



Epidemiological profile and growth rate of malnourished children aged 6 to 23 months in Lubumbashi in the DRC

André Ngombe Kaseba¹, Clément Tshimanga Mufike², Christelle Mwewa Kapopo¹, Eric Mukomena Sompwe^{1,3}, Paul Mawaw Makan^{1,3}

(1) School of Public Health, University of Lubumbashi, Lubumbashi, Democratic Republic of Congo

(2) Ministry of Public Health Hygiene and Prevention, Kananga, Democratic Republic of Congo

(3) Faculty of Medicine, University of Lubumbashi, Lubumbashi, Democratic Republic of Congo.

Abstract

Introduction

The epidemiological profile of the infant and weight growth of malnourished is subject to several disparities depending on the environment. The objective of this study is to contribute to the understanding of the nutritional status of children aged 6 to 23 months in Lubumbashi.

Methods

This is a cross-sectional descriptive study that took place from April 2020 to April 2021 in the ZS Kampemba and Tshamilemba. Three hundred and ninety five children were collected. Calculations of the prevalence of malnutrition in infants were carried out by descriptive analyzes with Ena software.

Results

The prevalence of malnutrition among infants in Lubumbashi aged 6 to 23 months ranges from 14.1% to 29.3%. That is 33.9% in Tshamilemba higher than that of Kampemba with 33.1%. GAM (<-2z-score and/or edema) was 15.1% at (95% CI [10.6; 21.1] p value <0.05) for girls and 11.9% at (95% CI [7.8;17.7] p value <0.05) for boys. The sex ratio is 1 in favor of the male sex, i.e. 51%. The age group of 6 to 11 months was represented with 55.6% of infants. Initiation to complementary foods was early for the majority of cases, ie 92% of infants in the two Health Zones.

Conclusion

At the end of this cross-sectional descriptive study, we note an obvious need for education of the population on infant malnutrition and the need for the involvement of state structures to promote an effective nutritional policy.

Key words: epidemiological profile, weight gain, malnutrition, Lubumbashi.

Resumé

Introduction

Le profil épidémiologique du nourrisson et croissance pondérale de malnutris est sujet à plusieurs disparités selon les milieux. L'objectif de cette étude est de contribuer à la compréhension du statut nutritionnel des enfants de 6 à 23 mois à Lubumbashi.

Méthodes

Il s'agit d'une étude descriptive transversale qui s'est déroulée d'avril 2020 à avril 2021 dans les ZS Kampemba et Tshamilemba. Trois cent nonante cinq enfants ont été colligés. Les calculs de la prévalence de la malnutrition chez les nourrissons ont été effectués par des analyses descriptives avec le logiciel Ena.

Résultats

La prévalence de la malnutrition chez les nourrissons de Lubumbashi de 6 à 23 mois varie de 14,1% à 29,3%. Soit 33,9% à Tshamilemba plus élevée que celle de Kampemba avec 33,1%. La MAG (<-2z-score et/ou œdème) était de 15,1% à (95% IC [10.6; 21.1] p value <0,05) pour les filles et 11,9% à (95% IC [7.8; 17.7] p value <0,05) pour des garçons. Le sexe ratio est de 1 en faveur du sexe masculin soit 51%. La tranche d'âge de 6 à 11 mois était représentée avec 55,6% de nourrissons. L'initiation aux aliments de complément était précoce pour la majorité des cas soit 92% des nourrissons dans les deux Zones de Santé.

Conclusion

Au terme de cette étude descriptive transversale, nous notons un besoin évident d'éducation de la population, sur la malnutrition du nourrisson et la nécessité d'une implication des structures étatiques pour promouvoir une politique nutritionnelle efficace.

Mots-clés : profil épidémiologique, croissance pondérale, malnutris, Lubumbashi.

Correspondance :

André Ngombe Kaseba, School of Public Health, University of Lubumbashi, Lubumbashi, Democratic Republic of Congo,

Téléphone : +243999307295

Email : andrekaseba86@gmail.com

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1.INTRODUCTION

Malnutrition is a universal problem that hinders sustainable development and whose consequences are unacceptable on a human or global level.[1]. Today, nearly one in three people worldwide suffer from one of the following forms of malnutrition: wasting, stunting, vitamin and mineral deficiency, overweight, obesity, and non-communicable diseases (NCDs) related to feed [1,2]. According to the United Nations, 151 million girls and boys under the age of 5 are too short for their age (stunting), over 50 million are underweight for their height (wasting) and over 38 million are stunted. overweight: none of these children are growing up healthily[1]. In addition, nearly 16 million children under 5 suffer from both stunting and wasting, and 8 million suffer from both stunting and obesity.[1].

According to UNICEF, nearly 195 million children in the world suffer from malnutrition and each year malnutrition is responsible for at least a third of the deaths of 8 million children under the age of five.[3].It is very present in sub-Saharan Africa and Asia where it is responsible for the death of 3 to 5 million children each year.[3]. Child malnutrition is more alarming and remains a major public health challenge for poor and developing countries. According to the FAO, 20% of the 792 million people who lack food live in Asia and Africa[4]. Twenty-five thousand people, especially children, die every day from hunger and 1 in 3 children living in sub-Saharan Africa suffer from malnutrition.[4]. Severe acute malnutrition (SAM) affects approximately 20 million children under five and is associated with 1-2 million preventable deaths each year[5]. Children with SAM have a high risk of death (nine times higher) compared to normal or moderately malnourished children [5]. In most developing countries mortality rates remain high, ranging between 20 and 60%[6].

The number of children under 5 affected by stunting in 2018 was estimated at 55.1 million just for African countries in the SUN (scaling up nutrition) Movement, and sub-Saharan Africa is home to a large number of these children.[7]. This is due to a combination of various factors including, inadequate food due to inappropriate food practices and infectious and parasitic diseases that

develop in deficient individual and collective environmental hygiene conditions, poverty, among the country of West and Central Africa[8 ; 7]. Nigeria is one of the countries where the prevalence of stunting and wasting remained high, at 44% and 11% respectively; thus suggesting that West and Central Africa is already behind in achieving SDG2[9]. In Africa, SAM contributes to more than one million child deaths every year[10]. Children with SAM have a 5 to 20 times higher risk of death compared to children of the same age and with normal nutritional status[10].

In Nigeria, the prevalence of undernutrition among women of reproductive age living in households with unimproved and improved environmental conditions was 17.2% and 7.2% respectively[11]. In Ethiopia, a study found a prevalence of 36.8% for food insecurity among breastfeeding women[12]. Women with no formal education, no income-generating activities, no home gardening practices, alcohol consumption by husbands and a low minimum dietary diversity score[12]. In the Democratic Republic of Congo (DRC), 43% of children under five suffer from chronic malnutrition or stunted growth, i.e. almost one in two children. Six provinces out of the 26 in the country have prevalences exceeding 50% (emergency threshold) and 14% deaths. All 26 provinces of the country have more than 40% malnourished children[13]. In addition, the situation of chronic malnutrition has stagnated over the past 15 years: the prevalence has evolved from 38% of children under five in 2001, to 47% in 2007 and 43% in 2013-2014.[13]. Children in rural areas are more frequently stunted than those in urban areas (47% against 33%)[14]. In Lubumbashi, the study conducted in 2002 in the Bongonga and Suzanella quarters in the Health Zone (ZS) of Kampemba revealed a prevalence of 33.5% for stunting and 3.8% for wasting, associated with level of education and age of the mother, as well as anorexia, diarrhea and the age of the child under 12 months[15]. P. Mudekereza demonstrated that in Lubumbashi, the median age of malnourished children was 24 months against 36 months for the well-nourished group, with extremes ranging from 6 to 59 months for both categories.[16].

Another study shows that HIV infection alters the nutritional status of children in Lubumbashi with 60.2% global malnutrition and 8.4% stunting [16].

The consequences of malnutrition on the economy: it increases the susceptibility to disease and leaves individuals weak and lethargic, reducing their capacity to work. Thus, it lowers productivity, hinders economic growth and the effectiveness of investments in health and education, and increases poverty. The economic losses due to malnutrition are greater, amounting to approximately 3.5 trillion dollars per year worldwide[17].

And about 1.7 billion dollars in 2014 for the DRC, but also on the health plan it generated an additional cost of 228.9 million dollars this due to the addition of 4,853,118 cases of clinical episodes and 74 \$.2 million due to the addition of 697,973 cases associated with undernutrition in children under 5[18]. Malnutrition remains one of the major problems among infants and young children in most developing countries. It is a real public health problem that affects several age groups in these countries. Haut-Katanga is a part of the Democratic Republic of Congo where malnutrition is a major scourge[19]. It is an essentially mining region, being in second position after the province of Maniema in terms of the prevalence, rate of malnutrition and the highest infant mortality in the Democratic Republic of Congo.[13].

Very few studies have been conducted so far on the epidemiological profile and weight growth of malnourished infants in the two HZs of Kampemba and Tshiamilemba. Weaning requires direct nutrition interventions in terms of appropriate and adequate food intake, good care, health, nutrition and hygiene practices. It is in this context that our research work takes place, with the aim of contributing to the improvement of the nutritional status of children in our study environment. As objectives for our study: To determine the socio-demographic characteristics of the malnourished aged 6 to 23 months in the two HZs; Determine the prevalence of malnutrition among children aged 6 to 23 months in the HZs ofKampemba and Tshiamilemba and to assess the anthropometric parameters of the children surveyed,Determine the

complementary foods as well as the breastfeeding rhythm of the mothers in the two HZs.

2. POPULATION AND STUDY METHODS

2.1. Study framework

The Health Zones of Tshamilemba and Kampemba belong to the Administrative Commune of Kampemba, city of Lubumbashi, province of Haut Katanga in the Democratic Republic of Congo (DRC). They have in common a climatetropical with two seasons: the rainy season from November to April and the dry season from May to October, the level of insalubrity of the deplorable environment in almost all the districts of the Commune Kampemba, there is no waste management or environmental protection program. There is also an abnormally high popular density, thus exposing them to promiscuity.

2.1.1 Kampemba Health Zone

It has a total population of 513,751 inhabitants, a high density of 3425 inhabitants/km² on an area of 150km². It is subdivided into 22 AS accessible by road. It shares its boundaries with six Health Zones (see map). It is crossed by several streams, one of which is very polluted by faeces which constitute the backbone of epidemics of cholera and other diseases. Three Health Areas at potential risk of epidemics are Kabanga, Suzanella and Polyvalent. She has the following health problems: 30% of the population does not have access to drinking water, The size of the population is abnormally high with a high density and risk of explosion of diseases and epidemics due to overcrowding, No partnership support for Nutrition and Wash (PAO-Kampemba 2021).

2.1.2. Tshamilemba Health Zones

It is limited to the North by the Airport road, to the South by the Kasenga road, to the East by the Arocarias Avenue extended to the mines of the star, to the West by the Likasi road. The Health Zone borders the health zones of Lubumbashi to the West, Rwashi to the East and Kampemba to the South East. It has an area of 42 km², a density of 2,977 inhabitants/km² with a total population of 125,014 inhabitants distributed in 7 Health Areas which are: AS Prefabricated Camp (CPF) with 11,953 inhabitants, AS Ciment-Kat (CMK) 7,473

inhabitants, AS Foire with 7,834 inhabitants, AS Quartier Industriel (QI) with 6,216 inhabitants, AS Jesus le Roc (JLR) with 15,732 inhabitants, AS Kigoma-Est (KE) with 45,260 inhabitants and AS Kigoma-Ouest (KO) with 30,545 inhabitants (see map). The Tshamilemba Health Zone is home to populations, the majority of whom live from agriculture, poultry farming, handicrafts, street-selling of various products, petty trade; a minority of the populations work in the public service and in commercial and mining companies (CHEMAF, Brasserie Simba, SNCC, SOTRAFER, SAFRICAS, SNEL, etc.). Water and electricity are provided by public companies, but do not serve more than half of the population. Some households use water from artisanal wells or runoff. On epidemiologically, the major problems, according to their importance, are malaria, acute respiratory infections, diarrheal diseases, typhoid fever and malnutrition (PAO-Tshamilemba 2021).

2.2. Study population and sampling

The study population consists of all infants from 6 to 23 months. We carried out a random cluster sampling by a simple random selection method.

The sample size was calculated based on the following formula:

$$n = z^2 \alpha \times (1 - \alpha/2) \times p \times q / e^2$$

n: minimum size to obtain significant results for an event and a fixed level of risk.

za: confidence level (the typical value of the 95% confidence level) was 1.96.

$\alpha/2$: constant 0.05/2 or 0.025

p: probability of occurrence of the event or the prevalence of malnutrition which was 40%

q: the complement of p = 1 – p or proportion of people who are not malnourished.

d=e: margin of error or degree of precision (usually set to 5% or 0.05).

With an estimated prevalence of 40% from 2020 to 2021, the calculated sample size was 359. Thus calculated, $n = 359$; i.e. an expected minimum sample of $n \times 10/100 + n$, i.e.: $(360 \times 10/100) + 360 = 395$ cases.

2.3. Target population

Our target population is made up of infants in the ZS of Tshamilemba and that of Kampemba in the DPS of Haut Katanga.

2.4. Selection criteria

As inclusion criteria, data from children whose age varies from 6 to 23 months living in one of two HZs. Each child for whom the weight is not omitted in the form and in the period from April 2020 to April 2021 and those who were brought for a preschool consultation during our study period and whose accompanying adults have consented to participate in the 'study.

The non-inclusion criteria were: data from children with any form of acquired immunosuppression (HIV and long-term corticosteroid therapy); children under 6 months or over 23 months; those whose supporters were unable to provide the information contained on the data collection sheet and those whose parents (the supporters) expressed their disagreement with participating in the interview.

2.5. Description of variables

2.5.1. Infant demographic variables

The most used for our study are: age in months, sex, origin, marital status.

2.5.2. Infant anthropometric variables

The weight in grams with the SALTER type balance[25]. The height in centimeters child in a supine position and well stretched out thanks to the pressure exerted on the knees by the aid[25]. Arm circumference using the MUAC "Mid Upper Arm Circumference" bracelet on the left arm, midway between the olecranon and the acromion[34]. Skin folds by lightly pinching the skin on the front of the forearm between the thumb and index finger. Anthropometric indices (Weight at Age, Weight at Height and Height at Age)[2]. Anthropometric indices allow comparison using international [NCHS/WHO 1977, WHO (MGRS) 2006], regional or local reference populations[25,35]. These are the proportions:

Height for Age (TPA), used to determine chronic or stunted MLN°;

Weight/height (PPT) to determine acute MLN° or thinness/wasting;

Weight for age (PPA) to determine overall MLN° (chronic and acute) or underweight, its prevalence is equivalent to an indicator of progress for the MDGs[35].

2.5.3. Sociodemographic variables of parents

They are endogenous: maternal age at childbirth, state of health of the mother, nutritional state of the mother and Endogenous of the infant: age, sex, prematurity, birth weight, state of health.

2.5.4. Parents' socioeconomic exogenous variables

These are social level, education, culture, household size, number of children and birth order. Exogenous food: breastfeeding, age of weaning and introduction of food, complementary food[25].

2.6. Data collection technique

Before the actual collection of data, a questionnaire is developed and pre-tested for its improvement on the population of two HZs Tshamilemba and Kampemba in Lubumbashi.

The interviewers were recruited from among the Registered Nurses of the Health Zones and initiated for one day on filling out the form: the objectives of the study and the collection process. A measuring board, for the measurement of the size, taken in lying position, by the competition of 2 people, the occiput, the shoulder blades, the buttocks and the legs of the infant flat on the horizontal plane. The length is noted in centimeters (cm). A SALTER scale, for measuring weight, expressed in Kg. A MUAC, for measuring brachial circumference, on the left arm, halfway between the olecranon and the acromion[36]. On the appendix page are the photos of land taken discreetly relating to the different techniques (see Photos in appendix 4)

Our survey team consisted of the team leader who was responsible for ensuring the quality and reliability of the data collected. Two measurers, responsible for taking anthropometric measurements. A community relay (RECO), to facilitate the conduct of the investigation and make it more efficient. He could guide teams and locate households. Finally an interviewer for the orientation of the questionnaire.

2.7. Data processing and analysis

The data collected on the basis of a form as mentioned above, will be entered with the Excel software then exported for processing on the Epi info 7 version 1.1.14 software for the statistical and association measurement frequencies.

For this study, we calculated WHO 2006 z-scores from the variables of weight, height/length, age, and sex using emergency nutrition assessment software for the standardized monitoring and evaluation of relief and transitions (SMART)[37]. Et the nutritional status was classified as follows: normal nutritional status (Z-score greater than or equal to -1.00), mild malnutrition (Z-score between -2.00 and -1.01), malnutrition moderate (Z-score between -3.00 to -2.01) and severe malnutrition (Z-score less than -3.00)[38].

2.8. Source of data, Period and type of study

The data collection sheets, the nursing staff, the infants as well as their mothers or guards constituted the source of the data for our cross-sectional descriptive study which took place from April 04, 2020 to April 04, 2021 in the two ZS Kampemba and Tshamilemba . This is with the aim of determining the prevalence of malnutrition among infants in Kampemba and Tshamilemba in Lubumbashi in the DRC, identifying the HZ most affected in this age group and evaluating the anthropometric parameters that explain its existence as a health problem. in this place.

3. RESULTS

3. 1. Flowchart

Following our inclusion criteria, we analyzed data for 395 infants.

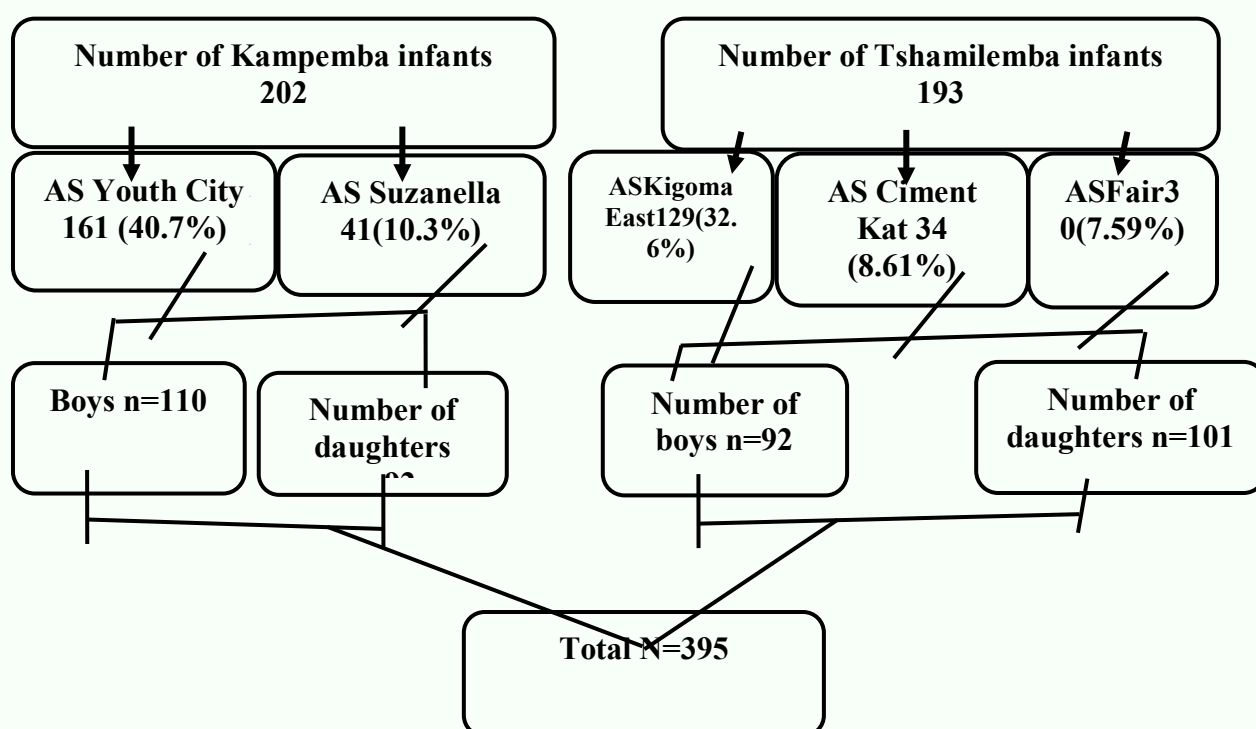


Figure 1: Flow diagram of the sample of infants surveyed.

3. 2. Socio-demographic characteristics of respondents.

PaintingII: Distribution of infants according to age groups.

Age (months)	Frequency	Percentage
6-11	220	55.68
12-17	138	34.94
18-23	37	9.38
Total	395	100

In view of this table, it appears that 55.68% of infants were aged 6-11 months, i.e. more than half of the population surveyed.

PaintingIII: Distribution of mothers according to their age group.

Age groups (years)	Frequency	Percentage
17-25	132	33.52
26-30	117	29.55
31-40	129	32.5
41-48	17	4.26
Total	395	100

This table II shows that the age group of young women from 17 to 25 years old was 33.52% more represented than the others.

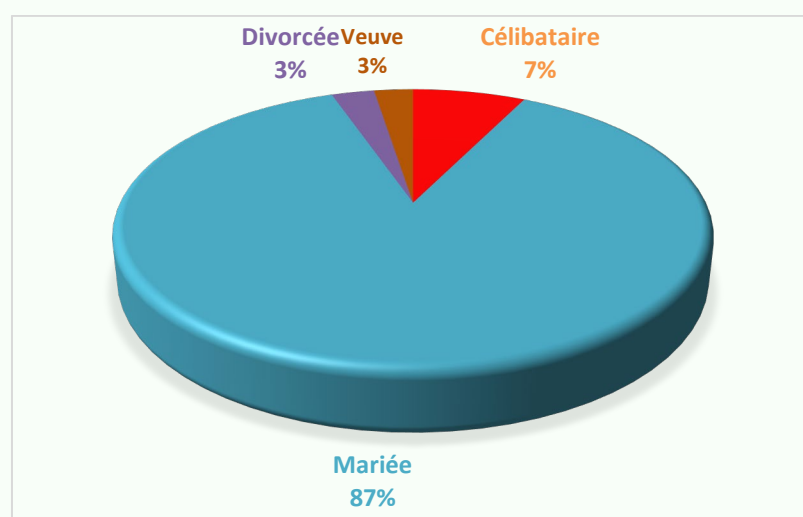


Figure 2: Distribution of women by marital status.

Figure 5 above shows that 7% of women are single, 3% divorced, 3% widowed against 87% married.

Figure 6 below indicates that 51% of infants were male versus 49% female.

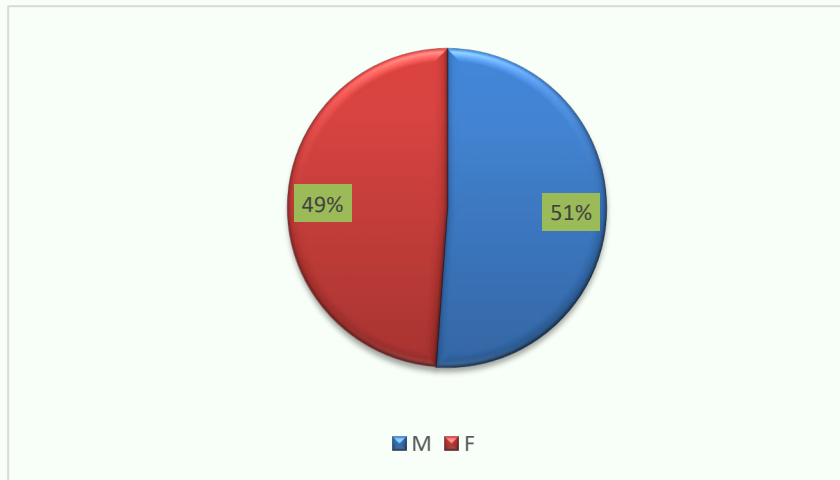


Figure 3: Distribution of infants by gender.

3.3. Prevalence of malnutrition among children aged 6 to 23 months in two Health Zones according to the standards of WHO and assessment of anthropometric parameters.

PaintingIV: Prevalence of global acute malnutrition according to the two HZs.

Kampemba					Tshamilemba				
Z-score	-1	-2	-3	-4	Z-score	-1	-2	-3	-4
P/A	26	6	5	0	P/A	17	15	3	0
YOUR	24	31	21	1	YOUR	21	18	13	9
P/T	13	2	1	1	P/T	20	1	14	3
Total	131/202 (64.8%) 33.16%				Total	134/193 (69.4%) 33.9%			
NOT						395			

It appears from this table that the Tshamilemba Health Zone has more malnourished compared to the Kampemba Health Zone with 134 malnourished or 33.9% with a high prevalence of stunting or 61 cases (15.4%), followed by acute malnutrition 38 cases (9.6%) and underweight (8.8%).

PaintingV: Prevalence of acute malnutrition based on weight-for-height (and/or oedema) z-scores and by sex.

		All n = 395	Boys n = 201	Girls n = 194
Prevalence of global malnutrition (<-2 z-score and/or edema)		(47) 13.5% (10.3 - 17.5; 95% CI)	(30) 15.1% (10.6 - 21.1; 95% CI)	(23) 11.9% (7.8 - 17.7; 95% CI)
Prevalence of moderate malnutrition (<-2 z-score and >= -3 z-score, no edema)		(3) 0.9% (0.3 - 2.5; 95% CI)	(1) 0.6% (0.1 - 3.1; 95% CI)	(2) 1.2% (0.3 - 4.2; 95% CI)
Prevalence of severe malnutrition (<-3 z-score and/or edema)		(44) 12.6% (9.6 - 16.5; 95% CI)	(29) 14.5% (10.1 - 20.4; 95% CI)	(20) 10.7% (6.9 - 16.3; 95% CI)

This table indicates that the prevalence of overall malnutrition is the most represented with 47 children, i.e. 13.5%, while moderate malnutrition is the least represented with 0.9% and that boys are the most affected by GAM.

PaintingVI: Prevalence of acute malnutrition according to the weight-for-height index in z-scores (and/or oedemas), by sex and by ZS.

	Tshamilemba n = 193	Kampemba n = 202
Prevalence of global malnutrition (<-2 z-score and/or edema)	(30) 15.5% (11.7 - 21.0; 95% CI)	(18) 8.9% (5.4 - 14.4; 95% CI)
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score, without edema)	(2) 0.9% (0.2 - 3.1; 95% CI)	(3) 1.3% (0.4 - 4.5; 95% CI)
Prevalence of severe malnutrition (<-3 z-score and/or edema)	(29) 15.0% (11.0 - 20.1; 95% CI)	(15) 7.6% (4.4 - 12.9; 95% CI)

Children from households in the HZ of Tshamilemba have a prevalence of severe malnutrition around 15% (95% CI [11.0%; 20.1%], p value<0.05) compared to those from households in the ZS of Kampemba 7.4% to (95% CI [4.4%; 12.9%], p value <0.05) this result is statistically significant.

PaintingVII: Prevalence of acute malnutrition according to the weight-for-height index in z-scores and/or oedemas, by age group in the two zones.

		Severe wasting (<-3 z-score)		Moderate wasting (>= -3 and <-2 z-score)		Normal (>=-2 z-score)		Edema	
		Tsham i	Kamp emba	Tsham i	Kamp emba	Tsham i	Kamp emba	Tsham i	Kamp emba
Age (months)	Total Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)
6-17	211/ 144	19(9)	2(1.4)	2(0.9)	2(1.4)	179(84 .8)	135(93 .8)	11(5.2)	5(3.5)
18-29	11/2 1	2(9.5)	0(0.0)	0(0)	0(0)	16(76. 2)	6(54.5)	3(14.3)	5(45.5)

Total	232/155	21(9.1)	2(1.3)	2(0.9)	2(1.3)	195(84.1)	141(91)	14(6.0)	10(6.5)
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This table shows that 84.1% of infants are in normal health (≥ -2 z score) in the age group of 6-17 months for the Tshamilemba Health Zone while 91% in the Health Zone kampemba and 9.1% versus 1.3% severe wasting (< -3 z score) in Tshamilemba and Kampemba respectively.

PaintingVIII: Prevalence of severe or moderate wasting.

Age (months)	Total	Severe wasting (< -3 z-score)		Moderate wasting (≥ -3 and < -2 z-score)		Normal (≥ -2 z-score)		Edema	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
6-17	315	23	7.3	3	1.0	277	87.9	12	3.8
18-29	27	2	7.4	0	0.0	18	66.7	7	25.9
Total	342	25	7.3	3	0.9	295	86.3	19	5.6

This table demonstrates that 87.9% are in normal health (≥ -2 z score) in the 6-17 month age group and that 7.4% have severe wasting (< -3 z score) in the 18-29 month age group and 3.8% edema in the 6 to 17 month group.

PaintingIX: Distribution of acute malnutrition according to edema based on weight/height z-scores.

TSHAMILEMBA	< -3 z-score		≥ -3 z-score	
	Presence of edema	Marasmic Kwashiorkor	Presence of edema	Kwashiorkor
		Freq. 0 (0.0%)		Freq. 11 (6.0%)
	Absence of edema	doldrums		No severe malnutrition
		Freq. 17 (9.0%)		Freq. 164 (85.0%)
KAMPENBA	< -3 z-score		≥ -3 z-score	
	Presence of edema	Marasmic Kwashiorkor	Presence of edema	Kwashiorkor
		Freq. 0 (0.0%)		Freq. 13 (6.4%)

	Absence of edema	doldrums	No severe malnutrition
		Freq. 3	Freq. 186
		(1.3%)	(92.0%)

This table shows that 6% of Kwashiorkor are in Tshamilemba and 6.4% in Kampemba.

PaintingX: Prevalence of acute malnutrition according to MUAC (and/or oedema) thresholds and by sex.

	All n = 395	Boys n = 201	Girls n = 194
Prevalence of global malnutrition (< 125 mm and/or oedema)	(112) 28.4% (24.0 - 33.3 95% CI)	(56) 28.2% (22.1 - 35.1 95% CI)	(56) 28.8% (22.5 - 36.0 95% CI)
Prevalence of moderate malnutrition (< 125 mm and ≥ 115 mm, no edema)	(22) 5.7% (3.7 - 8.6 95% CI)	(7) 3.9% (1.9 - 7.8 95% CI)	(15) 7.6% (4.5 - 12.6 95% CI)
Prevalence of severe malnutrition (< 115 mm and/or edema)	(89) 22.7% (18.7 - 27.4 95% CI)	(48) 24.3% (18.6 - 31.1 95% CI)	(41) 21.2% (15.7 - 27.9 95% CI)

Children from households in two HZs have a prevalence of severe malnutrition of 22.7% (95% CI [18.7%; 27.4%], p value < 0.05) compared to moderate malnutrition 5, 7% (95% CI [3.7%; 8.6%], p value 0.05). This result is statistically significant.

PaintingXI: Prevalence of acute malnutrition by age, based on MUAC thresholds and/or oedema.

		Severe wasting (< 115 mm)		Moderate wasting (≥ 115 mm and < 125 mm)		Normal (≥ 125 mm)		Edema	
Age (months)	Total	Freq.	%	Freq.	%	Freq.	%	Freq.	%
6-17	319	50	15.7	23	7.2	246	77.1	12	3.8
18-29	27	7	25.9	5	18.5	15	55.6	7	25.9
Total	346	57	16.5	28	8.1	261	75.4	19	5.5

This table shows a predominance of children with a normal crease in relation to the arm circumference (≥ 125 mm) with 75.4% and that moderate wasting (≥ 115 mm and < 125 mm) in last position with 8.1%.

PaintingXII: Prevalence of combined GAM and SAM according to P/T and PB (and/or oedema) thresholds and by sex according to Z-score.

	All n = 395	Boys n = 201	Girls n = 194
Prevalence of combined GAM	(124) 31.5%	(62) 30.9%	(63) 32.4%

(P/T <-2 and/or MUAC < 125 mm and/or oedema)	(26.9 - 36.6 95% CI)	(24.7 - 38.0 95% CI)	(25.8 - 39.7 95% CI)
Prevalence of combined SAM	(104) 26.4%	(56) 28.2%	(48) 24.7%
(P/T < -3 and/or MUAC < 115 mm and/or edema)	(22.1 - 31.3 95% CI)	(22.1 - 35.1 95% CI)	(18.8 - 31.7 95% CI)

This table shows, in the two HZs, a high prevalence of GAM with 31.5% (95% CI [26.9%; 36.6%], p value <0.05) compared to MAS with 26.4% (95% CI [22.1%; 31.3%], p value 0.05) this result is statistically significant.

PaintingXIII: Prevalence of underweight based on weight-for-age z-scores by sex.

	All n = 333	Boys n = 170	Girls n = 162
Prevalence of underweight (<-2 z-score)	(34) 10.2% (7.4 - 13.9 95% CI)	(25) 14.7% (10.2 - 20.8 95% CI)	(9) 5.6% (2.9 - 10.2 95% CI)
Prevalence of moderate underweight (<-2 z-score and >=-3 z-score)	(23) 6.9% (4.6 - 10.2 95% CI)	(16) 9.4% (5.9 - 14.7 95% CI)	(7) 4.3% (2.1 - 8.6 95% CI)
Prevalence of severe underweight (<-3 z-score)	(11) 3.3% (1.9 - 5.8 95% CI)	(9) 5.3% (2.8 - 9.8 95% CI)	(2) 1.2% (0.3 - 4.4 95% CI)

Children from households in two health zones have a prevalence of underweight of 10.2% (95% CI [7.4%; 13.9%], p value < 0.05) i.e. 6.9%(95% CI [4.6% - 10.2%] p-value <0.05)And3.3% (95% CI [1.9% - 5.8%] p value <0.05)respectively for moderate underweight and severe underweight, this result is statistically significant.

PaintingXIV: Prevalence of underweight by age, based on weight-for-age z-scores.

		Severe underweight (<-3 z-score)		Moderate underweight (>= -3 and <-2 z-score)		Normal (>=-2 z-score)		Edema	
Age (months)	Total	Freq.	%	Freq.	%	Freq.	%	Freq.	%

6-17	307	11	3.6	19	6.2	277	90.2	12	3.9
18-29	20	0	0.0	4	20.0	16	80.0	7	35.0
Total	327	11	3.4	23	7.0	293	89.6	19	5.8

This table shows that the 6-17 month age group is severely underweight (<-3 z score) with 3.6%.

PaintingXV: Prevalence of stunting by age based on T/A z-score.

Age (months)	Total	Severe growth retardation (<-3 z-score)		Moderate growth retardation (≥ -3 and <-2 z-score)		Normal (≥ -2 z-score)	
		Freq.	%	Freq.	%	Freq.	%
6-17	315	48	15.2	46	14.6	221	70.2
18-29	27	5	18.5	3	11.1	19	70.4
Total	342	53	15.5	49	14.3	240	70.2

This table shows that 15.5% of children are stunted and that 70.2% are normal.

3. 4. Complementary feeding practices and breastfeeding rhythms of mothers in the two HZs.

PaintingXVI: Distribution of mixed complementary foods.

MIXED FOODS	Freq.	%
Cereal (corn, rice) + legume (soya, groundnut, bean, cowpea)	217	54.94
Tubers (cassava) + other foods	49	12.41
Other mixtures	129	32.66
Total	395	100

It emerges from this table that 54.94% of women give mixtures of cereals plus legumes to their children, while 12.41% give tubers plus other foods.

PaintingXVII: Distribution of children having consumed at least 4 complementary food groups.

Consumption of 4 food groups	Kampemba		Tshamilemba	
	Frequency	%	Frequency	%
Yes	149	73.6	126	65.2
No	53	26.4	67	34.8
Total	202	100	193	100

This table shows that 149 infants or 73.7% consume at least 4 food groups in the Kampemba health zone while 65.2% in the Tshamilemba health zone.

This figure shows a prevalence of 92% having been introduced to other foods besides breast milk.

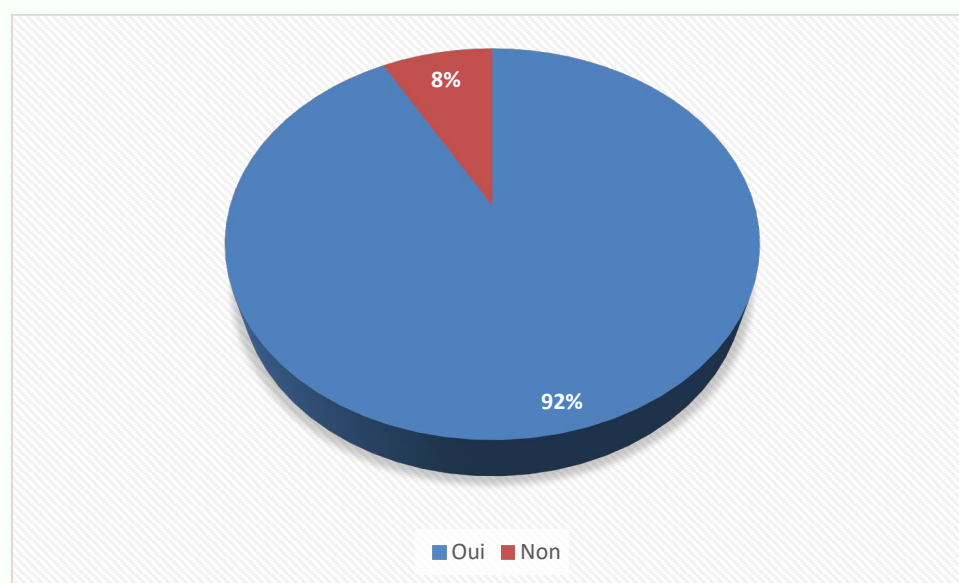


figure1: Distribution of children according to inclusion in complementary foods.

PaintingXVIII: Distribution of infants according to initiation to complementary foods in relation to age.

Age	Frequency	%
Less than 6 months	262	66.3
More than 6 months	133	33.7
Total	395	100

The majority of children, 66.3%, ate complementary foods at less than 6 months, while a third of them, 33.7%, over 6 months.

4. DISCUSSION

The study focused on the epidemiological profile and weight growth of 395 malnourished children aged 6 to 23 months in Lubumbashi, case of Tshamilemba and Kampemba Health Zones from 2020 to 2021. We were concerned to determine the prevalence of malnutrition in these children ; Identify the Health Zone with a high prevalence of malnutrition in this age group and assess the anthropometric parameters at the admission of these children.

4.1. Study limitations

A few limitations to which this study has come up should be noted. First of all, since the survey is essentially based on an interview method, it is possible that an information bias could have intervened (loss of selective memory, directed questioning that could influence certain answers, certain missing data that could cause loss of an entire infant's data). The ENA software plays a role in data quality control, identification but not correction. Indeed, being a cross-sectional study, it does not make it possible to determine the long-term evolution of the nutritional status of the infants examined. However, despite these limitations, the scope of this study is large enough to achieve the objectives it has set itself. But also,

4.2. General characteristics of the sample

4.2.1. Infant and maternal sociodemographic characteristics

At the end of our investigation, the results indicate that 51% of the infants were male against 49% for the female. It appears that in the present series, the male sex is more represented than the female sex, with a sex ratio of 1.04. Which almost corroborates with the current statistical distribution of the Congolese population in general in favor of the male sex, 1.03 men are born for every woman.[39]. THE55.68% of infants were aged 6-11 months, more than half of the population surveyed, unlike infants in the age group of 18 to 23 months with 9.38%. This could be a reflection of attendance at pre-school consultations where mothers are accustomed to bringing infants as long as the national vaccination schedule is in progress, up to 9 months and less often beyond this period.[40]. As for the provenance, a commune, Kampemba, including two ZS

and five AS. In the lead ZS Kampemba 51.2% and Tshamilemba 48.8% of infants. The age group of young women from 17 to 25 years old was 33.52%, the most represented than the others. Average age of 28.6 years. O. Morakinyo, Nigeria found 40% of women in the age group of 15-25 years and more than half or 57.2% of married women [11]. Their marital status ranges from single 5.8%, divorced 2.8%, widowed 2.5% to married 87.4%.

4.2.2. Prevalence of infant nutritional status

The nutritional status of the infant is the best indicator of his diet. The indicators used make it possible to determine three forms of nutritional deficit: underweight (expressed by the Z-score weight-for-age), stunting or chronic malnutrition (expressed by the Z-score height-for-age) and wasting or acute malnutrition (expressed by weight-for-height Z-score). The results show that the prevalence of malnutrition in the two health zones is respectively 33.1% for Kampemba and 33.9% for Tshamilemba. S. Nandy and M. Pomati in their study, in Nigeria found 11% acute malnutrition [9]. This result reflects the common membership of two HZs in the same ecosystem and the weak predominance in Nigeria due to the fact that it is one of the emerging countries of Africa. The prevalence of GAM (<-2 z-score and/or oedema) in children from households in two ZS is 22.7% (95% CI [18.7%; 27.4%], p value < 0.05) compared to moderate malnutrition 5.7% (95% CI [3.7%; 8.6%], p value 0.05).

This result is close to the conclusions of the studies carried out by P. Mudekerezwa [16]; observations documented by Mukalay M., et al., Mukuku O. et al, Morakinyo O. et al [11,14]. The only nuance would simply reside in the size of the sample and the type of study initiated. These similarities can be explained above all in the African context. The study revealed that the prevalence of global malnutrition is the most represented with 47 children, i.e. 13.5%, while moderate malnutrition is the least represented with 0.9% and boys are the most affected by GAM. ; 87.9% are in normal health (≥ -2 z-score) in the 6-17 month age group and 7.4% have severe wasting (<-3 z-score) in the 6-17 month age group. age of 18-29 months; 87.4% of children do not have severe malnutrition and 7.2% are marasmic while 5.5% have kwashiorkor; 28.4% of

children are in global malnutrition because having a MUAC (< 125 mm) and 5.7% have moderate malnutrition. The results indicated a predominance of children with normal skinfold compared to arm circumference (≥ 125 mm) with 75.4% and that moderate wasting (≥ 115 mm and < 125 mm) in last position with 8.1%. We note a high prevalence of combined acute malnutrition with 31.5% (95% CI [26.9% - 36.6%], p value < 0.05) which is statistically significant; for underweight 10.2% or 34 children are underweight. The age group between 6-17 months has severe underweight (< -3 z score) with 3.6%. These results corroborate the observations documented by Luboya O. et al., Mujinga W., FAO, EDS_RDC_2013-2014 -3 z-score with 3.6%. These results corroborate the observations documented by Luboya O. et al., Mujinga W., FAO, EDS_RDC_2013-2014 -3 z-score with 3.6%. These results corroborate the observations documented by Luboya O. et al., Mujinga W., FAO, EDS_RDC_2013-2014 [19;17]. These reconciliations of evidence can be justified by the socio-economic situation of households in Lubumbashi DR-Congo, the way of life, the level of knowledge and education, the culture and especially the habits and customs. The results also indicate that 15.5% of children are stunted and 70.2% are normal. These evidences also go in the same directive as those documented on acute malnutrition by UNICEF, UN, EDS-RDCII 2013-2014 [39,18].

4.2.3. Complementary feeding and breastfeeding

Complementary feeding was submitted to 73.6% of infants in Kampemba and 65.2% in Tshamilemba. The mixture cereals plus legumes to 54.9% of infants while 12.4% received tubers plus other foods. Regarding initiation to complementary foods, our results revealed 92% of infants surveyed and 66.3% before the age of six months. This does not coincide with 49.9% result of the study conducted on the nutritional status in Algeria / Tabessa, in 2018 by A. Khalida [31]. This difference lies in the fact that Algeria, a northern country, is emerging from underdevelopment towards development, which would explain a low rate of initiation to complementary foods.

5. CONCLUSION

At the end of this study, here are our conclusions: The most dominant age of malnutrition is between 6 to 11 months with 55.6%, the male sex is the most affected with 51% than the sex female with a sex ratio of 1. and single women outnumbered widows, divorced, the overall prevalence of malnutrition ranged from 28% to 33%. ZS Kampemba and Tshamilemba have a prevalence of 33.1% and 33.9% respectively. The anthropometric parameters, weight, height, age, MUAC and the height/age, weight/height, weight/age indices show that there is a lower weight/height in the population studied than in the reference population. The nutritional status of children aged 6 to 23 months in Lubumbashi remains a concern. Its extent is a real public health problem. The implementation of adequate and efficient preventive and corrective measures can therefore limit the worst. Targeted and concerted actions should be undertaken at all levels to improve this situation, which is mentioned under the point of recommendations.

Abbreviations:

AS:Health Area,

DPS: Provincial Health Division,

ET: Standard Deviation,

ENA: Emergency Nutrition Assessment,

FAO: Food and Agriculture Organization,

FOSA: Health Training,

IC: Confidence Interval,

MAG: Global Acute Malnutrition,

MAS: Severe Acute Malnutrition,

MGRS: Multicenter Growth Reference Study Group,

MNT :Non-Communicable Diseases,

MUAC: Middle Upper Arm Circumference,

NCHS: National Center for Health Statistics,

SDGs: Sustainable Development Goals,

MDGs: Millennium Development Goals,

WHO: World Health Organization,
P/A(PPA): Weight For Age,
PAO: Operational Action Plan,
MUAC: Arm Circumference,
P/T(PPT): Weight For Height,
DRC: Democratic Republic of Congo,
SUN: Scaling Up Nutrition,
TPA: Height For Age,
UNICEF: United Nations Children's Fund,
HIV: Human Immunodeficiency Virus,
WASH: Water, Sanitation and Hygiene,
WHO: World Health Organization,
ZS: Health Zone.

Author contributions

Study design and tools: ANK, CMK, CTM, analysis and interpretation: ANK, CTM, EMS, PMM, manuscript: all. All authors have read.

Ethical approval and consent to participate

Ethics approval has been obtained. All participants had provided written informed consent before participating.

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