Original Research Article

Identification of the determinants of severe acute malnutrition among children: A hospital based cross-sectional study

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Abstract

Introduction: Survivors of acute malnourished children are at increased risk of developing stunting and various diseases, disorders, poor educational performance, and low productive life so the aim of this study was to Identification of the determinants of severe acute malnutrition among children.**Materials and Methods:**Study design was a cross sectional and involving 64 patients with severe acute malnutrition. Face to face interview was conducted with mother of eligible children using paper based semi- structured questionnaire. Any inconsistencies in questionnaire were addressed during the fieldwork. Anthropometric measurements (weight and recumbent length/ height) of the children were taken and compared with height for weight indicators Z-score.**Results:**Of the 64 cases and 116 controls, 40% of children were between the age group of 12–23 months in both cases and controls, and 28.2% of cases and 23.4% of controls were in the age group of 24–35 months. The mean age was 24 months in both cases and controls (cases: 25.31 ± 13.3, control: 25.29 ± 13.4). There was no difference in the mother's age at the time of the birth of the index child among both the cases and controls (P = 0.106). **Conclusion:**Collaborative efforts should be organized to improve promotion of better child caring practices through appropriate age specific child and maternal feeding practices, prevention and early treatment of acute childhood illnesses and promotion of family planning.

Keywords: Malnutrition, Children, prevention, practices

Introduction

In order to holistically address the issues surrounding malnutrition,a comprehensive understanding of the multi-dimensional complexities at play in society is crucial. Indicators showing levels of nutritional status in children are often regarded as representative of the health and general wellbeing of a society at large. High levels of malnutrition in children, particularly in those under the age of five, tend to prevail in areas where levels of socio-economic development are also low[1].In addition to direct causes such as inadequate dietary intake,lack of exclusive breastfeeding,respiratory and gastrointestinal infections, indirect factors such as food insecurity, presence of morbidity among parents, and poor environmental conditions especially overcrowding, lack of sanitation and poor purchasing power are detrimental to the healthy growth of the child thereby predisposing them to chronic morbidity and at times culminating in mortality[2-7].Despite the marked improvement in health and living conditions, India is still way behind in achieving the target for child mortality; the failure to address malnutrition being negatively conducive to the same[8].Globally, 7.5 million under-five children are wasted and 16.4 million are severely undernourished[9]. SAM con- tributes to over one million under-five deaths per annum. Survivors of acute malnourished children are at increased risk of developing stunting and various diseases, disorders, poor educational performance, and low productive life[10].Child under nutrition is a critical public health issue ubiquitous in many developing countries where various infectious diseases are rampant[11,12]. Several studies have showed the association between SAM and poverty,large family size,[15]low dietary diversity and unimproved sanitation, and hygiene,[13-16] exposure to pathogens, and recurrent infections[13-17].The rate of wasting among under-five years children was higher in rural areas and in provinces 1 and 2[19,20]. Overall health indicators in province 2 are relatively low, especially among poorer households. The problem of under nutrition in province 2 is still high and poses challenges in the attainment of goals to improve the nutrition status of children[21].

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Material and methods

Study design was a cross sectional and involving 64 patients with severe acute malnutrition from 6 to 60 month of age was employed to identify the risk factors of severe acute malnutrition among children. The cases and controls were defined as per the World Health Organization (WHO) Multicentric Growth Reference Study (MGRS) Criteria 2006. Children with SAM, that is, weight for height z-score of less than −3SD with or without nutritional edema were considered as cases. Children with weight-for-height z-score more than -1SD and mid-upper arm circumference (MUAC) ≥13.5 cm were considered as controls.

Inclusion criteria

Children between 6 and 60month of age admitted in civil hospital Ahmedabad for severe acute malnutrition with any of the following[4,5]

- MUAC <11.5mm with or without any grade of edema
- WFH (weight for height) <-3 SD with or without any grade of edema
- Bilateral pitting edema +/++

Exclusion criteria

Children with known chronic illnesses, and congenital abnormality which affects the feeding pattern of the children were excluded from the study. A baseline survey was

undertaken by the Department of Pediatrics, IGIMS Patna, India as part of a clinical trial to evaluate the efficacy of three feeding regimens(locally prepared ready-to-use therapeutic food [RUTF-L],commercially available RUTF [RUTF-C], and augmented home-prepared foods [AHPF]), on the recovery of children from uncomplicated SAM, in Vellore[22]. Briefly, children with MUAC < 13 cm in the age group 6–59 months were identified in the community and were referred to the study clinic for anthropometric measurements and further screening. The Z scores of weight for height were calculated using the WHO Anthro software[23]. Children with Z score less than −3SD were classified as cases of SAM, following which a home visit was done by a medical officer and trained field workers on the same day, to document existing risk factors, before the initiation of feeding interventions.

Data collection

Face to face interview was conducted with mother of eligible children using paper based semi- structured questionnaire. Any inconsistencies in questionnaire were addressed during the fieldwork.Anthropometric measurements(weight and recumbent length/height) of the children were taken and compared with height for weight indicators Z-score as per WHO 2006 growth standards. For weight, a digital scale was used for accurate measurement with minimal clothing. The height measurement was taken on flooring that was not carpeted and against a flat surface such as a wall. The measurements were done for 3 times to finalize final measurement to record. Validation of instruments and measurements was done on a daily basis.

Statistical analysis

The collected data were entered into Microsoft Excel, 2007 and were converted into Statistical Package for Social Sciences (SPSS 11.5 version) for data analysis.

Results

A total of 180 participants were recruited into the study, including 64 cases and 116 controls. The socio-demographic characteristics of the study population were described in Table 1. Of the 64 cases and 116 controls, 40% of children were between the age group of 12–23 months in both cases and controls, and 28.2% of cases and 23.4% of controls were in the age group of 24–35 months. The mean age was 24 months in both cases and controls (cases: 25.31 ± 13.3, control: 25.29 ± 13.4). There was no difference in the mother's age at the time of the birth of the index child among both the cases and controls (P = 0.106).

Table 1: Demographic characteristics of the study population

Category		Cases n=64 (%)	Controls n=116 (%)
Gender	Male	31(48.4%)	56(48.2%)
	Female	33(51.5%)	60(51.7%)
Residence	Urban	44 (68.7%)	86 (74.1%)
	Rural	20 (31.2%)	30 (25.8%)
Type of house	Huts	10 (15.6%)	9 (7.7%)
	Mixed	9 (14%)	49 (42.2%)
	Pucca	38 (59.3%)	53 (45.6%)
	Mansion	7 (10.9%)	5 (4.3%)
Type of family	Nuclear	29(45.3%)	65(56.0%)
	Joint	17(26.5%)	42(36.2%)
	Extended	18(28.1%)	9(7.7%)
Religion	Hindu	40(62.5%)	96(82.7%)
	Christian	11(17.1%)	0
	Muslims	12(18.7%)	20(17.2%)
SES* (BG Prasad's)	I (high)	3(4.6%)	7(6.0%)
	II	5(7.8%)	13(11.2%)
	III	17(26.5%)	39(33.6%)
	IV	25(39.0%)	47(40.5%)
	V (low)	14(21.8%)	10(8.6%)
Fathers occupation	Unemployed	3(4.6%)	0
	Unskilled/semi-skilled	27(46.1%)	57(49.1%)
	Skilled	16(25%)	30(25.8%)
	Clerical/shop owners	12(18.7%)	15(12.9%)
	Semi-professionals/Professionals	6(9.3%)	14(12.0%)
Mothers' occupation	House wife	51(79.6%)	101(87.0%)
	Working mothers	13(20.3%)	15(12.9%)
Fathers' education	Illiterate/Primary	19(29.6%)	26(22.4%)
	Middle	15(23.4%)	31(26.7%)
	High school	20(31.2%)	30(25.8%)
	High secondary and more	10(15.6%)	29(25%)
Mothers' education	Illiterate/Primary	19(29.6%)	31(26.7%)
	Middle	17(26.5%)	27(23.2%)
	High school	15(23.4%)	32(27.5%)
	High secondary and more	13(20.3%)	26(22.4%)
Family size	4 and more	6(9.3%)	8(6.8%)

Among the 180 children studied, 50% of cases and 67% of controls were in the normal height for age cutoff points, that is, HAZ >-2 to 3 SD. Among cases, 27.8% were stunted, and 18.5% were severely stunted (HAZ <−3). Among controls, 14.3% were stunted, and another 14.3% were severely stunted. As per the case definition, all children in the cases had WHZ scores below – 3 SD. Among controls, 82.4% of the children had WHZ ≥1 SD. Few children in the control group (15.1%) had a "possible risk of being overweight" (WHZ >1 to ≤2 SD), 5.4% of controls were overweight (WHZ >2 to ≤3 SD), and none were obese (WHZ >3 SD). Table 2 describes the various risk factors for SAM. In the demographic domain, only religion showed a statistically significant association with SAM. With regard to birth and infancy related factors, low birth weight, incomplete immunization, presence of congenital anomalies, and parents' having more than one child emerged as significant risk factors for SAM. The presence of current medical illness and hospitalization were also contributory risk factors for SAM. SAM was found to be more prevalent among those who were not exclusively breastfed and those with inadequate calorie and protein intake. In the domain of family health and dynamics, SAM was found to be associated with the presence of chronic illness in the mother, underweight mothers (BMI <19.4), poor knowledge of nutrition among mothers, history of smoking tobacco, and history of alcohol consumption among fathers, and history of child's contact with tuberculosis.

Table 2: Risk factors associated with SAM

Category		Case *n*=64 *n*(%)	Control *n*=116 *n*(%)	OR(95%CI)	AOR(95%CI)	*P*
Demography-related risk factors:						
Religion-	Hindu	42(65.6%)	95(81.8%)	0.40(0.19-0.87)	0.55(0.15-3.2)	0.376
	Others	22(34.3%)	21(18.1%)			
SES(BGPrasad)	Low	40(62.5%)	58(50%)	1.89(0.95-4.61)	1.39(0.49-4.52)	0.605
	High	24(37.5%)	58(50%)			
Child's birth-related risk factors:						
Birthweight	<2.5Kg	32(50%)	14(12.0%)	11.4(5.51-26.61)	9.90(3.91-27.82)	<0.001*
	≥2.5Kg	32(50%)	102(87.9%)			
Congenital disorder	Present	12(18.7%)	7(6.0%)	8.71(1.59-39.2)	0.91(0.09-11.03)	0.929
	Absent	52(81.2%)	109(93.9%)			
Beingsinglechild	yes	16(25%)	51(43.9%)	0.34(0.18-0.74)	0.59(0.19-1.85)	0.349
	No	48(75%)	65(56.0%)			
Child's morbidity-related risk factors:						
Current Medical illnesses	Present	16(25%)	9(7.7%)	7.51(1.99-22.4)	4.73(0.59-24.91)	0.171
	Absent	48(75%)	107(92.2%)			
Hospitalizationin last1 year	Present	16(25%)	12(10.3%)	4.65(1.36-10.90)	0.85(0.17-5.51)	0.843
	Absent	49(76.5%)	104(89.6%)			
Immunization	Incomplete	15(23.4%)	11(9.4%)	4.75(1.8-11.02)	1.39(0.26-8.1)	0.749
	Complete	49(76.5%)	105(90.5%)			
Child'sdiet-related risk factors						
Exclusively breastfed	No	29(45.3%)	17(14.6%)	7.23(3.6-15.01)	5.61(1.78-13.61)	0.002*
	Yes	35(54.6%)	99(85.3%)			
Calorie intake	Inadequate	43(67.1%)	31(26.7%)	8.36(4.46-16.20)	9.091(4.11-0.89)	<0.001*
	Adequate	21(32.8%)	85(73.2%)			
Parental-relatedrisk factors:						
Household TB contact	Present	12(18.7%)	7(6.0%)	8.71(1.58-39.1)	1.01(0.16-8.61)	0.997
	Absent	52(81.2%)	109(93.9%)			
Mother's BMI in kg/m^2	Underweight(<18.5)	18(28.1%)	13(11.2%)	4.84(1.8-11.04)	7.81(1.96-25.51)	0.004*
	Others	46(71.8%)	103(88.7%)			
Mother's nutritional knowledge	Poor	52(81.2%)	79(68.1)	4.93(1.5-13.10)	1.9(0.49-7.91)	0.395
	Good	12(18.7%)	37(31.8%)			
Fathersmokes	Yes	32(50%)	40(34.4%)	3.01(1.08-4.92)	1.06(0.38-4.10)	0.981
	No	32(50%)	76(65.5%)			
FatherAlcoholConsumption	Present	35(54.6%)	46(39.6%)	1.99(1.04-4.81)	1.6(0.43-5.16)	0.662
	Absent	29(45.3%)	70(60.3%)			

Discussion

The birth weight is affected by many socioeconomic factors such as being rural or urban, wealth, caste, religion, education, and tobacco use by mother[24]. Similar studies conducted in different countries also showed a strong association between malnutrition and LBW[25-28]. A study done in Ghana showed that preterm babies were prone to develop malnutrition in later life[27]. This study did not find any significant association between prematurity and the child's nutritional status. This might be due to high early neonatal death among preterm babies[29] or improvement of nursery care over the years after the introduction of the National Rural Health Mission (NRHM) Programme in India[30]. The study revealed that low economic status (below poverty line; earning <$1.9/day)) was more than 11 folds at risk (AOR: 11.139 at 95% CI: 1.419–87.456) of developing SAM in chil- dren less than 5 years, which was statistically significant. The finding of our study is supported by the study done in Odisha of India, Bangladesh, and Ghana[31-33]. This could be explained by the fact that children from families of low socioeconomic status have limited access to food, health services, hygiene and sanitation.However, studies conducted in Illam, Nepal and Kenya showed that low economic status was not statistically significant with malnutrition.In our study there was no significant association between SAM and number of family members. The study done in Rupandehi, Nepal, Bangladesh, Pakistan are in accordance with the result of our study[34-36].The insignificant difference found between SAM and family size might be due to the social setting of the indigenous village (Satar), where children of both cases and controls live in joint family. Birth interval was found significantly associated with SAM in bivariate analysis of our study but upon adjusting confounders in multivariate analysis,it was not significantly associated with SAM. In accordance with our study, a study done in Africa has also found birth interval to be insignificantly associated with SAM[37]. Other driving factors like poor economic condition of the household might have impacted more on the occurrence of SAM, therefore, birth interval was found to be insignificant with SAM.Healthy nutritional practices in the early growing periods of the child prevent the risk of malnutrition. Of all the children who were included in the study, 22% didn't receive exclusive breastfeeding till 6 months and 62% children had delayed introduction of complementary feeding (54% between 7 month and 1 yr, and 8% after 1 year of age).[1] A large lot (80%) had calorie intake deficit of more than 60%.1 Incidence of SAM in children who were currently breastfed (n=36) was higher among those whose mothers were undernourished (78% having BMI<18.5).22% children had diarrhea and 34% had febrile illness in preceding 2 weeks among the total enrolled children with SAM. 10% had other chronic medical or surgical problems. Malnutrition and infection form a vicious cycle; infection precipitates the acute bouts of malnutrition and malnutrition predisposes the children to infection.Though belonging to the Hindu religion was a protective factor in the bivariate analysis, it was not so in the multiple logistic models. Surprisingly, no statistically significant association was noted between low SES and SAM. This finding was contrary to the conclusions of a study done in Rajasthan, which showed that 82% of underweight children belonged to the low SES group[38].This could be due to the public distribution system (PDS) in Tamil Nadu. The Tamil Nadu PDS follows the distribution of staple foods to every household, irrespective of whether they fall below or above the official poverty line In Summary, results from the present study confirm that LBW, absence of exclusive breastfeeding, inadequate calorie intake by children, and low BMI of mothers as significant risk factors for the development of SAM among children aged 6–59 months.

Limitation

Finding appropriate controls in the community was a major limitation of the study. Apart from that, there may be interviewer bias in the data collection as the interviewer was aware of the nutritional status of the cases and controls before the interview. The majority of the mothers, both cases and controls, had difficulty in recollecting the duration of breastfeeding and the time of initiation of complementary feeds. This could have raised a recall bias in the study. Also, the calorie intake was based on a single 24 h dietary recall and may have subsequently resulted in overestimation or underestimation of the actual calorie intake of the children.

Conclusion

Having the knowledge of various risk factors of SAM would benefit the primary care physicians and the community health workers to identify the "atrisk" children in the community through screening (based on the risk factor) and help them to address the problem early. Also, various new programs should be implemented to reduce the poor nutritional status of young girls and women in the reproductive age group. Age of the child <2 years, female gender, bigger family size, poverty, illiteracy in mother, poor feeding practices, improper complementary feed introduction, poor nutritional status of mother whose child were breastfed, acute or chronic illness in child and narrow birth spacing were the chief determinants of SAM in under five children. As a result, collaborative efforts should be organized to improve promotion of better child caring practices through appropriate age specific child and maternal feeding practices, prevention and early treatment of acute childhood illnesses and promotion of family planning.

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