

The clinical spectrum of severe acute malnutrition in children in Cameroon: a hospital-based study in Yaounde, Cameroon

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Background: Severe acute malnutrition (SAM) is a major health problem, and the cause of more than half of childhood deaths in children less than 5 years in developing countries. Globally, 20 million children under 5 years of age are severely malnourished according to the World Health Organization (WHO). In Cameroon, the prevalence of SAM remains high and estimated at 1.9% in 2011 and 1.3% in 2014. The aim of this study was to determine the epidemiology, clinical aspects and outcome of SAM at the Yaounde Gynaeco-Obstetric and Pediatric Hospital (YGOPH).

Methods: We retrospectively reviewed the medical records of children hospitalized in the YGOPH for SAM over a period of 8 1/2 years (from September 2006 to March 2015). We included the medical records of children under 15 years of age who were hospitalized in the pediatric unit of the YGOPH for the management of SAM. Data was collected using a data entry form and was analyzed with Epi info version 3.5.4 software. Data was considered statistically significant for P less than 0.05.

Results: The prevalence of SAM was 2.72%. The median age was 9 months (range, 23 days–112 months). The most represented age group was 6 to 12 months with 34.6% of the children. The most frequent symptoms on admission were: wasting (58.1%) and fever (53.6%). The mean interval between the onset of symptoms and admission was 30.36 days. Marasmus was the most frequent clinical form of SAM observed in 88.8% of the children. Respiratory tract infections were the most common comorbidities and were present in 45 patients (25.1%), followed by malaria in 15.1% of cases. The sero-prevalence of human immunodeficiency virus (HIV) was 43.75% amongst the 32 children whose HIV status was known. Dehydration was the most frequent complication, with an occurrence of 29.6%. A total of 58.7% of patients were discharged following clinical improvement and the mortality rate was 15%. The average duration of hospitalization was 8.25 days.

Conclusions: SAM is a frequently encountered pathology in this context with a high mortality, thus the need to step up prevention strategies. Health education during pediatric consultations and vaccination sessions on the appropriate feeding of the young infant and the child should be reinforced.

Keywords: Severe acute malnutrition (SAM); child; hospitalization; Cameroon

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Introduction

In 2009, the World Health Organization (WHO) estimated that 20 million children under 5 years suffered from severe acute malnutrition (SAM) worldwide (1), which is associated to more than half of their deaths each year in developing countries. SAM has been a real obstacle to the achievement of the fourth Millennium Goal for development (2). In Africa, severe malnutrition is responsible for 5–15% of deaths in children from 0 to 59 months, causing about 1 to 2 million deaths yearly (3). In 2011, the demographic and health multiple indicator survey revealed that Cameroon globally has 5.6% of children with acute malnutrition with 1.9% of them being severely malnourished (4), and the prevalence stayed at 1.3% in 2014 (5). Most studies on malnutrition so far assessed the nutritional status of children in certain communities of the country, notably the study of Nem in Garoua in 2010 among preschool children (6), and more recently in 2014 evaluating the nutritional status of children aged from 6 to 59 months in the localities of Mouanko (7) in the Littoral and Bafou in the West region (8).

We decided to carry out a study on malnutrition in a hospital setting precisely in Yaounde Gynaeco-Obstetric and Pediatric Hospital (YGOPH) which has a nutritional rehabilitation unit since 2003. This work aims to determine the epidemiological, clinical aspects and outcome of children with SAM managed in YGOPH.

Methods

The study was conducted in the general pediatric service of YGOPH which has a management unit for malnutrition. The YGOPH is a category one hospital located in Cameroon's capital Yaoundé receiving patients from Yaoundé and all over the country.

This was a descriptive and retrospective cross-sectional study that was carried out from September 1st 2006 to March 31st 2015. The source of our data was the admission and medical files. The children included in our study were under 15 years old and presented with at least one of the following criteria by Golden *et al.* (9):

- (I) For infants less than six months or less than 3 kg: infants too weak to suckle effectively regardless of the weight for height index (W/H), weight for age (W/A) or any other anthropometric measure; and/or infants no longer gaining weight at home after a series of weight gain during growth monitoring,

and/or infant with an index of W/H < -3 Z score, and/or with bilateral edema;

- (II) For children over six months and more than 3 kg: W/H index < -3 Z score, and/or presence of bilateral edema, and/or mid upper arm circumference (MUAC) < 115 mm (6–59 months);
- (III) For children admitted into the study we collected the following information: socio-demographic data (age and sex of patients) and characteristics of mothers (maternal age and occupation), and the father's profession;
- (IV) Clinical data: anthropometric parameters, signs and symptoms on admission, clinical forms of SAM, complications and comorbidities on admission;
- (V) Data on the outcome: number of days of hospitalization, weight gain, clinical evolution of those discharged alive, number of deaths and causes of death.

The data collected by the data sheets were entered and analyzed using Epi Info Version 3.5.4 software, and Microsoft Office Excel 2010. The quantitative variables were described as mean \pm standard deviation and categorical variables were described in terms of proportion.

For anthropometric variables, they were interpreted using the WHO Anthro software Version 3.2.2 and WHO Anthroplus version 1.0.4 for children over 60 months. We made a description of the number of days of hospitalization with a univariate analysis. P value was calculated using the Mann Whitney/Wilcoxon test which is used to compare means. The significance level was set at $P < 0.05$.

Results

Epidemiological features

From September 2006 to March 31, 2015, 17,981 children were admitted in the pediatric unit of the YGOPH. Among these children, 489 presented with SAM, giving a prevalence for SAM of 2.72% in our hospital setting. We excluded files that did not contain anthropometric data, that had incomplete records or that were missing. A total of 179 medical files met our eligibility criteria (*Table 1*) and were exploited. Among the 179 retained files, 88 (50.8%) were male and 91 (49.2%) female giving a sex ratio of 0.97. The median age on admission was 9 months with extremes of 23 days and 112 months. The most represented age group was that of 6 to 12 months, with 34.6% of cases. The average age of the mothers was 26 ± 6.5 years, ranging from 13 to 47. About 27.7% of the mothers were within

Table 1 Distribution of children with SAM according to the inclusion criteria

Inclusion criteria	Number of cases (n=179)	Percentage (%)
Weight/height less than -3 Z-score (n=145)	99	68.27
Mid upper arm circumference less than 11.5 cm (6–59 months) (n=120)	94	78.33
Nutritional oedema (n=179)	18	10.06
Poor weight gain* (0–6 months and/or less than 3 kg) (n=47)	15	31.92

*, infant not putting on weight at home or too weak to suckle adequately regardless of the weight for height index or any other anthropometric parameter. SAM, severe acute malnutrition.

Table 2 Signs and symptoms upon admission

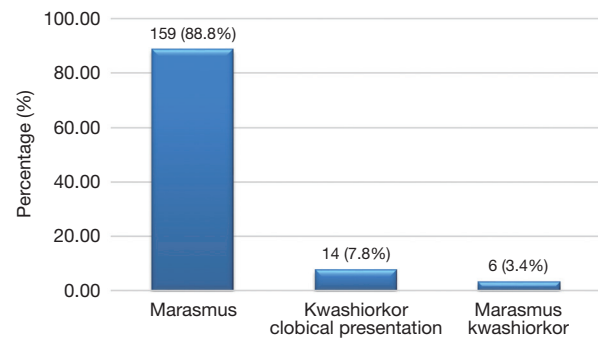
Signs and symptoms	Number of cases* (n=179)	Percentage (%)
Weight loss	104	58.1
Fever	96	53.6
Anorexia	84	46.9
Diarrhea	73	40.8
Cough	59	33.0
Asthenia	55	30.7
Vomiting	50	27.9
Respiratory distress	23	12.8
Edema	18	10.1
Convulsions	17	9.5
Skin lesions	8	4.5
Alteration of consciousness	4	2.2
Other functional signs**	8	4.5

*, a patient could have many signs and symptoms; **, irritable, abdominal pain, rhinorrhea, otorrhea.

the 20–25 years age group and 48.4% of mothers were unemployed. When they were employed, it was a liberal profession in 33.3% of cases. As for fathers when their profession was known, it was mainly liberal (65.1%).

Clinical features

The main symptoms on admission were weight loss, fever and loss of appetite with 58.1%, 53.6% and 46.9% as respective frequencies (Table 2). The median time interval between the onset of symptoms and admission was 14

**Figure 1** Distribution of the clinical forms of severe acute malnutrition.

days (range, 1 to 390 days). Marasmus was the dominant clinical form with 88.8%, then kwashiorkor with 7.8% and marasmus- kwashiorkor with 3.4% (Figure 1).

Altogether, 85.01% of the study population presented with at least one comorbidity. Respiratory tract infections were the dominant comorbidities (25.1%) followed by malaria and sepsis (Table 3). Of the 179 exploited cases, the human immuno deficiency virus (HIV) status was known for 32 children, and 14 of them tested positive (43.75%). The most common complication on admission was dehydration (29.6%). Hypoglycemia and heart failure was the least common (Table 4).

Of the 60 children in our sample whose age of introduction of foods other than breast milk was known, 26 began before 6 months, giving 43.3%. The 18 medical files of children of 6 months and above that informed us on diet from birth to 6 months showed that 10 were exclusively breastfed till 6 months, making up 8.3% of our patients.

Outcome

One hundred and five children had a favorable clinical

Table 3 Distribution of comorbidities

Comorbidities	Number of cases* (n=179)	Percentage (%)
Pneumonia	45	25.1
Malaria	27	15.1
Sepsis	26	14.5
Dermatitis	17	9.5
Thrush	11	6.2
Urinary tract infection	11	6.1
Dysentery	8	4.5
Otitis	9	3.9
Cerebral motor disability	5	2.8
Mouth ulcers	5	2.8
Meningitis	4	2.2
Other comorbidities**	15	8.4

*, a patient could present more than one comorbidity; **, pyloric stenosis, Hirschprung’s disease, labiopalatine cleft, osteomyelitis, pericarditis anal imperforation.

Table 4 Distribution of complications on admission

Complications	Number of cases* (n=179)	Percentage (%)
Dehydration	53	29.6
Anemia	14	7.8
Respiratory distress	12	6.7
Septic shock	6	3.4
Hypothermia	5	2.8
Hypothermia	2	1.1
Heart failure	1	0.6

*, a patient could have more than one complication.

evolution, while 27 deaths were recorded (Table 5). Septic shock (25.9%) and respiratory distress (18.5%) were the most frequently found causes of death, with 44.4% of deaths with no known cause (Table 6).

Among the 94 cases of marasmus whose discharge was authorized, 80 had gained weight; making up 85.1% while 51.25% of them had a satisfactory weight gain of greater than 10 g/kg/day (Figure 2). The average daily weight gain

Table 5 Evolution during hospitalization

Progression	Number of cases	Percentage (%)
Favorable	105	58.7
Dead	27	15.0
Transfers to other units	10	5.6
Discharged against medical advice	37	20.7
Total	179	100.0

Table 6 Causes of death

Causes of death	Number of patients	Percentage (%)
Septic shock	7	25.9
Respiratory distress	5	18.5
Dehydration	1	3.7
Hypothermia	1	3.7
Anemia	1	3.7
Unknown	12	44.4
Total	27	100.0

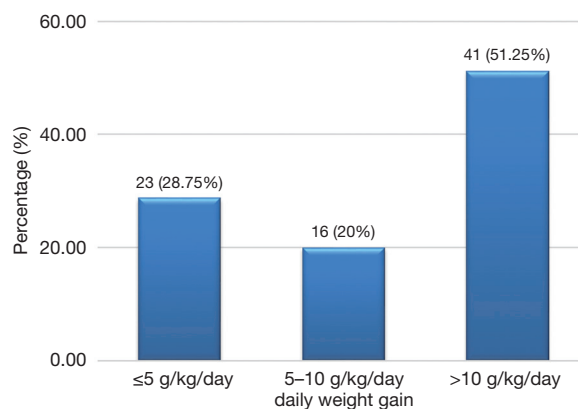


Figure 2 Pattern of weight gain.

was 15.86±13.8 g/kg/day. Among the 10 children who had edema and were discharged, 5 had an average daily weight loss of 4.9±2.9 g/kg/day, 4 experienced a mean weight gain of 7.7±8.3 g/kg/day and 1 child had no weight gain. The overall average number of days of hospitalization was 8.25±5.6 days with a range of 1–34 days. Deaths occurred on average before the first four days of admission (3.77 days)

Table 7 Distribution of mean hospital stay and the clinical presentation of SAM

Variables	Number of cases	Mean (days)	Standard deviation (days)	P
Mode of discharge (n=132)				
Authorized	105	10.27	5.41	0.0000
Death	27	3.77	4.30	
Clinical form of SAM (n=132)				
Marasmus	116	8.40	4.93	0.0624
Kwashiorkor	12	14.5	9.70	0.0116
Kwashiorkor marasmus	4	8	7.35	0.6156

SAM, severe acute malnutrition.

with a range of 1 to 17 days. The death occurred almost twice earlier than the discharge date ($P=0.0000$) (Table 7). Children whose discharge was authorized were hospitalized for a number of days ranging from 2–34 days. Children with marasmus had on average 8.4 days of hospitalization, while those with kwashiorkor had a larger average number of days of hospitalization 14.5 days ($P=0, 0116$) (Table 7).

Discussion

We found a prevalence of SAM of 2.72%, the rate was similar to that found by Ubesie *et al.* in Nigeria which was 2.8% (10) and below the 3.75% found by Ehouzou (11) in 2014 at the Mother and Child Centre of the Chantal Biya Foundation (MCC/CBF). This difference can be explained by the fact that the MCC/CBF has a hospitalization and treatment unit for SAM with a greater capacity than the YGOPH. The sex ratio was 0.97 which indicates a virtual equality between the sexes with a slight female predominance. Mutombo *et al.* in Ivory Coast had found a sex ratio of 0.91 (12). Ubesie *et al.* in Nigeria had also found a female predominance (10) and Irena *et al.* in Zambia in 2014 had a male predominance (13) with no statistically significant difference. The median age of our study population was 9 months. This age was lower than the 17 months found by Irena *et al.* in 2011 in Zambia (13). It should also be noted that this study included children from 6 months; whereas we included children from the neonatal period. In our study, SAM was more common in the age group of 0 to 6 months and 6 to 12 months with respectively 32.4% and 34.6% of the population, while Ubesie *et al.* noted that children from 6 to 12 and 12 to 24 months were the majority. The age group of 0 to 6

months held the second highest proportion in our study. This can be explained by the frequency of poor feeding practices: weaning, poor dilution and poor hygiene of feeding bottles listed in our study. Those whose ages were between 6 and 12 months in our study had the highest proportion. This can be explained by the fact that it is in this age group that food diversification is done and when poorly managed, it promotes the occurrence of malnutrition.

The maternal age ranged from 13–47 years with a mean age of mothers 26.3 ± 6.5 years, those whose ages ranged between 20 and 25 years were most represented (27.7%); this age is the usual period of maternity in Cameroon according to the 2011 Demographic Health Survey in Cameroon (4).

Weight loss and fever were the most frequent functional signs on admission representing 58.1% and 53.6% respectively. This could be due to high proportions of marasmus (88.8%) in our study population. Marasmus is reflected by severe wasting ($P/T < -3$ Z score). Ubesie *et al.* and Irena *et al.* had found a predominance of diarrhea in 72.7% and 59.2% respectively (10,13) in our study it was present in 40.8% of patients. The average time between the onset of symptoms and admission to the YGOPH was 30.36 days; which is relatively long. It can be explained by the habit of seeking care with self-medication and sometimes traditional medicine, which are the first means of routine care in our community. We have not found other authors who have studied this variable.

The most encountered complication was dehydration (29.6%), this is due to the large proportion of diarrhea (40.8%) in our study, although clinical signs used to assess dehydration are confused with those of SAM. The diagnosis

of dehydration was made if there was recent fluid loss form diarrhea or vomiting, thirst and a change in the eyeballs, as indicated by the mother. In second place we had severe anemia (7.8%) which was considered when the hemoglobin level was less than 4 g/dL or when the hematocrit was below 12%. This rate was higher than that found by Bachou *et al.* in Uganda (6.5%) (14) and lower than that found by Ubesie *et al.* (24.2%) (10). The most predominant clinical form of SAM was marasmus (88.8%), followed by kwashiorkor (7.8%). The predominance of marasmus was found by several authors including Ubesie *et al.* (34.9%), and Mutombo *et al.* in Ivory Coast (70.5%) (10,12). In Sudan, Gabbad *et al.* instead found a predominance of kwashiorkor in children under 5 years (43.8%) (15).

Regarding comorbidities, 81.56% of children with SAM had at least one co morbidity that is, pneumonia (25.1%) (with 3 cases of pulmonary tuberculosis), malaria (15.1%) and sepsis of unknown focus (14.5%). These three pathologies were also the majority in the Ubesie *et al.* study (10), but in different proportions. In India in 2014, Kumar *et al.* had found a proportion of lung infections of 27.8%, relatively similar to that found in our study (16). The HIV status was known in 32 of our patients, that is 17.8%.

This rate is low compared to that found by Saloojee *et al.* in South Africa (39%) (17). This is due to the fact that the results of the HIV serology test were not available in the records or was not systematically requested in all cases of SAM. Among them, 14% or 43.75% had a positive status. Other studies have found a lower rate, namely in Zambia (38.9%) (13); and in Nigeria (13.6%) (10). However the HIV serology prevalence of our study was lower than that observed by Saloojee *et al.* in South Africa that is 87% (17). Among the 132 patients whose progression in the hospital was known, 27 died giving a mortality rate of 20.45%. Children with marasmic-kwashiorkor had a higher mortality rate of 75%. Ubesie *et al.* had also observed a high mortality in children with marasmic- kwashiorkor compared to other clinical forms of SAM (53.3%) (10). The mortality rate observed in our study is higher than that found by Savadogo *et al.* in Burkina Faso 16% (18); but significantly lower than those found in Nigeria by Ubesie *et al.* (10) and in Zambia by Irena *et al.* (13) with 40.1% and 40.5% respectively. This difference can be explained by the fact that our study focused on a more recent period and benefited from newer and improved treatment protocols.

We noted that all children who tested negative for HIV survived; while a large proportion of those who tested positive died (35.7%). It is a co-infection which forms with

malnutrition a vicious circle of immune-suppression and opportunistic infections that can lead to death.

The most frequent causes of death were septic shock and respiratory distress. The high proportion of patients (20.7%) who were discharged against medical advice is due to the financial constraints of the parents. Death occurred in half of the cases in the first 2 days of hospitalization which corroborates the findings in Zambia of Irena *et al.* (13) this is repeated below. By the end of the first week, 78% of deaths had occurred. The average duration of hospitalization was 8.25 days with a range of 1 to 34 days, which is similar to Page *et al.* (8 days) (19); and to that found by Irena *et al.* (9 days) (13). Ubesie *et al.* had found a longer duration (16 days). Children who had kwashiorkor stayed longer in the hospital, 14.5 days on average in contrast to those with marasmus who spent 8 days in hospitalization on average. Ubesie *et al.* had also found that children with kwashiorkor spent more time in hospital than those with other clinical forms. We did not find in our study reasons that account for this difference but this can be explained by the fact that children with edema stay longer in the stabilization phase where loss of edema must occur before going to the rehabilitation phase. Therefore, their management takes longer than children with marasmus. Death occurred in half of the cases in the first 2 days of hospitalization which corroborates the findings of Irena *et al.* in Zambia (13).

Among the 94 cases of marasmus with favorable evolution, 80 gained weight, hence 85.1%. The mean weight gain was 15.86 (\pm 14.80) g/kg/day. This is higher than that observed by Savadogo *et al.* from 1999 to 2003 in a nutritional rehabilitation center in Burkina Faso, which gave 10.18 (\pm 7.05) g/kg/day (18). According to WHO, weight gain is considered small if it is <5 g/kg/day, medium or moderate if it is between 5 g/kg/day and 10 g/kg/day and satisfactory or good if it is >10 g/kg/day with nutritional rehabilitation (20). We recorded a satisfactory weight gain (>10 g/kg/day) of 51.25%, which is higher than that found by Hossain *et al.* in Bangladesh (30.90%) (21). Among children who presented with edema, half had an estimated weight loss of 4.9 (\pm 2.99) g/kg/day, it was higher than that found by Hossain *et al.*, which was 1.9 g/kg/day (21).

We did not address the therapeutic component because treatment protocols have been changed several times during the study period.

Conclusions

SAM remains a frequent severe public health problem in

developing countries such as Cameroon and is associated with high morbidity and mortality. It mainly affects infants under 24 months. The causes are dominated by poor feeding practices. SAM is grafted to significant comorbidities and complications responsible for the death of affected children. Information, education and communication to parents on the causes and prevention means of this condition must be strengthened by medical staff to reduce morbidity and mortality related to malnutrition.

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Footnote

Conflicts of Interest: The authors have no conflict of interest to declare.

Ethical Statement: The study was approved by the Institutional Committee for Ethics in Research in Human Health (No: 136/CIERSH/DM/2015) of the Yaounde Gynaeco-Obstetric and Pediatric Hospital. Since it was a retrospective study on patients' file informed consent from the patients was not necessary, but confidentiality of the information collected was ensured.

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