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Research Article

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Sociodemographic, Clinical Correlates, and Hospitalization Outcomes in 0 to 59 Months Children with Severe Acute Malnutrition in the Therapeutic Nutritional Unit

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Abstract

Background

Globally, the mortality and morbidity estimates from Severe Acute Malnutrition (SAM) in under-five children (0-59 months) are highly significant in low-income countries. This study aims to contribute to the fight against SAM in under-five Chadian children.

Method

A cross-sectional study was performed on data collected from surveys conducted for 30 days on 326 hospitalized patients with SAM of under- five children. The participants included in the study fulfilled the admission criteria at the therapeutic nutritional unit (TNU) of Alerte Sante. This study assessed the sociodemographic characteristics, factors related to healthcare access, dietary patterns and clinical factors, and length of hospitalization and outcomes for the admitted children. MAS types were classified using the mid-upper arm centimeter (MUAC), WHO Weight- to-Height Z-score (WHZ) scale, and edema assessment.

Results

Among the study population, the male gender was predominant (65.6%). Most of the children (85.9%) belong to Muslim households. Children aged between 12 and 23 months were mainly represented. Marasmus type of SAM was around 90%. The most prevalent chief complaint for admission was Diarrhea (18.8%). The findings revealed 69% of patients discharged after recovery, 11 (3.37%) deaths, from which 54.5% belong to the age group of 12-24 months.

Conclusion

SAM is still prevalent in N'Djamena for under-five children. The study found several socio-demographic factors associated with SAM. Considering the strong association between diarrhea and related highest- case fatalities, advocacy and health education regarding breastfeeding, hygiene, and nutrition will immensely help.

Keywords: Severe Acute Malnutrition, Under-5 Children, Socio-Demographic and Clinical Factors, Mortality and Morbidity, Chad, Marasmus, Kwashiorkor, Central Africa

1. Background

Malnutrition is still a public health problem among children in low- and middle-income countries [1]. According to anthropometric and clinical assessments, malnutrition can be classified as mild, moderate, or severe [2]. Severe acute malnutrition (SAM) is defined as children 6 to 59 months of age who are three standard deviations below the median (z-score) of weight-for-height for the World Health Organization (WHO) growth standards or whose mid-upper arm circumference (MUAC) is less than 115 mm, with or without nutritional edema [3]. Globally, Southern Asia and sub-Saharan African countries detained the highest ranks of waded children [4].

Around 14.3 million of under-five children's lives are severely wasted in the world, with 3.5 million from Africa [4].

Nutrition-related factors contribute to about 45% of deaths in children under 5 years of age [5]. SAM also weakens the immune system, increasing children's susceptibility to diseases and death [6]. Sub- Saharan Africa has the highest under-5 mortality rate, with one child in 13 dying before their fifth birthday [5]. The World Health Organisation (WHO) has developed treatment guidelines for severely malnourished children to reduce the mortality rate by less than 10% [7]. Unfortunately, the mortality from SAM remained between 10 and 40% in several hospitals in Sub-Saharan Africa despite the usage of the WHO management guidelines [8]. Persistent mortality has been identified to be associated with conditions such as HIV infection in children, the absence of maternal participation in the child feeding program, inadequate care from healthcare workers, and mis-prescription therapy [9-12].

Childhood malnutrition is a significant public health problem in Chad, with a notable increase in cases [13]. Malnutrition is mainly attributed to several socio-economic and demographic causes [14]. In Chad, Médecins Sans Frontières (MSF/Doctors Without Borders), in partnership with the Ministry of Public Health, launched an inpatient therapeutic feeding center (ITFC) in the neighborhood of Ndjari in N'Djamena to treat complicated SAM children aged six (6) months to five (5 years) [15]. A national non-governmental organization (NGO) called Alerte Santé established a Therapeutic Nutritional Unit (TNU) on April 13, 2013, to emphasize the importance of holistic management in SAM.[16] Alerte Santé is under the alliance's funding for International Medical Action (ALIMA) and European Commission humanitarian aid (ECHO) [16]. TNU focused on the inpatient care of SAM children with medical complications. Four Nutrition Services in Ambulatory Care Settings were established for outpatient monitoring of non-complicated SAM and moderately acute malnourished children living around areas called Atrone, N'djari, Madjorio, and Hilé houdjaj. The inpatient TNU facilitates inpatient admission and provides intensive care and nutritional rehabilitation for malnourished children by administering systematic amoxicillin and nutrition treatment. To our awareness, no studies evaluated the sociodemographic characteristics, factors related to healthcare access, dietary patterns and clinical factors, and length of hospitalization and outcomes during SAM in children admitted to the TNU in Chad using the selected study design employed in our research. Hence, we conducted this study to contribute to the fight against SAM in under-five Chadian children in N'Djamena, Chad.

2. Methods

2.1 Study Setting and Timeframe

We conducted a descriptive cross-sectional study in the TNU from May 24 to June 24, 2015. The TNU was allocated an area within the Chad-China Friendship Hospital in Diguel. The TNU has 70 hospital beds capacity. TNU's activities run 24 hours a day, with three teams composed of physicians, nurses, nutritional assistants, and hygienists rotating every eight hours. They give therapy, therapeutic milks, and ready-to-use therapeutic foods to patients and keep the room clean. The consultation and the medical visit are made by the physicians. Physicians decide the change in treatment, discharge, and other medical decisions during the management of patients.

2.2 Inclusion Criteria

This study includes Chadian children aged between 0-59 months (under five) who met the criteria for admission to TNU and were hospitalized due to medical complications during the study period.

2.3 Exclusion Criteria

This study excluded malnourished children above 59 months old, SAM in children aged 0-59 months without complications, and moderately acute malnourished children aged 0-59 months with medical complications that do not meet the SAM criteria.

3. Data Collection

3.1 Sampling

This was an exhaustive sample, met consecutively with children between 0 and 59 months of age admitted in the TNU of ALERTE SANTÉ during the data collection, meeting the study's criterion.

3.2 Data Collection Technique

We collected the data on a pre-established form filled in using information collected during the interview and data from patient records. The survey questionnaires adopted were based on studies correlating SAM and the WHO assessment forms [17]. These survey forms were paper-based and manually entered into a spreadsheet before conducting statistical analysis.

Data was collected under the following headings:

- The sociodemographic characteristics (age and gender of patients, religion, parents' educational level, parents' status, and parents' occupation).
- The factors related to healthcare access (distance from TNU, onset of symptoms, and first point of contact).
- The dietary patterns and clinical factors (Diet, breastfeeding weaning age, immunization status, uvulectomy history, symptoms, SAM type, MUAC distribution, admission criteria, medical complications associated with SAM).
- Length of hospitalization and outcome (hospital stay length, hospitalization outcome, age of deceased patients, primary cause of death).

Sociocio-demographic characteristics **and factors related to healthcare access**

We collected information about the age and gender of the children, the religion of the household, parents' level of education, and occupation. We assessed further details such as the distance from TNU, the onset of symptoms, and the first point of care.

3.3 Dietary Patterns and Clinical Features

Related to the clinical features, we identified the types of SAM and associated admission criteria, as well as the MUAC distribution of the study population. We recorded information about diet and breastfeeding weaning age. We looked for vaccination status, history of uvulectomy, symptoms, and medical complications associated with SAM.

3.4 Length of Hospitalization and Outcome of the Study Population

In analyzing the study on severe acute malnourished children, the hospital's stay length, hospitalization outcome, age of deceased patients among the study population, and primary cause of death were all considered as factors to determine the effectiveness of treatment and identify areas for improvement.

3.5 Anthropometric Measurement

We confirm the MAS diagnosis of the patients by measuring the Height, weight, and MUAC (Mid- Upper Arm Circumference); this subsequently helps classify malnutrition. The temperature of each patient is taken before the consultation.

3.6 Measurements and Tools Used

The patients' length is measured using a simple horizontal length scale and stadiometer, and children are weighted using a standard weight machine [18]. Children are labeled to have SAM when weight-to-height is below -3 standard deviation (SD) using the WHO Child Growth Standards [19]. As the World Health Organization recommends, a Shakir cuff is used to measure the Mid Upper Arm Circumference (MUAC) [20]. A WHO Weight-to-Height Z-score (WHZ) scale is used to evaluate malnutrition [20]. We classified it into marasmus, kwashiorkor, or marasmic–kwashiorkor (a mix of the two), the SAM [21,22]. The patient is identified as SAM-type marasmus based on the WHO as having MUAC<115 mm or a WHZ<−3 [20].

The bipedal pitting edema was used to identify edematous malnutrition or kwashiorkor [22,23]. The edema is identified by pressing the children's skin at certain parts (upper or lower limbs) and then releasing it to find out if there is a remaining dimple [22]. We utilized the thermometer to take the temperature: the patient is considered febrile or pyrexial if the oral temperature taken is more than 37.5°C (99.5°F) or the rectal temperature measured exceeds 38°C (100.5°F) [24].

3.7 Ethical Considerations and Informed Consent

This study complied with the Declaration of Helsinki (1964) [25]. Chad-China Friendship Hospital management and the Therapeutic Nutritional Unit's medical coordination were notified about the study protocol and data collection tools. A research authorization was issued by the Centre National de Nutrition et de Technologie Alimentaire (CNNTA) with the approval number of N°043/RT/PR/PM/MSP/SE/SG/CNNTA/2015. The study's purpose was explained to the research participants. Informed oral consent was received after a briefing on the purpose and protocol of the study. Privacy and confidentiality concerning information

were assured to families. Only the healthcare provider's team, implicated in the patient's care, was given permission to access patients' medical information. Once families had consented to the data collection, they were allowed to take part in the study.

3.8 Statistical Analysis

The data was gathered and inputted into Microsoft Office Excel 2010. Descriptive statistics was conducted using MS Excel 2010. Quantitative variables were described as mean and categorical variables were described in terms of proportions.

4. Resutats

The study recruited a total of 326 hospitalized patients. The following factors and outcomes are discussed below: sociodemographic factors, factors related to healthcare access, diet, medical history, clinical profile, duration of hospitalization, hospitalization, and clinical outcome.

4.1 Socio-Demographic Characteristics

Our study population was predominantly of male sex with 65.6% (212 out of 326), favoring a sex ratio for males (1.85) as presented in Table 1. The mean age of study participants was 11.5 ± 6.87 months (range: 20 days to 39 months). The majority of families practice Islam (85.9%, 280 over 326) (Table 1). There were 11 (Table 1) orphans out of 326 study participants, with six children's fathers (1.8%) and five children's mothers (1.5%) having died. The majority of the mothers (79.5%, 258 over 326) were illiterate (Table 1). Similarly, 238 fathers out of 326 (73.0%) were illiterate (Table 1). Out of 326 patients, 278 (85.3%) parents of the patients were married (Table 1). Almost half (Table 1) of the fathers were unemployed or working odd jobs (45.7%). All mothers were housewives (Table 1). Out of 326 children, 67.5% (220/326) were from households with 1 to 4 children (Table 1).

Characteristics	Study Population (n)	Percentages (%)
Sex		
Male	212	65.0
Female	114	35.0
Age groups (months)		
0-5	35	10.7
6-11	123	37.7
12-23	138	42.3
24-59	30	9.2
Religion		
Muslim	280	85.9
Christian	35	10.7
Atheists	11	3.4
Parent’s status (alive/ deceased)		
Alive	315	96.6
Father deceased	6	1.8
Mother deceased	5	1.5
Both parents deceased	11	3.4
Mother’s educational status		
Illiterate	258	79.5
Elementary school	57	17.5
High school	11	3.4
Father’s educational status		
Illiterate	238	73.0
Elementary school	46	14.1
High school	42	12.9
Marital Status		
Married	278	85.3
Single mothers	37	11.3
Widowed	11	3.4
Father’s occupation		
Unemployed/odd jobs	149	45.7
Traders	110	33.7
Civil servants	49	15.0

Students	18	5.5
Mother's occupation		
Housewives	326	100
Maternal age (years)		
15-25	158	48.5
26-36	159	48.8
More than 37	9	2.8
Number of children in the household		
1-4 Children	220	67.5
5-9	98	30.1
Ten or more	8	2.5

Table 1: Socio-Demographic Characteristics of the Study Population

4.2 Factors Related to Healthcare Access

The distance of the TNU from the patient's residence varied from 1 to 20 km. Although most patients lived within 15 km, as represented in Table 2 from the TNU (77.6%, 253 over 326), many (22.4%, 73 out of 326) still traveled from a farther distance of more than 15 km Table 2. Our results revealed that patients' parents or guardians sought care at the TNU after more than five days (45.1%, 147 of 326) of symptom onset. Most of the patients (73.6%, 240) presented to TNU as the first point of contact, as displayed in Table 2.

Independent variable	Study Population (n)	Percentages (%)
Distance from TNU		
Within 15 km	253	77.6
More than 15 km	73	22.4
Onset of symptoms		
1-2 days	50	15.3
3-5 days	81	24.8
More than five days	147	45.1
Not precise	48	14.7
First point of contact		
Nutrition Services in Ambulatory Care Settings	89	27.3
Home	151	46.3
Other health structures	86	26.4

Table 2: Factors Related to Healthcare's Access to the Study Population

4.3 Dietary Pattern, Medical History, and Clinical Factors

Cereal porridge (57.1%, 186 out of 326) is the predominant diet of our study populations as demonstrated in Table 3. There were 18 patients (17%) who weaned on breastfeeding at the age of 0-5 months, and the majority (74 patients, 72%) weaned at the age of 6-15 months (Table 3).

Most patients (75%, 243) have dropout vaccination status, and only 44 patients (14%) out of 326 patients completed their vaccination as displayed in Table 3. More than half of the participants (56.7%, 185) had undergone uvulectomy. These children were mainly hospitalized with symptoms of diarrhea (18.1%), followed by cough and fever (14.7%), along with other symptoms as the findings from Table 3.

Most SAM patients presented with marasmus type (90.2%, 294 out of 326) in whom the admissions criteria used were MUAC <115 mm, Z-score < -3, or the association of both (Table 3). In marasmus patients whose MUAC was taken, most of them (47.8%, 98 out of 205) measured less than 100 mm (Table 3). Edema was found in the other group of children (9.81%, 32 out of 326) (Table 3) who fit into the definition of kwashiorkor, but all of them were diagnosed with marasmus as well and are considered to have the mixed form (kwashiorkor + marasmus) of SAM. The majority of SAM's mixed forms were admitted based on the criteria of edema and Z-score < -3 (68.8%, 22 out of 32) (Table 3). Among marasmus patients admitted at the TNU without MUAC, 21.4% (19 out of 89) weighed less than 3 kg. The main criterion for admission is the existence of medical complications. Most of SAM's patients presented with respiratory tract infections (40%) or others, as presented in Table 3.

Independent variable	Study Population (n)	Percentages (%)
Diet		
Formula	30	10.5
Cereal porridge	186	57.1
Vegetables, fish, and meat	136	41.7
Breastfeeding and cereal porridge	26	8.0
Breastfeeding Weaning Age		
0-5 months	18	17
6-15 months	74	72
16-24 months	11	11
Vaccination Status		
Complete	44	14
Up-to-Date	35	11
Dropout	243	75
Uvulectomy History in the Study Population		
Yes	185	56.7
No	139	43
Symptoms		
Vomiting	12	3.6
Diarrhea	59	18.1
Fever	31	9.5
Cough	18	5.5
Anorexia	4	1.2
Cutaneous Eruption	5	1.5
Vomiting, diarrhea, and fever	43	13.2
Vomiting and diarrhea	39	12.0
Vomiting and fever	17	5.2
Diarrhea and fever	24	7.3
Cough and fever	48	14.7
Anorexia and fever	23	7.1
Cutaneous Eruption and fever	3	0.9
SAM type		
Marasmus	294	90.2
Marasmus & Kwashiorkor	32	9.8
MUAC distribution in Marasmus patients		
< 100 mm	98	47.8
100-109 mm	64	31.21
110-114 mm	43	20.97
Distribution of Marasmus patients' admission criteria		
MUAC < 115 mm	200	68.0
Z-score < -3	89	30.3
Both MUAC and z-score	5	1.7
Distribution of marasmus patients without MUAC as admission criteria		
No MUAC measures (just z-score as criteria)	35/89	39.3
Aged < 6 months old (just z-score as criteria)	35/89	39.3
Weight less than 3 Kg (just z-score as criteria)	19/89	21.4
Admission criteria for mixed form (Marasmus & kwashiorkor) of SAM		
edema + MUAC + z-score	5	15.6
edema + z-score	5	15.6
edema + MUAC	22	68.8

Medical Complications Associated with SAM patients		
URTI	48	15
LRTI	83	25
Enteritis	54	17
Conjunctivitis	9	3
Others	132	40

Table 3: Dietary Pattern, Medical History, and Clinical Factors of the Study Population

4.4 Length of Hospitalization and Outcome

The patient's hospital stay of five days represented 35% (114/326) of cases (Table 4). Out of the 326 cases, 225 (69.0%) patients were discharged after recovery (Table 4). During our study period, we have listed 11 (3.37%) patients' deaths (Table 4). Among the 11 patients who died, 6 (54.5%) most of them belonged to the 12-24 month age group (Table 4). The primary cause of death in these patients was attributed to gastroenteritis (63.6%) (Table 4).

Independent variable	Study Population (n)	Percentages (%)
Hospital's stay length		
Three days	88	27.0
3-5 days	114	35.0
Ten days	16	4.9
More than ten days	85	26.1
Hospitalization outcome		
Discharged after recovery	225	69.0%
Clinical improvement	39	11.9%
Discharged against medical advice	9	2.76%
Clinically stable	33	10.1%
Referred to tertiary care centers	9	2.76
Died	11	3.37%
Age group of deceased patients		
12-24 months	6	54.5%
6-11 months	4	36.4%
0-5 months	1	9%
Primary cause of death		
Gastroenteritis	7	63.6%
Pneumonia	3	27.3%
Staphylococcus infection	1	9.1%

Table 4: Length of Hospitalization and Outcome of the Study Population

5. Discussion

We conducted a cross-sectional survey-based study in a secondary referral hospital in N'Djamena, focusing on children from 0 to 59 months old with SAM. This study analyzed SAM's underlying sociodemographic, clinical variables, and outcomes over one month after hospitalization. Our study has shown the pattern of male predominance (65.0%) consistent with the study conducted by Chiabi et al. (50.8%) in Yaoundé and by Irena et al [26]. (53.5%) in Lusaka [27]. Results also showed that SAM was more common in the 6 to 11 months and 12 to 23 months' age group, with 37.7% and 42.3%, respectively. The results were consistent with a study conducted in Nigeria by A. Ubesie et al [28]. Most of the patient's parents practice Islam (85.9%), which can be justified by the predominantly Muslim neighborhood of the TNU. Similar demographics were noticed in another study by Abessa et al. at Jimma's University Hospital in Ethiopia [29]. This study has reported that most SAM children (67.4%) had one to four siblings. Mothers of the patients were predominantly between 15-35 years (97.3%). Having more siblings in one family household is linked with the family's economic status, and it can harm the quantity and quality of the family's food ration, suggesting that a large family size contributes significantly to malnutrition [30].

Almost three-fourths of fathers (73%) and mothers (79.5%) reported being illiterate, which can contribute to their children's nutritional status [31]. Father illiteracy was significantly associated with SAM [32]. These characteristics have reflected their lack of education and irregular income, exposing them to poverty that will limit the food supply shortage, hygiene, sanitation, and access to health care. It will lead to malnutrition and infection susceptibility, increasing the financial burden.

Most patients (45.1%) admitted to the TNU have consulted five

days after the symptoms. These results may have reflected the patients' knowledge or ignorance about access to health care and approaching healthcare in critical conditions. WHO often imputes children or maternal mortality in low-and middle-income countries to the phenomenon known as "three delays": (i) delay in deciding to seek care, (ii) delay in identifying and reaching healthcare facilities, and (iii) delay in receiving adequate and appropriate treatment [33].

Most patients (83%) started to wean breastfeeding after six months. Exclusive breastfeeding after six months increases the risk of SAM in children [34]. Three-fourths of patients (243, 75%) were vaccination dropouts, which increases the risk of SAM in children [34]. Interestingly, more than half (57.0%) of patients in this study had undergone uvulectomy. These aseptic surgical procedures were said to be exposed to infections [35]. This study has reported that SAM consists of 90.2% marasmus type and 9.8% mixed form (marasmus and kwashiorkor). In comparison, this prevalence of marasmus was nearly similar to a study conducted in Cameroon [26].

Diarrhea was the most common presentation, consistent with previous studies reflecting that prolonged diarrhea was a significant risk factor in the occurrence and complications of SAM in children [35]. Among hospitalized patients, the majority of SAM children (35.0%) had a length of stay of 3-5 days, which is significantly lower compared to the international standard (SPHERE), which sets management of SAM to <30 days [36]. This result was also lower than a study conducted in Yaoundé, Cameroon (8.25 days) and Gedeo Zone, Ethiopia (14 days) [26,37]. On the contrary, another study done in Gado outpatient therapeutic center in Cameroon reported a median duration of stay of 48, 36.3, and 24.5 days for those with marasmus, marasmic kwashiorkor, and kwashiorkor, respectively [38]. These results show that a dynamic and practical treatment approach in TNU has helped the smooth and speedy recovery of hospitalized SAM children. It was reflected by higher discharge rates (69.0%) and clinical improvement with inpatient SAM children (11.9%). Chad reports a high burden of SAM cases and the second-highest under-5 mortality globally [39]. This study has reported 11 deaths out of 326 SAM children (3.4%), pointing to late access to health services, jeopardizing these patients' vital prognoses. This study reported a relatively lower mortality rate. Mortality in our study was lower than the minimum SPHERE standard (10%), as well as compared to the study of GADO Outpatient Therapeutic Center in Cameroon (9.3%) and hospital-based study in Yaoundé, Cameroon (15%). The lower mortality rate in our study possibly reflects the contributory role of this nutritional and therapeutic center in death reduction. Most of the deaths, six out of eleven (54.5%), were of 12-24 months. It may be due to an increased risk of infection in the weaning age group because of depressed immunity and irregular, insufficient feeding practices [40].

Major complications causing death were gastroenteritis (63.6%). This study has reported that diarrhea isolated or associated with other functional symptoms was prevalent in half of the study patients. This is consistent with the work of Tickell KD et al [41]. who found that children with acute malnutrition and diarrhea are at high risk for mortality. Our findings explain the fact that acute malnutrition is also a risk factor for diarrhea-associated mortality. Most deceased patients (9/11; 81.8%) had a length of stay fewer than 48 hours. The deaths are explained by the late health access, patients arriving at the TNU in the deleterious state, making it unlikely to stabilize their health and possibly have a poor prognosis.

5.1 Strength and Limitation of the Study

This study's unique feature is the inclusion of data regarding the classification of SAM cases in the capital of Chad, N'Djamena. It revealed significant information related to the features of children with SAM.

The study was unfortunately carried out for one month, and another team carried out further evaluation as the study findings were shared with them. We did not assess the income of families due to inconsistent employment and the inability to determine the exact monthly income.

One major limitation was regarding communication with the parents of patients. The language barrier with the parents was notable as the parents were comfortable speaking their mother tongue. They didn't speak or understand French or local Arabic, which necessitated an interpreter for translation while interviewed.

6. Conclusion

The study concluded several factors associated with SAM children, including parents' illiteracy, delayed healthcare access, Exclusive breastfeeding after six months of age, a large number of vaccination dropouts, and the practice of uvulectomy in children. Diarrhea is the principal reason for healthcare-seeking and has proved to be a significant pathology with eminent lethality. Overall, illiteracy and unemployment have specified the need to strengthen the primary infrastructure of education, health education, and possibly some policy initiatives for compulsory education. Addressing the root causes is necessary to achieve a definitive and permanent solution for malnutrition. A stepwise approach will immensely help the holistic management of SAM patients.

There is a need for quantitative and qualitative studies involving the parents' acquaintance concerning their feeding and traditional practices linked with malnutrition. A nationwide study in households for the quantitative and qualitative analysis of nutrients given to children aged 0-5 years to demonstrate a cause-and-effect relationship between hygiene and the occurrence of malnutrition, as well as a passive screening for malnutrition in the community managed by health centers, would be among the future perspectives to think about in the fight against malnutrition.

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