting and underweight as 10.1%, 20.8% and 17% respectively.²² Thus, showing that there could be differences in malnutrition prevalence using different criteria.

In our study, most common disease was acute gastroenteritis followed by pneumonia. Similar to present study, Choudhary et al reported gastrointestinal disease as most common disease condition followed by respiratory tract infection.⁴ In other studies from India, respiratory tract infection was most dominant disease among hospitalized children.²³⁻²⁵ The disease profile of children in present study was similar to that reported by Gandhi et al, who in their study among 600 under-five children reported diarrhea (7.2%), measles (9.5%) and ARI (13.7%) as the major diagnoses while a total of 418 (69.6%) were clustered under the heading others.²⁶ We also encountered two or more disease entities together in many cases.

Micro-nutrient deficiency is common in the presence of malnutrition. Iron, zinc and fat-soluble vitamins like vitamin A and vitamin D are generally deficient.^{27,28} We found anemia in 80.9% children; comprising of 40 severely anemic children. Malnutrition in association with anemia in large number of hospitalized under-five children has been reported by many workers.^{29,30} Generally vitamin D deficiency rickets doesn't manifest in malnourished children as it is a disease of growing bone and in chronic malnutrition bone growth is stopped with stunting. When nutritional rehabilitation is done then rickets may manifests. No doubt only 4.3% children had rickets in our study.

Socio-economic position of the family is a strong determinant of health and nutrition. We found in majority of cases parents belonged to upper lower or lower middle socio-economic class and were illiterate or semilliterate. Similarly Chakraborty et al reported almost similar findings in their study.¹⁸ Poor socioeconomic status, large family, illiteracy and low education have been reported to be the dominant features in others studies too.^{18,19,27,30}

Similar to our study, Priyanka et al reported low birth weight and incomplete/unimmunized status significantly associated with malnutrition.³¹ Purohit et al reported type

of family, education of mother, birth weight and birth order to be significantly associated with undernutrition.³² Usha Devi et al in their study found mother's education to be an independent predictor of malnutrition among hospitalized children.⁵ Chakraborty et al reported association of incomplete immunization and lower maternal education with underweight and Tadesse and Mekonnen found association of late initiation of breastfeeding and repeated episodes of respiratory infections with stunting.^{18,20} So there should be focus of the policy makers on educating a girl child.

There was a significant association between feeding malpractices and malnutrition in present study. Various community and hospital-based studies too have shown a significant association between them in under five children.⁵ There is a strong need to educate family, especially the mothers about nutritional needs of the child and also how a nutritive diet can be prepared at home with available food items at low cost. Healthcare workers must counsel the parents about the importance of birth spacing, family planning, immunization, exclusive breastfeeding till 6m of age and time of weaning.

We have observed decreasing trend in mean calcium concentration from normal to SAM category of patients. Poor feeding practices and lower socioeconomic status in MAM and SAM children could be linked to lower calcium concentration as compared with normal children. It must be remembered that for young children breastfeeding and animal milk are the only sources of calcium.³⁵

Limitation

It is known that biochemical changes and micronutrient deficiency are prevalent in malnourished children. However we could not estimate micronutrients in the serum in these malnourished children.

CONCLUSION

The study revealed that almost half of the admitted children between 6m to 5 years were suffering from moderate acute malnutrition (28.7%) and severe acute malnutrition (20%). Most common disease was acute gastroenteritis followed by pneumonia. Malnutrition was associated with low birth weight, higher birth order, less birth spacing, large family size, incomplete immunization, lower socioeconomic status and lower maternal education. Besides these, faulty feeding practices since birth were also associated with malnutrition.

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