

## Determinants of Severe Acute Malnutrition in Children Aged 0-59 Months

Toralta Nodjitouloum Joséphine<sup>1,2\*</sup>, Souam Nguele S<sup>1,2</sup>, Djidita Hagre<sup>1,2</sup>, Granga DD<sup>1</sup>, Abdelsalam T<sup>2</sup> and Brahim Boy O<sup>2</sup>

<sup>1</sup>Pediatrics Department, University Hospital Center for Mother and Child - N'Djamena - Chad

<sup>2</sup>Faculty of Health Sciences, University of Ndjamen - Chad

**\*Corresponding Author:** Toralta Nodjitouloum Joséphine, Pediatrics Department, University Hospital Center for Mother and Child - N'Djamena, Chad.

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### Abstract

**Introduction:** Infant malnutrition is endemic in Chad. In 2018 in N'Djamena, the prevalence was 13.5%. This study aimed to identify factors influencing Severe Acute Malnutrition (SAM) in children under 59 months admitted to two Medical Feeding Centres in N'Djamena.

**Patients and method:** We conducted a cross-sectional, descriptive and analytical study of the files of children aged 6 to 59 months admitted for severe acute malnutrition in two feeding centres in N'Djamena, from September 2019 to February 2020. The files were selected randomly, and the study sample size was calculated using the Schwarz formula. Descriptive and analytical analysis was done using Chi-2 and binary logistic regression; a P value < 0.05 is considered statistically significant.

**Results:** Age 0-24 months (p = 0.001), breastfeeding mode (p = 0.027), early diarrhoea (p = 0.040), age of weaning (p = 0.013) and diversification (p = 0.034), self-medication (p = 0.047), and use of traditional care (p = 0.020) were significantly associated with SAM. The mother's age and education level (p = 0.029) are also factors in the occurrence of SAM. Environmental hygiene and especially hand washing before feeding the child (p = 0.007) were significant for the occurrence of SAM.

**Conclusion:** Factors related to the mother, the child and the environment interact closely to lead to SAM in the child. Only concrete and multidisciplinary actions can overcome this problem.

**Keywords:** Severe Acute Malnutrition; Infant; Medical Feeding Centre; N'Djamena

### Introduction

Malnutrition is a state of imbalance between the nutritional needs and intakes of an individual. It is a significant challenge of this century, occupying the first ranks of the SDGs (Sustainable Development Goal by 2030). Age 5, and more than 322,000 suffer from severe acute malnutrition yearly [1]. According to the results of the 2018 SMART (Standardized Monitoring and Assessment of Relief and Transition) survey [2], the average rate of acute malnutrition at the national level is 13.5% among children aged 6 to 59 months. N'Djamena, the country's capital, is 13.1% [3]. This study aims to identify the spectrum of determinants that lead to the occurrence of SAM in children less than five years old admitted to 2 Medical Feeding Centres in N'Djamena.

## Patients and Method

The Medical Feeding Centre of the Mother and Child Academic Hospital and the Medical Feeding Centre of Notre Dame des Apôtres Hospital served as the study framework. The study was a descriptive and analytical cross-sectional study conducted over six months which involved all children under 59 months admitted for severe acute malnutrition, with consenting mothers or caregivers. Children under 59 months admitted for Failure to Thrive associated with a chronic cardiovascular or cerebral pathology (cerebral palsy) and any malformation that could hinder their growth regardless of their diet were not included in the study. Sampling was random and concerned any case of severe acute malnutrition corresponding to the study population and the inclusion criteria. The sample size was 287 children. Variables studied: The dependent variable was the occurrence of severe acute malnutrition in children under 59 months-Independent variables: Socio-demographic characteristics of the child and the mother, socio-cultural characteristics, and environmental factors. Severe acute malnutrition is classified according to WHO 2006 standards [4]: Children aged 6 to 59 months whose W/H weight-height index is  $<-3$  z-score and/or MUAC  $<115$  mm and/or having nutritional oedemas. Pre-established questionnaires were sent to mothers and caregivers who consented. The available child follow-up notebooks were also consulted. We used the baby scale or SECA weight scale with 10 g precision; the Salter scale allows weighing up to 25kg with an accuracy of 0.100 kg. The electronic personal scale with an accuracy of 0.100 kg. The height was measured with the Shorr height chart for children; the Mid Upper Arm Circumference (MUAC) was measured with Shakir's bandages. We used the unisex tables of the WHO 2006 classification to determine the Weight-Height, Height-Age and Weight-Age ratios. Data entry and analysis were done using Statistical Package for the Social Sciences (SPSS) and Microsoft Excel software. The results are refined and compared by the chi-square continece test.

## Results

At the end of our investigation, 287 cases of malnourished from 0 to 59 months were collected, and the sex ratio male/female (M/F) was 1.03. The age group of 6 to 11 months was predominant (30.31%), with an average age of  $15.5 \pm 9.7$  months. The evidence of recurrent diarrhoea was found in 88.9% of cases. Of all the children surveyed, 63.8% were weaned before 24 months and only 7.7% after 24 months. The mothers were in 45.9% of cases in the age group of 25 to 34 years, with an average age of  $25.85 \pm 5.9$  years. They were, in 59.6% of cases, not educated. We found some harmful practices: removal of the uvula in 72.1% of cases, gum incisions in 81.9% of cases, and purging in case of diarrhoea in 81.2% of cases. Food taboos were reported in 69.7% of cases. The use of soap for hand washing was practised in 56.1% of cases. The borehole/pump was households' most common water source, with 71.4%. The proportion of families with an improved toilet was 72.1%, and 3.8% had no toilet.

### Breastfeeding mode

<i>Features</i>	<i>n</i>	<i>%</i>	<i>P</i>
<b><i>Breastfeeding method</i></b>			
Exclusive Breastfeeding	3	1,0%	
Mixed Breastfeeding	76	26,5%	0,027
Formula Feeding	6	2,1%	
Predominant Breastfeeding	202	70,4%	
EBM at 1% and predominant breastfeeding at 70.2%;			

**Table 1:** Distribution of children according to their diet.

*Diversification and type of meal*

<b>Features</b>	<b>n</b>	<b>%</b>	<b>P</b>
<b>Age at the start of diversification</b>			
Diversification not introduced	26	9,1	
Early	103	35,9	0,049
Normal	6	2,1	
Late	152	53,0	
<b>type of meal</b>			
specific meal	69	26,4	
Family meal	192	73,6	0,018

**Table 2:** Distribution of children according to age of diversification.*Characteristics of the mother*

<b>Educational level</b>	<b>n</b>	<b>%</b>	<b>P</b>
Educated	116	40,4%	+7
Not educated	171	59,6%	0,0029

**Table III:** Level of education of the mother.*Cultural practices*

<b>Features</b>	<b>n</b>	<b>%</b>	<b>P</b>
<b>Removal of the uvula</b>			
Yes	207	72,1%	0,007*
No	79	27,9%	
<b>Self-medication</b>			
Yes	208	72,5%	0,005*
No	79	27,5%	
<b>Traditional care</b>			
Yes	87	30,3%	0,020*
No	200	69,7%	

These practices are significant, i.e.,  $p < 0.05$ .

**Table 4:** Breakdown according to culture-related practices.

About 2 out of 3 older children have had their uvula removed.

- DHS 2015 [50]: 58% of children have undergone or will undergo removal of the uvula.

**Hand hygiene**

Features		n	%	P
<b>Washing hands before/after:</b>				
Toilet	Yes	176	61,3%	0,007*
	No	111	38,7%	
Handling of children’s food	Yes	157	54,7%	0,016*
	No	130	45,3%	
Having fed the child	Yes	163	56,8%	0,007*
	No	124	43,2%	
Have changed the child	Yes	174	60,6%	0,002*
	No	113	39,4%	

Hand washing: significant in all forms (p<0.05).

**Table 5:** Distribution according to hand washing.

- DHS 2015 [44]: one in five households (22%) had water and soap for hand washing.

Features	OR	IC 95%		P
		Inferior	Superior	
Sex	0,186	0,038	0,904	0,037*
Children’s age	0,165	0,005	5,595	0,022*
type of meal	0,314	0,107	0,916	0,034*
Oedema	2,395	1,119	5,124	0,024*
Hospitalizations	0,182	0,031	1,052	0,057
Malaria	24,174	1,937	301,712	0,013*
Underweight	0,168	0,066	0,428	0,000*
Growth retardation	0,378	0,143	0,998	0,050*
mother’s age	3,759	0,196	72,186	0,003*
mothers profession	2,536	1,176	5,468	0,018*
Self-medication	2,826	1,013	7,880	0,047*
Mx diarrhoea	3,275	0,883	12,145	0,076
Waste destruction	4,608	0,991	21,427	0,051
Standing water nearby	2,433	1,001	5,910	0,050*

\*: statistically significant link.

**Table 6:** Multivariate factors associated with SAM.

The multivariate analysis confirmed that the age of the children, the type of meal, oedema, and malaria had a statistically significant link with SAM, that is, p < 0.05. Similarly, the age of mothers and their occupation and standing water near houses also had a statistically significant link with the occurrence of SAM.

**Discussion**

**Characteristics of the child**

In our study, there was a slight male predominance in 50.1% of cases. The sex ratio is 1.03. Gender has no statistically significant link (p= 0.117) with the occurrence of SAM. This result corroborates that of other regional authors [5, 6], who observed a male predomi-

nance of 57.7% and 51.3%, respectively.

The age group from 6 to 23 months represented the most, with 67.94% of cases. The average age is 15.5±9.7 months. Age has a statistically significant link with the occurrence of SAM ( $p = 0.001$ ). Some authors from the sub-region: Ndoumbé in 2015 [12] and Awoke et al. in 2016 [13], respectively, reported that 67% and 68.2% of malnourished children surveyed were under 23 months. According to UNICEF [14], the prevalence of SAM is high between 0 and 24 months.

In children, the age group between 6 and 23 months, included in the first 1000 days, is marked by solid growth and an increase in nutritional needs; it is also the period during which food diversification takes place [15, 16]. Thus, the intake, often insufficient in quantity and quality, early or late, exposes the child to the risk of nutritional deficiencies, making him more vulnerable to external aggressions.

### *The type of breastfeeding*

We found that 70.2% of the children were or are under predominant breastfeeding, 28.6% under mixed or artificial breastfeeding. Exclusive breastfeeding was found in only 1% of cases. There is a statistically significant link between SAM and the child's breastfeeding type  $p=0.027$ .

Our results support the observations of the 2018 SMART survey [11], in which 87.3% of women breastfeed their babies for up to one year and beyond, but less than one in six women practice exclusive breastfeeding.

Exclusive breastfeeding for the first six months of a child's life is recommended by the WHO [15], as it is an effective way to protect the child from common childhood illnesses [17]. A child not breastfed exclusively with breast milk is exposed to and risks having repeated diarrhoea leading to under nutrition. This risk is increased by the poor quality of water, the mode of sterilization of baby bottles, and the reconstitution and conservation of substitute milk [18]. Thus, we must insist, during prenatal consultation, on the importance of Exclusive breastfeeding.

### *The age of food diversification*

In 58.24% of cases, the first food (porridge) was introduced late (between 9 and 15 months), while 35.46% had received it before six months (early). The age of diversification has a statistically significant link to the occurrence of SAM ( $p = 0.049$ ). These figures are similar to the authors [9] in N'Djamena. They found that food was introduced in 33.4% of cases before six months.

The type of meal is statistically significant with the occurrence of SAM,  $p = 0.034$ . Poorly conducted diversification (early or late) is a source of malabsorption and insufficient intake. Thus, for nutritional needs to be met, complementary foods must be provided at the right time and be adequate and safe [19].

### *Weaning age*

Two hundred five children (205) in our sample were weaned off. The weaning age is between 12 and 24 months for 66.3% of the malnourished, with an average of 18 months. Furthermore, it is 22.9% weaned before 12 months. Weaning age has a statistically significant link with the occurrence of SAM ( $p = 0.013$ ). Ndoumbé [12] in Dakar found that the average weaning age in the severely acutely malnourished population was 18.9 months. The weaning period is a delicate time for the child on the nutritional level. When done too early and especially disruptively it causes a nutritional imbalance that leads to undernourishment.

### *Medical history and early signs*

Infectious diseases during childhood are found in the history of malnourished children surveyed, with a high prevalence of diarrhoea at the onset of the disease in 88.8% of cases. It is significant with  $p=0.004$ .

Ndamobissi, in 2017 [21], reported that diarrheal diseases are by far the most detrimental to the nutritional status of children in sub-Saharan Africa. Diarrhoea is the second leading cause of death in children under five after pneumonia. It opens the way to malnutrition [19, 20]. The history of recurrent malaria ( $p = 0.013$ ) and vomiting ( $p = 0.010$ ) as a sign of onset are statistically significant with the occurrence of SAM. Untreated or poorly treated, any condition can lead to malnutrition in children. Characteristics of mothers: The predominant age group among mothers was 25 to 34 years old at 44.9%, followed by 18 to 24 years old (40.1%) with an average age of  $25.85 \pm 5.9$  years. The mother's age has significance in the occurrence of SAM in children with  $p = 0.004$ . This result was also found by Mukuku et al. [20] in the Democratic Republic of Congo. The young age of onset of childbearing most often linked to early marriage in our contexts may explain the relatively young age of the mothers in our sample. Therefore, the immature mother's lack of experience in the care and feeding of the child is a risk factor for poor healthcare.

### *Level of education*

The uneducated mothers in our study were the most numerous at 46.7%. This figure is lower than that of Ngaringuem et al. [9] in N'Djamena, who found that 64.5% of mothers were uneducated. The level of education of the mothers has a statistically significant link with SAM ( $p = 0.029$ ), and this corroborates with those found by Mukuku et al. [20] and Tariq [16] with  $p = 0.001$  respectively.

The low level of education is generally accompanied by inadequate hygiene and care practices, thus exposing the child to infectious diseases. It is, therefore, crucial for maternal and child health that girls are in school and continue to go to school [22].

### *Hand washing*

The proportion of mothers who wash their hands without soap was 43.6%. Of those who use soap (56.1%), the practice was not regular and did not concern all the instances of handwashing". According to the 2015 DHS MICS [11], only one in five households (22%) had water and soap for hand washing.

Hand washing is a simple and essential practice in the fight against aero-digestive diseases. They are sometimes responsible for severe gastroenteritis in children.

### *Knowledge of mothers related to child feeding*

Of the mothers of children surveyed, 50.2% did not know what exclusive breastfeeding consisted of. Those who knew it did not practice it because they said they feared that "the child would die of thirst" or that it was "constraining and incompatible with their activities" but also because "the elders disapproved of them".

The ideal age to start diversification was six months, for 69.3%. This figure contrasts with the practice where diversification starts much earlier. The reasons given in this regard are, among others: weight loss or low weight of the child, breast milk considered to be of poor quality, and for still others, it was follow-up or on the advice of the elders.

The ideal weaning age is between 12 and 18 months for 50.9% of them, and the mode of weaning is disruptive for 64.1%. The sex of the child, the presence of a new pregnancy and/or quite simply because the child was considered significant enough or that he did not eat enough of the family dish are the reasons for advanced early weaning by mothers. Thus, it appears that mothers are not sufficiently informed and educated on the ideal practices regarding child nutrition.

The uvula removal was performed in 72.1% or more than 2/3 of the children. According to the 2015 DHS [11], 58% of children have had their uvula removed. In addition, the pain and oedema prevent the ingestion of food and, therefore, a reduction in intake.

Scarification and incision of gums 41.8%, purges and taking a decoction during diarrhoea in 70% of cases are among the recurrent practices during childhood illnesses. The purge made during diarrhoea aggravates the state of intestinal malabsorption and, therefore, the insufficiency of intake.

### Drinking water source

98.6% of households had access to an improved water source. However, for 52.61% of them, the source was not located on the inhabited plot. This situation considerably limits their water consumption. This result corroborates that of the EDS-MICS 2014-2015 [11], in which 97% of households in the capital use an improved water source. However, Ndamobissi in 2017 [21] noted the impossible situation of children who have access to borehole water sources (potentially drinkable) but who nevertheless register high malnutrition rates in Niger, Ghana and Ethiopia. This situation can be explained by the questionable quality of the water pipes or the non-sterile mode of supply. The type of latrine, the poor disposal technique for garbage and household waste, and the presence of stagnant water near houses are significant in SAM, with values of  $p < 0.05$  for one or another of the indicators. Maintaining a healthy living environment is an essential factor of good health for children, which can protect them from malnutrition.

### Conclusion

Severe acute malnutrition is unequivocally an urgent matter for present and future society. Its consequences are immediate and often irreversible. Malnutrition's occurrence is multifactorial; therefore combating malnutrition, must go through the knowledge and control of its determinants (mother's young age and low educational level, the type of meal, Poorly conducted diversification, early weaning, diarrheal diseases, malaria, harmful practices etc). The efficient approach must be multi-sectoral, including all areas of the country's development.

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