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DESCRIPTIVE SURVEY-BASED STUDY OF CO-MORBIDITIES AND OUTCOME IN HOSPITALISED CHILDREN WITH PRIMARY SEVERE ACUTE MALNUTRITION.

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ABSTRACT.

Introduction:
Aim & Objectives: To determine the different co-morbidities associated in children aged 6 - 59 months with primary severe acute malnutrition and the outcome of primary severe acute malnutrition in children.

Material & Method:
This study was conducted over 2 years (From November 2019 to October 2021) at the Department of Pediatrics, S.C.B. Medical College & Hospital, S.V.P. Postgraduate Institute of Pediatrics, and Nutritional Rehabilitation Centre (NRC), Cuttack. This is a hospital-based descriptive survey study. The children aged 6 – 59 months, meeting the WHO definition of Severe Acute Malnutrition were included in the study.

Results
The most common presenting complaint seen in our study population was fever, present in 60 of cases. The 2nd most common presenting complaint was cough and cold in 51 (%) of subjects, followed by loose stool, seen in 34 cases; and not gaining weight in 31 (%) cases. Acute respiratory tract infections were found to be the most common infectious co-morbidity, present in 43 children. Diarrhea was the second most common infectious co-morbidity which was seen in 34 children.

Conclusion:
SAM is more seen in low socio-economic groups; and in families with lower rates of access to and utilization of safe water and sanitation facilities. Lower rate of complete immunization, as compared to national and state level statistics; and inadequate exclusive breastfeeding and delayed weaning are common findings in SAM children.

Recommendation
Exclusive breastfeeding for the first 6 months of life, followed by the introduction of complementary feeds at 6 months; continued breastfeeding till 2 years. Immunization as per schedule, as several cases were partially immunized. Socioeconomic status has to be improved including parental education regarding following hygienic practices, usage of safe water, and sanitation

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INTRODUCTION.

According to WHO, globally there are around 13.6 million children who are severely acutely malnourished. Asia is home to more than three-quarters of all children suffering from severe wasting; and more than half of all children affected by wasting live in Southern Asia [1]. As per the NFHS-5 survey, severe acute malnutrition affects 7.7% of under-5 children in India, and 6.1% of the under-5 population in Odisha [2].

The 2025 Global Nutrition Targets include Maternal, infant, and young child nutrition targets (MIYCN) under which target 1 is a 40% reduction in the number of children under 5 who are stunted, target 3 is a 30% reduction in low birth weight and target 6 is to reduce and maintain childhood wasting to less than 5%[3].

As per the 2021 Global Nutrition Report, the world is off course to meet five of the six MIYCN targets. Current progress in the prevalence of LBW and wasting and in the number of children under 5 years of age who are stunted is insufficient to meet the 2025 target. By 2025, the number of

stunted children is estimated to be 131 million (27 million above the expected 40% reduction in the target number of stunted children), while the prevalence of wasting will remain well above the 5% target [4].

Great acceleration in progress is needed for all the nutrition targets. The ongoing COVID-19 pandemic is impeding the achievement of the global nutrition targets as well as Sustainable Development Goal Targets 2.1 and 2.2. Short and long-term responses are urgently needed to avoid losing the progress made so far and to bring the world back on track [5].

Children suffering from severe acute malnutrition are at 5-20 times higher risk of death compared to well-nourished children [6]. Diminished immune functions render undernourished patients more susceptible to infections, notably by opportunistic pathogens. SAM also puts children at a greater risk of dying from common infections, increases the frequency and severity of such infections, and contributes to delayed recovery. In addition, the interaction between SAM and infections can create a potentially lethal cycle of worsening illness and deteriorating nutritional status. Scrimshaw et al demonstrated the synergistic interactions between malnutrition and infection in community-based studies [7].

The first line of defense against infection is the innate immune response, particularly the epithelial barrier and mucosal immune response. SAM compromises the mucosal epithelial barrier in gastrointestinal, respiratory, and urogenital tracts resulting in susceptibility to infection. Children with severe malnutrition are at risk of several life-threatening problems like hypoglycemia, hypothermia, serious infections, essential micronutrient deficiencies, and severe electrolyte imbalance and because of this vulnerability, they need careful assessment, special treatment, and management.

Co-morbidities are responsible for the high incidence of morbidity and mortality in children with severe acute malnutrition [8, 9, 10]. Every year a good number of SAM cases are admitted to this hospital from all parts of Orissa with a variety of infections like RTI, diarrhea, measles, tuberculosis, UTI, etc, who may or may not have signs & symptoms of overt infection. There is a paucity of data regarding the pattern of co-morbidities in SAM children, especially in Odisha. Most of the studies are related to infectious co-morbidities while only a few studies are related to micronutrient deficiencies in severely malnourished children. Therefore, this study was conducted to identify the co-morbidities in children with SAM admitted to our hospital.

AIM &OBJECTIVES.

To determine the different co-morbidities associated in children aged 6 - 59 months with primary severe acute malnutrition and determine the outcome of primary severe acute malnutrition in children admitted to the indoor wards of the Department of Pediatrics, SCB Medical College and hospital; and SVP Postgraduate Institute of Pediatrics and the Nutritional Rehabilitation Centre of SVPPGIP, Cuttack.

MATERIAL &METHOD.

After getting clearance from the institutional ethical committee, this study was conducted over 2 years (From November 2019 to October 2021) at the Department of Pediatrics, S.C.B. Medical College & Hospital, S.V.P. Postgraduate Institute of Pediatrics, and Nutritional Rehabilitation Centre (NRC) Cuttack. This is a hospital-based survey descriptive study. The children aged 6 – 59 months, meeting the WHO definition of Severe Acute Malnutrition, and admitted to the indoor wards of the Department of Pediatrics, SCB Medical College & Hospital (SCBMCH), and SVP Postgraduate Institute of Pediatrics (SVPPGIP); and Nutritional Rehabilitation Centre (NRC) of SVPPGIP during the study period was included in the study. A convenient sample size of 100 was taken.

INCLUSION CRITERIA.

- Children aged between 6 months to 59 months,
- Fulfilling the recommended criteria for Severe Acute Malnutrition-Weight-for-height less than -3SD and/or visible severe wasting and/or Mid-upper arm circumference (MUAC) < 11.5 cm and/or Oedema of both feet (other causes of edema. Nephrotic syndrome ruled out).
- Admitted in the indoor ward or NRC of SCBMCH or SVPPGIP during the study period

EXCLUSION CRITERIA.

- Children< 6 months and > 59 months.
- Secondary malnutrition due to underlying chronic illness or systemic disorders.
- Children with congenital malformations.
- Patients who left the hospital against medical advice, before the completion of treatment,
- Children whose parents/caregivers did not give consent to participate in the study.

OBSERVATION.

In this study, a total of 100 children with severe acute malnutrition, were admitted to the Department of Pediatrics, S.C.B. Medical College & Hospital, S.V.P. Postgraduate Institute of Pediatrics, and Nutritional Rehabilitation Centre (NRC), Cuttack, included. Among the study population, 52(%) children were of age group 6-12 months. 35 (%) children related to the age group 13 – 24 months while 13 (%) children belonged to the age group 25 – 60 months. The median age of presentation was 11.5 months. Among the

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children, 57 (%) were male while 43 (%) were females. The ratio of male to female patients was 1.3:1

All the information and findings were recorded in predefined proforma, all filled questionnaires were checked and coded on Microsoft Office Excel Worksheet and any missing data or information was actively searched from patient's files. Descriptive cross-tabulations were performed and data was analyzed statistically.

Table -1: Distribution of Socio-demographic factors.

Parameter		Frequency (%)
Socio-Economic Class	Upper	0
	Upper Middle	0
	Lower Middle	11
	Upper Lower	75
	Lower	14
Immunization status	Complete	75
	Incomplete	23
	Unimmunized	2
Duration of exclusive breastfeeding	1 - 5 months	31
	6 months	42
	7 - 12 months	27
Facilities	Safe water supply	78
	Sanitary Latrine	63

Most of the children (75%) belonged to upper lower (IV) socioeconomic class. 14 (%) children belonged to the lower (V) class, and 11 (%) belonged to the lower middle class (III) (Table 5). Families 78 (%) of the children used safe water supply, while 22 (%) did not utilize safe water supply for daily activities, cooking, and drinking. Only 63 (%) of families used sanitary latrines, while 37 (%) of families did not utilize sanitary latrines and practiced open-field defecation (Table 1).

Table 2. Presenting complaints in the study population.

Presenting complaint	Frequency (%)
Fever	60
cough & cold	51
loose stool	34
Vomiting	19
skin lesions	6
Lethargy	26
Convulsion	4
not gaining weight	31

The most common presenting complaint seen in our study population was fever, in 60 (%) of cases. The 2nd most common presenting complaint was cough and cold in 51 (%) of subjects, followed by loose stool, seen in 34 (%) cases; and not gaining weight in 31 (%) cases. Other presenting complaints were lethargy in 26 (%), vomiting in 19 (%), skin lesions in 6 (%), and convulsion in 4 (%) cases of the study population (Table 2).

Table 3. Features of Severe Acute Malnutrition seen in the study

Features	Present (%)	Absent (%)
Oedema	14	86
Wasting	37	63
MUAC < 11.5 cm	89	11
Skin changes	12	88
Hair changes	20	80

Among the cases, 89 (%) had mid-upper arm circumference < 11.5 cm, and 11 (%) had MUAC ≥ 11.5 cm. 14 (%) had bilateral pitting oedema of nutritional origin (oedematous SAM), while 86 (%) had non-oedematous SAM. Visible severe wasting was present in 37 (%) of the SAM children in the study. Skin changes were found in 12 (%) cases and hair changes were detected in 20 (%) cases (Table 3).

Table 4. Associated Complications of SAM

Complications	Present (%)	Absent (%)
Unstable vitals	20	80
Hypothermia	15	85
Shock	5	95
Hypoglycemia	5	95
Dyselectrolytemia	17	83

20 (%) of children in the study population had unstable vitals at admission, while 80 (%) were vitally stable. Hypothermia was recorded in 15 (%) and hypoglycemia was documented in 5 (%) children. 5 (%) children presented with shock. Dys-electrolyte-mia was recorded in 17 (%) (Table 4)

Table 5. Distribution of infectious co-morbidities.

Co-morbidity	Frequency (%)
Diarrhea	34
Acute Respiratory Infection	43
UTI	6
Sepsis	16
Tuberculosis	8
HIV	1
Meningitis	7
candidiasis	3

Acute respiratory tract infections were found to be the most common infectious co-morbidity, present in 43 (%) of children. Out of the 43 children, radiological findings were evident in 15 (34.9%). Diarrhea was the second most common infectious co-morbidity which was seen in 34 (%) of children. It was followed by sepsis, seen in 16 (%) children. Out of those 16 children, 6 (38%) had culture-positive sepsis, and Klebsiella spp was the most common isolated organism (50%), followed by Staphylococcus aureus and Escherichia coli in the remaining. Tuberculosis as a co-morbid condition was seen in 8 (%) of the children. Out of those 8 children, 5 (62.5%) had pulmonary tuberculosis while 3 children had tubercular meningitis. CBNAAT for gastric aspirate or CSF was positive in 7 out of 8 (87.5%) cases. HIV infection was found associated with 1 (%) of cases. Meningitis was found to be associated with 7 (%) of cases, of which 4 (57%) were pyogenic meningitis and 3 (43%) were tubercular meningitis. Urinary Tract Infection (UTI) was diagnosed in 6 (%) of children, of whom 3 (50%) had growth of Escherichia coli, 2 (33.3%) grew Enterobacter spp while 1 (16.7%) had growth of Pseudomonas on culture. Candidiasis was seen in 3 (%) of cases (Table 5).

Table 6. Distribution of micronutrient deficiencies.

Micronutrient deficiency	Frequency (%)
Anemia	77
Vit A Deficiency	3
Vit B Deficiency	15
Vit D Deficiency	3
Zinc Deficiency	2

77 (%) SAM children out of the study population were found to be anemic, making anemia the most common non-infectious co-morbidity. Out of those 77 patients; 23 (29.9%) children had mild anemia, 47 (61%) had moderate anemia and 7 (9%) children had severe anemia. The mean hemoglobin level was found to be 9.8 g/dL for the study population, standard deviation being 1.8 g/dL (Table 6).

Vitamin A deficiency features were present in 3 (%) children; vitamin B complex deficiency was seen in 15 (%) children while features of vitamin D deficiency were present in 3 (%) children. Zinc deficiency was evident in 2 (%) children of study population.

Table 7. Outcome of SAM in the study population.

Outcome	Frequency (%)
Cured &Discharged	92
Expired	8

92 (%) SAM children were cured and discharged from the hospital. 8 (%) children out of the study population expired (Table 7).

Table 8. Length of hospital stay.

No. of days	Frequency (%)
≤ 10	6
11 - 15	17
16 - 20	24
21 - 25	14
26 - 30	18
31 - 35	7
36 - 40	7
41 - 45	5
46 - 50	1
51 - 55	1

The mean duration of hospital stay was 23.3 days, with a minimum of 11 and a maximum of 52 days (Table 8). The mean duration of achievement of target weight among the patients being discharged was found to be 19.2 days, with a minimum of 10 and a maximum of 38 days (Table 9).

Table 9. Duration of achieving target weight.

Duration (days)	Frequency (%)
≤ 10	5
11 - 15	32
16 - 20	18
21 - 25	19
26 - 30	15
31 - 35	2
≥ 40	1

Table 10. Comorbidities associated with cases of death.

Co-morbidity	Frequency (n)
Sepsis	5
Tuberculosis	2
Acute respiratory infection	1
HIV	1
Severe Anemia	1

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Out of the 8 deaths, 5 (62.5%) had sepsis as the infectious co-morbidity, 2 (25%) had tuberculosis and 1 (12.5%) had acute respiratory tract infection. (Table 10) Out of the 2 patients with TB, one had tubercular meningitis and the other had HIV infection with disseminated TB with severe anemia

Table 11. Distribution of shock in cases resulting in death.

Shock	Frequency, N (%)
Present	4 (50%)
Absent	4 (50%)

4 (50%) patients presented with shock, at the time of admission. The median interval between the time of hospitalization and the time of death was 2 days (Table 11).

DISCUSSION:

In the study, it was found that the median age of presentation in SAM children was 11.5 months, with 52% of children in the age group of 6-12 months. Most other studies found the maximum number of cases in the 13-24 months age group. However, a hospital-based study in our state by Pravati et al [11]also found the highest prevalence in the 6-12 months age group. This might be due to poor feeding practices, early or delayed weaning, and poor hygiene practices. In our study, only 42% of children were exclusively breastfed up to 6 months, 31% weaned before, and 27% after 6 months. Children less than 1 year of age require high calories for growth and metabolism. They also have a low capability to claim food and are susceptible to developing malnutrition. Food diversification is done in this age group, and when poorly managed, promotes the occurrence of SAM [6].

The study demonstrated a slight male preponderance with a male-to-female ratio of 1.3:1. This is similar to the studies by Choudhary et al [12], Garg et al[13], and Pravati et al[11]. However certain studies like Baskaran et al[14], Kumar et al[15], and Sengupta et al[16]found a female predominance. The male preponderance may be due to the greater number of male patients in the hospital, which might be because the male child gets more medical attention than the female, and is brought to the hospital early. Social norms may be responsible for it.
In this study, most of the children belonged to upper-lower and lower (75% and 14%) socio-economic classes. In our study population, severe malnutrition was not seen in the upper and upper-middle classes. Soni et al[17] and Ashraf et al[18] in their studies reported that the majority of malnourished children belonged to lower socioeconomic status (IV, V). Rao et al[19] and Singh et al[20]also reported that malnutrition is related to per capita income and socioeconomic condition. These results indicate that the unavailability of food, poor purchasing power, inappropriate distribution, and inadequate utilization might make the children vulnerable to malnutrition in a deprived community.

Only 75% of children in our study population were completely immunized, which is less than the state estimates as per NFHS-5[21]. It might be because most of the children in our study belonged to low socio-economic status (75% to IV, 14% to V), where the literacy rates and awareness about the importance of vaccination may be low. Sharma[22], Shah[23], and Devdas et al[24] observed that the better the socioeconomic and educational status of mothers; the better the immunization status of children. A similar result was found in a study by Oworet al in East Africa [25] showing a strong association between SAM and incomplete immunization.
42% of children in this study received exclusive breastfeeding up to 6 months of age, while 31% were weaned earlier and 27% were weaned late. A study done by Amsalu et al [26] showed introduction of another diet before six months of age is 3.2 times more common with cases than in the controls; and initiation of a complementary diet after one year of age was 3.4 times more common in the malnourished group, indicating that children with severe acute malnutrition are started with complementary diet either too early or too late.

Mallik et al [27] also reported that among children less than two years, malnutrition was observed significantly more in those who were not exclusively breastfed than the children exclusively breastfed for 4- 6 months. This could be explained as breast milk being a complete source of all vitamins, proteins, fat, and carbohydrates for the growing child and also decreases the chances of infections in exclusively breastfed infants in the initial six months of age. However, after 6 months of age, breast milk alone is not enough to meet the energy requirement of the child. Complementary feeding must be introduced in addition to continuing breastfeeding [28]. This often doesn't happen.
In our study, fever was the most common presenting complaint (60%), as seen in most other studies, including Garg et al[13], Aguayo et al [29], Pravati et al [11]. A study by Bagga et al [30] and Choudhury et al [31] also had similar findings. It was followed by cough and cold (51%); and loose stool (34%). Bernal et al[32] conducted a study on the treatment of severe malnutrition in children by

implementing the WHO Guidelines and observed that the most common sign of infection at admission was fever (26.3%), and the most common associated illness at admission was diarrhea (68.4%) with a significantly higher frequency in children with a severe degree of malnutrition. Bagga et al [30] in their study also reported diarrhea and fever as common presenting symptoms.

oedema at admission was seen in 14% of the study population in our study. The low incidence of edematous SAM in our study as compared to some other studies may be due to early intervention and better health care. Similar results were found in studies by Amsalu et al [26] in North West Ethiopia with marasmus (75%) and kwashiorkor (25%). Hyder et al[33] also found oedematous malnutrition being 16.3% in a study in Sudan. But Bertiet al [34]foundoedematous malnutrition to be 64% in a separate study in Ethiopia which may be due to differences in cohort. It is also similar to the study by Maitland et al[35]done in Kenya.

Visible severe wasting is an independent criterion for the diagnosis of SAM and was seen in 37% of the study population. The other criterion of mid-upper arm circumference < 11.5 cm was met within 89% of the study population. Skin changes like dyspigmentation, crazy pavement dermatosis, and flaky paint dermatosis were present in 12% of the study population during the time of presentation. Hair changes like depigmentation, flag signs, easy pluckability, and bald areas were found in 20%of patients of SAM in our study at the time of presentation.

In this study, it was found that acute respiratory tract infection (43%) was the most common infectious co-morbidity. It was followed by diarrhea (34%), sepsis (16%), tuberculosis (8%), meningitis (7%), urinary tract infections (6%), pyoderma (3%) and candidiasis (3%). A study by Nzioki C et al [36] found pneumonia as a co-morbid condition in 51% of cases which is comparable to our study. Baskaran et al [14] in their study also found pneumonia as a co-morbidity in 44.5%, and 44.4% in the study by Pravati et al [11], which is comparable to our study. Garg et al [13] found acute respiratory tract infections in 27% study population, which is less than our study. A study by Bertiet al[34] found pneumonia to be 10% in a study in Ethiopia which is lower than that of our study.

Diarrhea was the next most common infectious co-morbidity, seen in 34%. Bernal et al[35] found diarrhea as a co-morbidity in 68.4%, which is much higher than our study, which may be due to better hygiene practices in our study population. Baskaran et al[14] also found acute gastroenteritis to be present in 57.5% of the study population, which is higher than in ours. Ashraf et al [18] reported diarrhea in 25.8%, which is comparable to our study. Garg et al[13] and Sharma et al[22] found diarrhea to be associated with 42% and 50% respectively. Diarrhea leads to decreased immunity which leads to further diarrhea and a vicious cycle.

In this study, sepsis was found in 16% study population. A study by Berti et al [34] found septicemia to be 8.5% in a study in Ethiopia which is less as compared to our study. It is similar results of Hyder et al[33] and Baskaran et al [14], which showed 18% and 13% of SAM children respectively as having septicemia. Sepsis is also found to be significant in other studies by Sunguya et al [37], Ubesi et al[38], Mahgoub et al[39].

Tuberculosis was seen as associated in 8% of children in our study. Similar studies by Garg et al [13], Berti et al[34], and Sunguya et al [37] found TB in 13%, 6.6%, and 8% respectively, which is comparable to our study. Baskaran et al [14] and Aguayo et al [29] detected TB in % and 1.7% respectively, which is lower than that in our study population. In this study, meningitis was found to be associated with 7% of cases, while 4% of cases were pyogenic meningitis. Similar results were also seen in the study by Garg et al [13]. HIV infection was noted in 1% of children in our study and 3.5% in the study by Baskaran et al[14].

Urinary tract infections were found as a co-morbidity in 6% of children in our study. In a study by Sunguyaet al [37] the prevalence of UTI in severe malnutrition was 8%, and 9% in the study by Garg et al [13], which is comparable to our study. Baskaran et al[14] and Pravati et al[11] reported UTI in 13.5% and 25.7% respectively, which is higher than our study. UTI is a common infection in under-fives, which presents with fever, vomiting, and diarrhea which in malaria-endemic areas may be misdiagnosed and treated as malaria cases. Due to the severity of the disease, it may lead to malnutrition because of poor feeding, chronic diarrhea, and vomiting.

Anemia was the most common co-morbidity (77%) detected in our study population. This is comparable to most other studies. However, Baskaran et al [14] found anemia in only 27% of children, as they considered only severe anemia in their study. This is greater than in our study, in which only 9% had severe anemia. Anemia in SAM children is due to iron deficiency and ineffective erythropoiesis due to folic acid and vitamin B12 deficiencies, infections, worm infestations, and anemia of chronic disease[6,14].

The overlapping nature of protein-energy malnutrition and micronutrient deficiencies is well understood and it is seen that lack of one micronutrient is typically associated with deficiency of others. Anaemia (77%) and vitamin B complex deficiency (15%) were the two most common micronutrient deficiencies associated with malnutrition in our study, and this is consistent with the previous reports. Garg et al[13] detected inadequate levels of vitamin D in 97% of cases, while we observed vitamin D deficiency in only 3% of children. This was because Garg et al[13] in their study, used laboratory assessment of vitamin D levels, while in our study, vitamin D deficiency was assessed only by clinical and radiological examination.

The outcome in our study was categorized into two categories i.e., cured and discharged; and death. In the study population, 92% were cured and discharged with a variable number of admission days. The mean duration of hospital stay was found to be 23.3 days in our study, with a minimum of 11 and a maximum of 52 days; Similar study by Pravati et al[11] and Aguayo et al [29] showed a mean of 19.5 and 16 days respectively, which is similar to our study. As per WHO guidelines, length of stay <4 weeks is acceptable and >6 weeks is alarming [40]. So, the length of hospital stay in our study is acceptable. The mean duration of achievement of target weight was 19.2 days in our study, with a minimum of 10 and maximum of 38 days; and 16.2 days in a study by Pravati et al (31).

In this study, 8% of children died due to various complications. The median interval between time of hospitalization and time of death in our study was 2 days. A study in Ethiopia [41] reported a mortality rate of 8.47 % with a median time to death of 3 days, which is similar to our study. This finding is also in line with the study by Banga et al[40] in Uganda, which found that the majority of deaths occur within 72 and 48 hours of hospitalization respectively. The high mortality during the stabilization phase could be due to the poor response of the body, which has undergone reductive adaptation because of malnutrition, to the medical interventions [40].

In this study, it was found that shock, at the time of presentation, was present in 50% of the patients that expired. Banga et al[40], in their study, found shock to be an independent predictor of mortality, with a 60.9-fold higher risk of death. Wagner et al[41] and Kumar et al [15]also demonstrated the association of shock with the risk of mortality in SAM patients. This could be explained by either a poor body response to the medical interventions or an inadequate clinical or para-clinical monitoring of these patients, whose metabolism had completely changed because of the reductive adaptation.
Our study showed that in 62.5% of the deaths, sepsis was the infectious co-morbidity associated. Banga et al[4] found a 3.8-fold higher risk of death in patients with bacteremia. Studies by Maitland et al [35] and Roy et al [42] also showed an association between bacteremia and the risk of death. This could be explained by the impairment of the immune system due to malnutrition, causing bacterial overgrowth and infection that increased the morbidity and mortality among those children.

The study also showed tuberculosis in 25%, HIV infection in 12.5%, and severe anemia in 12.5% of the deaths. The study by Banga et al [40] in Uganda also found an association between TB and HIV infection and risk of mortality. The increased susceptibility to opportunistic infections and other co-morbidities could worsen the prognosis in HIV-infected individuals. Similarly, the poor host defense against tuberculosis in SAM children could explain the increased risk of death among these patients. Our study also showed severe anemia as a co-morbidity in 12.5% of deaths. Banga et al [40] also revealed 2.9 times increased likelihood of mortality compared to those without anemia. This could be explained by a poor body response to transfusion or by delayed transfusion.

A study by Bertiet al[34] found overall mortality to be 4.6% in SAM in a study in Ethiopia which is lower than our study. A study by Aguayo et al [29] done in Jharkhand showed mortality in 0.6% SAM cases which is lower than our study and maybe because they did not follow the cases referred to other centers. Hyder et al [33] found overall mortality to be 5.5% in a study in Sudan, which is less than our study. Banga et al [40], in their study in Uganda, found the death rate to be 14.5%. In a study by Mogeset al [43]in Ethiopia overall mortality was 21.6%, which is higher. However, according to the minimum international standard of acute malnutrition management, a death rate of < 10% is acceptable and >15% is alarming [44]. So, in our study the death rate of 8% is acceptable.

CONCLUSION:

Severe Acute Malnutrition in under-5 children is more common in maless and is most commonly seen in those less than 2 years of age. It is more seen in low socio-economic groups; and in families with lower rates of access to and utilization of safe water and sanitation facilities. Lower rate of complete immunization, as compared to national and state level statistics; and inadequate exclusive breastfeeding and delayed weaning are common findings in SAM children. Fever, being the commonest manifestation of infection, is the most common presenting complaint in hospitalized SAM children.

RECOMMENDATIONS:

Exclusive breastfeeding for the first 6 months of life, followed by the introduction of complementary feeds at 6 months; continued breastfeeding till 2 years. Immunization as per schedule, as several cases were partially immunized. Socioeconomic status has to be improved including parental education regarding following hygienic practices, usage of safe water, and sanitation. Early identification and appropriate management of shock in SAM patients with early inotrope support and antibiotics coverage. Prompt identification of co-morbidities and appropriate interventions are crucial to prevent death among these children.

LIMITATIONS.

The limitation of this study was a Smaller sample size due to pandemic restrictions, Lack of a comparison group, and

No biochemical tests for vitamin deficiencies were performed.

LIST OF ABBREVIATION.

SAM- Severe acute malnutrition
NFHS- National family and health services
WHO- World Health Organization
MIYCN- Maternal, Infant, and Young Child Nutrition
LBW- Low birth weight
CBNAAT- Cartridge-based nucleic acid amplification test
HIV- Human Immunodeficiency Virus
TB – Tuberculosis
UTI- Urinary tract infection

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AUTHOR'S CONTRIBUTION:

All authors were involved in research design, data analysis, and manuscript preparation and editing.

DISCLOSURE:

The authors report no conflicts of interest in this work.

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