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Undernutrition in Children under Five Years Old Hospitalized in Six Healthcare Facilities in Brazzaville

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Abstract

Aim: To contribute to improving the nutritional status of children under five. **Method:** This was an analytical cross-sectional study covering the period from January to October 2021. Children under five years of age hospitalized in the pediatric wards of six Brazzaville hospitals for undernutrition, together with their mothers, constituted our study population. The study variables were: sociodemographic in relation to the parents and the child, clinical in relation to the child, notably: history, psychomotor development, feeding behaviour, assessment of nutritional status. The statistical test used was: Chi2. **Results:** Out of 6480 children hospitalized in the selected pediatric wards, 320 (4.9%) were suffering from undernutrition. These included 170 boys (53%) and 150 girls (47%), sex ratio 1.1 and median age 22.66 ± 13.84 months. Children were fed mother's milk from the first hour (38.4%, n = 123). The rate of exclusive breastfeeding at 6 months was 35.3% (n = 113) and the average duration of mother's milk feeding was 15 months. The average age of the mothers was 25 years, and 70.10% (n = 225) lived with a partner. The infants were undernourished without oedema 65% (n = 208) and mixed 11% (n = 35). Undernutrition was moderate 70% (n = 224) and severe 30% (96). Mothers' lack of schooling and parents' lifestyle were associated with undernutrition. **Conclusion:** The prominence of undernutrition in Brazzaville's paediatric wards, and the type of associated factors identified, call for reinforced communication to change behaviour during antenatal consultations. But primary prevention lies in improving the socio-economic and cultural conditions of the population.

Keywords

Undernutrition, Children under Five, Health Facilities, Brazzaville

1. Introduction

Undernutrition is one of the leading causes of morbidity and mortality among children living in sub-Saharan Africa. It remains a major public health issue and a key concern within the Sustainable Development Goals (SDGs).

According to the World Health Organization (WHO), 45% of deaths among children under five years old are linked to nutritional problems [1] [2]. The WHO also estimates that approximately 16 million children under the age of five suffer from severe acute undernutrition, 90% of whom live in developing countries where dietary practices are often inadequate and incompatible with recommendations [3] [4].

In sub-Saharan Africa, hospital prevalence rates are high but vary between countries. For instance, the rates are 11% in the Democratic Republic of Congo, 10% in Burkina Faso, and 6.9% in Côte d'Ivoire [5]. In Mali, children under five bear the brunt of chronic undernutrition, with a prevalence of 37.1% [6].

The causes of this nutritional crisis, all of which are preventable, include maternal, dietary, and socio-environmental factors, as well as economic factors [7].

In Congo, data from the 2012 Demographic and Health Survey (DHS) report a prevalence of chronic undernutrition of 24% among children under five years old, including 8% with severe forms, 6% with acute undernutrition (or wasting), and 11.6% with underweight. These trends are corroborated by hospital data [8].

The high level of chronic undernutrition reflects chronic food insecurity, placing Congo among the 26 sub-Saharan African countries with an alarming hunger level, as indicated by a score of 20.5 on the Global Hunger Index [9]. In 2013, Congo joined the Scaling Up Nutrition (SUN) movement, which aims to improve nutrition outcomes and impacts.

To contribute to the improvement of children's nutritional status in Brazzaville, this study aimed to determine the prevalence of undernutrition among children under five years old hospitalized in pediatric departments in Brazzaville, to describe their sociodemographic, economic, and dietary characteristics, and to identify associated factors.

2. Patients and Methods

We conducted a multicenter, cross-sectional, analytical study with prospective data collection between January and October 2021 in the pediatric departments of level 2 and 3 healthcare facilities in Brazzaville. These included the Brazzaville University Hospital, Talangaï, Makélékélé, Bacongo, and Mfilou reference hospitals, as well as the Blanche Gomes Mother and Child Specialized Hospital.

Children aged 1 to 59 months who were hospitalized in the aforementioned pediatric departments, regardless of their pathology, were included if their clinical signs or anthropometric measurements, based on WHO standards [10], indicated undernutrition. This inclusion required prior consent from parents or legal guardians.

The study variables included:

- **Sociodemographic variables**: age (in months) and sex of the children, birth order within the family, parents' age (in years), gender, educational level, occupation, marital status, socioeconomic level according to UNICEF's survey of Congolese households [11], and household characteristics.
- **Clinical variables**: medical history (sickle cell disease, HIV infection, congenital heart and digestive malformations), feeding practices (exclusive breastfeeding for six months, milk substitutes, mixed feeding, complementary feeding), anthropometric parameters (weight, height, head and mid-upper arm circumferences as applicable), nutritional status (assessed according to WHO growth standards [10]), physical examination findings, and associated pathologies.

We used a hanging scale and a SECA-type bathroom scale with an accuracy of 100 g to weigh the children. The height was measured using a precision measuring rod accurate to 0.1 centimeter. For children under 2 years of age, the measuring rod was placed horizontally on a flat surface parallel to the ground. For children over 2 years of age, the measurement was taken in a standing position with the measuring rod held vertically. The child's age was determined based on the date of birth recorded in their medical file, vaccination record, or provided by their parent/guardian.

Based on anthropometric measurements, we calculated the following ratios:

- Weight-for-age (W/A), which was used to determine the percentage of children who were underweight (W/A below −2 Z score) and severely underweight (W/A below −3 Z score).
- Height-for-age (H/A): used to determine the percentage of children with growth retardation (H/A below −2 Z score) and severe growth retardation (H/A below −3 Z score)
- Weight-for-height (W/H) was used to determine the percentage of children who were emaciated (W/H below −2 Z score) or severely emaciated (W/H below −3 Z score).

Undernutrition was considered moderate when the upper arm circumference (UAC) was between 115 and 125 mm and the weight-for-height ratio was between −2 Z-score (emaciation) and −3 Z-score (severe emaciation); it was considered severe when the upper arm circumference (UAC) was less than 115 mm and the weight-for-height ratio was less than −3 Z-score with or without edema. Undernutrition was considered chronic when it had already had an impact on height, *i.e.*, a height-for-age ratio below −2 Z-score (stunted growth) or below −3 Z-score (severe stunted growth).

- **Therapeutic variables**: therapeutic feeding (industrial or homemade therapeutic milk), rehydration solutions, and treatments targeting underlying conditions.
- **Evolutionary variables**: hospital outcomes (discharge or death), complications, and length of hospital stay.

Data were sourced from medical records, hospitalization registers, and child follow-up documents, and were collected using a standardized survey form. Nutritional management involved administering therapeutic milks: F75 during the initial treatment phase at a dose of 100 - 130 kcal/kg body weight, F100 during the second phase, and ready-to-use therapeutic foods (RUTF).

Data entry and processing were performed using CSPRO version 7.4 software, while SPSS was used for data analysis.

Quantitative data were expressed as mean, standard deviation, mode, and range, while qualitative variables were presented as proportions. The Pearson Chi-squared test was used for statistical analysis, with a 95% confidence interval (CI) and a significance threshold set at $p < 0.05$ or 5%.

3. Results

3.1. Characteristics of the Study Population

During the study period, 340 children under five years old (5.2%) were hospitalized for undernutrition, of which 320 (4.9%) were included in this study. These consisted of 170 boys (53%) and 150 girls (47%), with a sex ratio of 1.1. The mean age was 22.66 ± 1.8 months, ranging from 5 to 48 months. These children lived in households with an average of 4.9 ± 1.07 members (Figure 1).

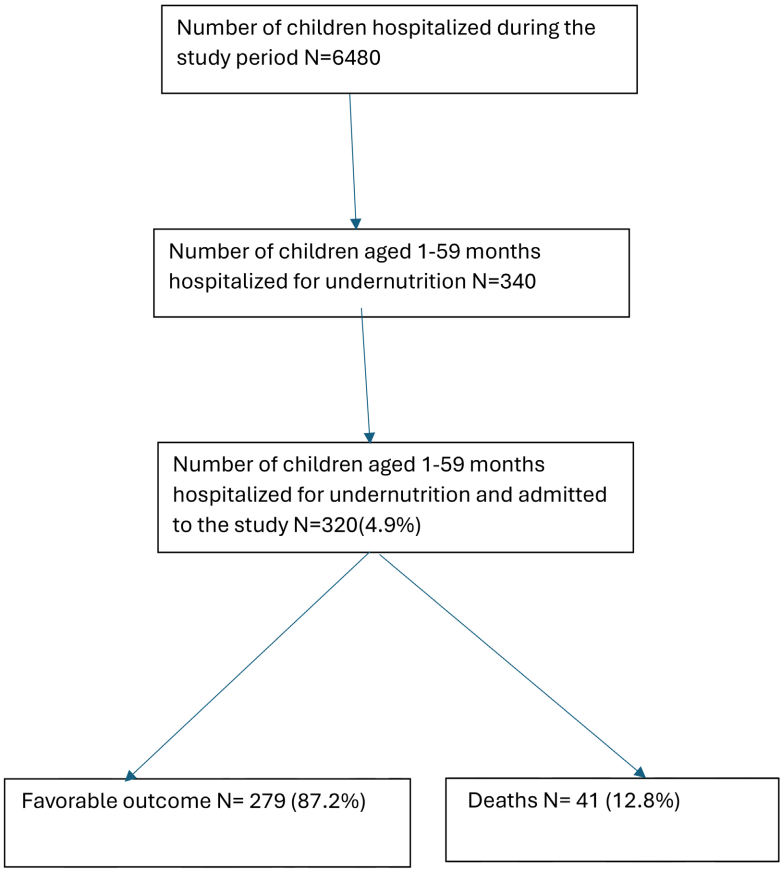


Figure 1. Flowchart for the selection of children.

The mothers' average age was 25 ± 1.4 years, with 70.3% living in a partnership. Of the mothers, 113 (41.6%) had no formal education, and 142 (44.3%) worked as street vendors.

3.2. Feeding Practices

Among undernourished children, 123 (38.4%) were breastfed within the first hour after birth. The rate of exclusive breastfeeding at six months was 35.3% (113 cases). Breastfeeding continued until 12 months of age for 198 children (62%) and until 24 months for 32 children (10%). Artificial feeding from birth was reported in 47 children (14.6%), while mixed feeding was observed in 102 children (31.9%).

The median duration of breastfeeding was 15.3 months, while the median duration of exclusive breastfeeding was 1.3 months.

Complementary feeding began, on average, at 4.3 ± 0.9 months, ranging from 1 to 9 months. Complementary feeding was introduced before six months in 142 children (44.4%), at six months for 128 children (40%), and after six months for 50 children (15.6%).

3.3. Study Results

3.3.1 Foods Used for Complementary Feeding

The foods used to begin complementary feeding are presented in Table 1.

Table 1. Distribution of children by food of initiation.

Food used for complementary feeding	Number (n)	Percentage (%)
Corn flour	185	57.8
Cheese	68	21.2
Yogurt	29	9.0
Biscuit	13	4.0
Other foods*	25	8.0
Total	320	100

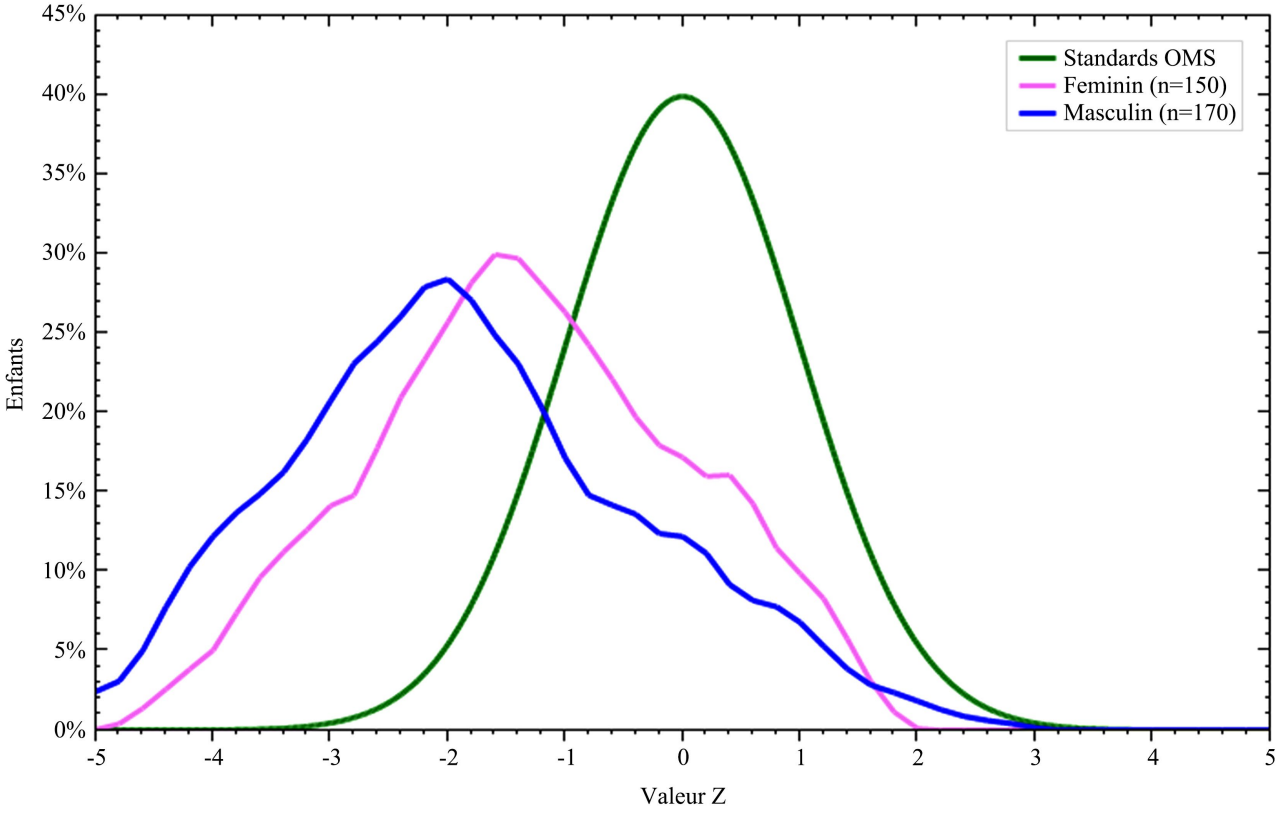
(*) Other foods include vegetables, legumes, etc.

3.3.2. Clinical Aspects

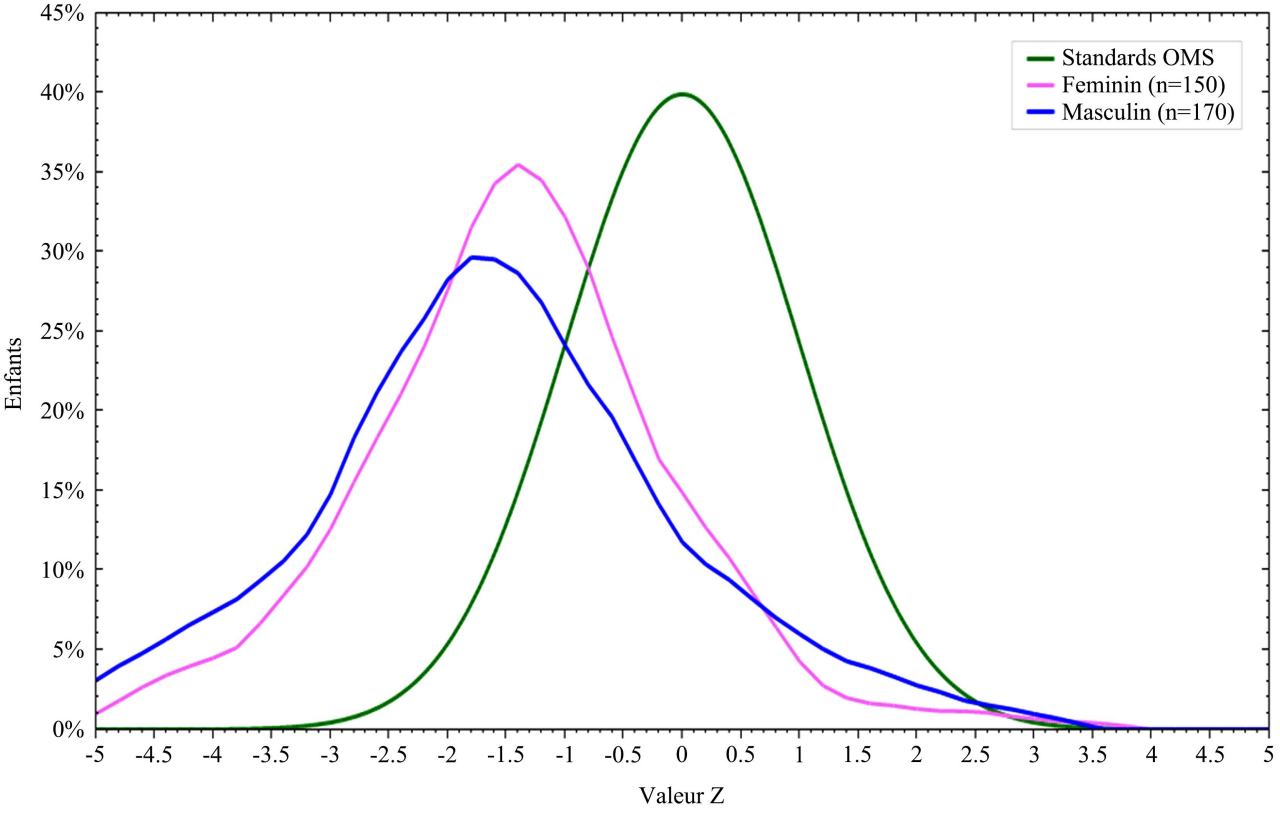
Undernutrition was without edema in 208 cases (65%), with edema in 77 cases (24%), and mixed (both with and without edema) in 35 cases (11%). It was acute in 76 cases (23.8%) and chronic in 244 cases (77.2%).

Wasting was observed in 137 cases (43%), and stunting in 247 cases (77.2%).

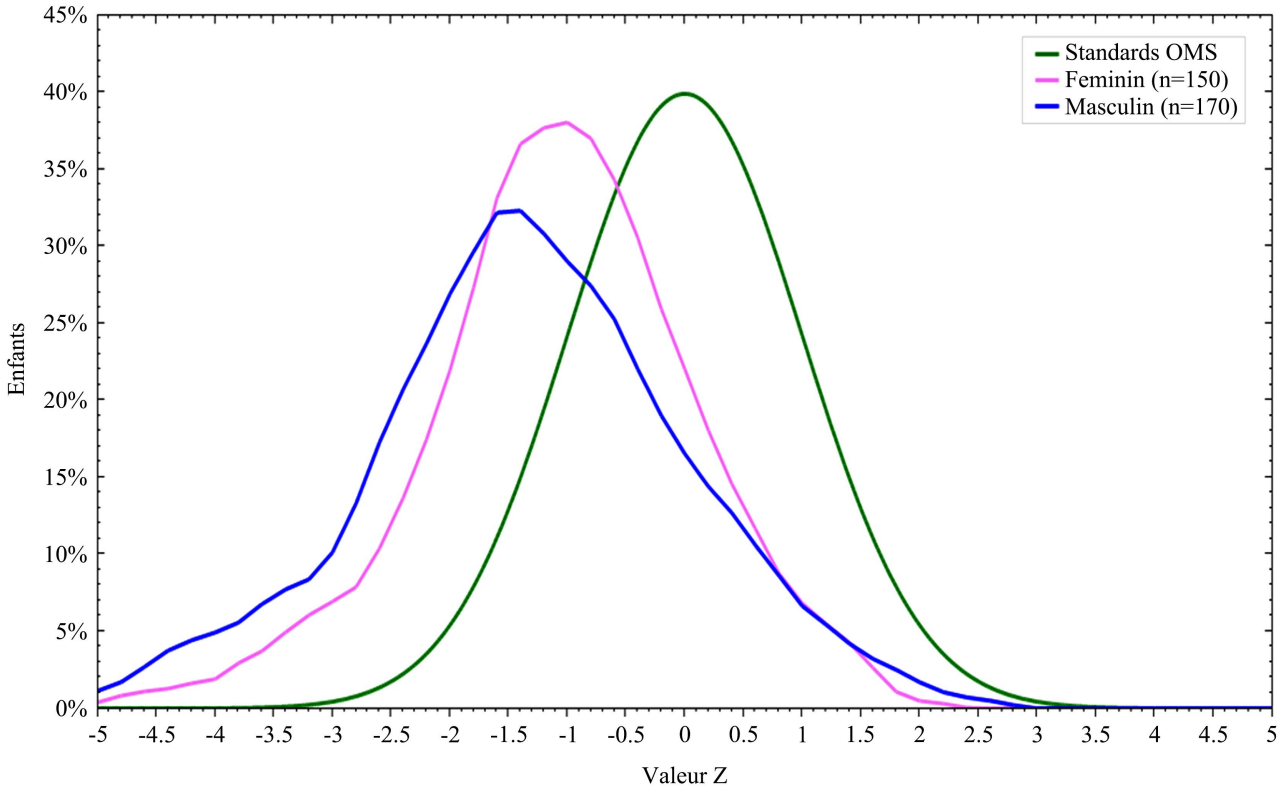
The growth curves for children under five years old hospitalized for undernutrition were all shifted to the left compared to WHO reference standards (Figure 2(a), Figure 2(b), and Figure 2(c)).


Standards OMS
Feminin (n=150)
Masculin (n=170)
Enfants
Valeur Z
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
-5
-4
-3
-2
-1
0
1
2
3
4
5

(a)


Standards OMS
Feminin (n=150)
Masculin (n=170)
Enfants
Valeur Z
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
-5
-4.5
-4
-3.5
-3
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

(b)



(c)

Figure 2. (a): Z-score curve of the W/H (Weight-for-Height) ratio of children compared to the reference population (WHO 2006); (b): Z-score curve of the H/A (Height-for-Age) ratio of children compared to the reference population (WHO 2006); (c): Z-score curves of the W/A (Weight-for-Age) ratio of children compared to the reference population (WHO 2006).

Table 2. Factors associated with undernutrition.

Growth retardation				
Variables	**Gross RQ**	**QRa**	**ICà95%**	**P-value**
Level of education (not in school)	6.95	4.1	2.0 - 8.5	0.000
Age group < 25 ans	2.04	1.8	1.0 - 3.4	0.045
Household size 5 - 6	3.33	2.6	1.4 - 4.9	0.002
Late breastfeeding	3.03	2.4	1.3 - 4.6	0.006
Weight insufficiency				
Variables	**GrossQR**	**QRa**	**ICà95%**	**P-value**
Level of education (not in school)	23.56	14.5	6.1 - 34.4	0.000
Single	2.01	0.46	1.21 - 11.98	0.041
Number of children in household (3)	9.88	1.2	2.4 - 11.98	0.000
Emaciation				
Variables	**GrossQR**	**QRa**	**ICà95%**	**P-value**
Level of education (not in school)	2.63	2.2	1.1 - 4.2	0.018
Late breastfeeding	4.94	3.7	1.9 - 6.8	0.000

3.4. Associated Factors

A multivariate logistic regression analysis was performed to identify significant factors after adjustment and to rule out confounding effects. For the different types of undernutrition (stunting, underweight, and wasting), variables with a p-value less than 0.05 were retained as independent risk factors or protective factors. An ORa > 1 indicated an increased risk of the outcome in question, while an ORa < 1 indicated a protective effect (**Table 2**).

4. Discussion

This study was conducted in level 2 and 3 healthcare facilities in the Brazzaville health department; no nutritional management centers or integrated health centers were included. Therefore, it is evident that several cases of undernutrition were missed by the survey. Consequently, the results cannot be extrapolated to the national level. Ideally, a national study that includes both urban and rural children would provide a more accurate picture of the country's overall situation. Financial constraints necessitated limiting the survey to the city of Brazzaville alone.

The overall prevalence of undernutrition is high in Brazzaville: 4.9%, including 43% wasting and 77.2% stunting. These rates are significantly higher compared to those reported in the 2012 DHS. In Benin, Yessoufou reported a stunting rate of 30% [12]. The high rates of undernutrition in Africa hinder the achievement of WHO's Sustainable Development Goal [2].

Infants aged 18 - 23 months, due to their extreme vulnerability, bear the brunt of undernutrition (21.9% in this study), similar to findings in Mali and Togo [13] [14]. This could be attributed to age-specific vulnerabilities.

Undernutrition affected children from parents working in the informal sector in 71.2% of cases. The lack of stable income, often below the minimum wage, negatively impacts household purchasing power and does not guarantee food security. SYO and Doumbia M.N. [15] [16] made similar observations. Children of mothers working as street vendors were particularly affected, accounting for 44.4% of cases in this study. The lack of time for these mothers to care for their dependent infants exposes them to poor feeding practices, often resulting in nutritional pathologies such as undernutrition. In Ethiopia, the risk factors identified include parental illiteracy, a monthly income of less than US$50, large families, and inappropriate dietary practices [17].

Parents of undernourished children were often uneducated (45.5% of fathers and 41.3% of mothers). Literacy rates in Congo have declined following successive sociopolitical events that destroyed many educational infrastructures. In contrast, in other African countries, women increasingly attend school: one in three women, according to SYO [15].

Among undernourished children, only 38.4% were breastfed immediately after birth. This early breastfeeding initiation rate is low compared to regions like Mopti (88.2%) and Sikasso (90.8%) in Mali, as reported by the SMART 2014 sur-

vey [18]. In Senegal, however, this rate was even lower: only 23% of children were breastfed within the first hour after birth [19].

This low rate of early breastfeeding initiation is detrimental to the child's harmonious development process. Yet, WHO recommends that newborns be breastfed immediately after birth (within about 15 minutes). The exclusive breastfeeding rate at six months was low at 35.3%, although it showed improvement compared to the 17% reported by Moyen in 2015 [20]. In Mali, this rate was similarly low in 1999, at 5.4% [21].

This low rate could be explained by inadequate awareness campaigns for mothers on the benefits of breastfeeding and sociocultural practices, as highlighted by other authors [22]. The WHO and UNICEF target of achieving at least 50% exclusive breastfeeding by six months by 2025 under the new Infant and Young Child Feeding (IYCF) guidelines remains far from being achieved in developing countries.

All growth curves (weight-for-age, height-for-age, weight-for-height) for undernourished children in Brazzaville were shifted to the left compared to WHO reference curves, reflecting inadequate nutritional status relative to the reference population and indicating undernutrition. In Congo, 23% of households have inadequate food consumption, insufficient for a healthy and active life [23].

Non-edematous undernutrition is the predominant form in Brazzaville, accounting for 65% of cases in this study; the severe form was the most represented at 70%. This result is similar to findings by Mouko *et al.* [8] in Brazzaville and in Moundou, Chad, who reported 61.7% and 63.1% of non-edematous forms, respectively. Conversely, SYO found 18.4% severe undernutrition and 16.5% moderate undernutrition [15].

Non-edematous undernutrition is recognized as the most widespread and early-onset form. Our results differ from those of Fati O in Niger, Maman O, and SYO, who found rates of 66.1%, 53%, and 78.8%, respectively [15] [18] [24].

Malaria (51%) and diarrheal diseases (36%) were the main pathologies associated with undernutrition in Brazzaville, consistent with findings by Hassane Zebib in Niger [24] and San Lorenzo M. *et al.* in Madagascar [25].

5. Conclusions

The prevalence of undernutrition in children under the age of five hospitalized in Brazzaville's pediatric wards is still high and a cause for concern. These are mostly infants presenting a severe form without oedema, with a predominance of growth retardation.

The infants are usually under 2 years of age, born to young, unschooled mothers working in the informal sector.

Not being put to the breast early, selling mothers, the child's young age, the mother's low level of education, household size and pathologies such as gastroenteritis, malaria and bronchopneumopathy are all associated with the onset of undernutrition.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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