



Factors Associated with Malnutrition in Children under 5 Years of Age in the Sankuru Province of the Democratic Republic of Congo

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Abstract

Introduction: In the Democratic Republic of Congo, particularly in remote areas such as the Sankuru health zones, malnutrition in children aged 0 to 5 years is a significant public health issue. It stems from a combination of factors (dietary, health-related, biological, socioeconomic, and environmental). **Methods:** A cross-sectional analytical study was conducted on 614 children aged 0 to 5 years, from May to October 2025. Multivariate logistic regression facilitated data analysis, leading to the identification of key predictors of malnutrition in Sankuru. The adjusted odds ratio (ORa) > 1, the 95% confidence interval (95% CI), and the significance threshold ($p < 0.05$) indicate a significant association. **Results:** The results of this study show a prevalence of malnutrition of all forms among children aged 0 to 5 years of approximately 52.1%. The presence of edema was significantly associated with malnutrition (ORa = 1.45; 95% CI: 1.18 - 1.78; $p = 0.001$). Socioeconomic factors such as lack of maternal education (ORa = 1.32; $p = 0.018$) and being a homemaker (ORa = 1.29; $p = 0.009$) were also significant. Environmental factors such as the use of river water (ORa = 1.33; $p = 0.007$), poor water storage (ORa = 1.41; $p = 0.005$), and lack of hand-washing (ORa = 1.28; $p = 0.022$) were also significant. From a nutritional standpoint, non-consumption of fruit was a highly associated factor (ORa = 1.72; 95% CI: 1.58 - 1.91; $p = 0.008$). Non-use of preventive health services was a significant variable (ORa = 1.27; $p = 0.025$). **Conclusion:** Multifactorial causes such as diet, access to healthcare, parental education (especially maternal), and environmental factors constitute the fundamentals of malnutrition in children under 5 years of age. Combined, appropriate, and efficient interventions can reduce the prevalence over time.

Subject Areas

Global Health

Keywords

Malnutrition in Children Aged 0 - 5 Years, Wash, Sankuru, Democratic Republic of Congo

1. Introduction

Malnutrition remains a major public health cause of morbidity and mortality among children aged 0 to 5 years worldwide. It contributes to infant mortality, accounting for one in three deaths [1] [2]. Among survivors, malnutrition is a significant source of impaired physical and motor development, reduced immune defenses, and impaired cognitive abilities and learning [3]. According to the latest joint 2025 estimates from the WHO, UNICEF, and the World Bank Group, 150.2 million children under 5 years of age suffer from stunting (23.2%), 42.8 million are wasted (6.6%), nearly 91.4 million are underweight (14.1%), and 37 million are obese [4] [5]. Child malnutrition stems from multifaceted factors such as poverty, food insecurity, inadequate feeding practices, recurrent infections, poor hygiene and sanitation, and limited access to health services [6]. UNICEF estimates that in Africa, 55%, or approximately 12 million, of annual child deaths are implicitly or explicitly attributable to malnutrition [7]. In children in developing countries, epidemiological data indicate that malnutrition remains the primary cause of immunodeficiency, increasing their exposure to recurrent infections [8] [9]. In other words, protein-energy malnutrition weakens the immune system by impairing phagocyte function, antibody production, and the integrity of mucosal barriers, leading to increased vulnerability to infections [10]. The association between malnutrition and infection contributes significantly to child morbidity and mortality [11]. The link between malnutrition and infection constitutes a self-reinforcing vicious cycle whereby any infectious outbreak worsens a child's nutritional status, and conversely, any state of malnutrition increases susceptibility to infection. This link contributes to 45% of infant deaths. This underscores the critical importance of appropriate and effective intervention strategies [12]. In the DRC, the coexistence of undernutrition (stunting and wasting), overweight and obesity, as well as vitamin and micronutrient deficiencies, represents a major challenge for the country [13] [14]. The results of the 2023 national nutrition surveys show that nearly 11 million children under 5 years of age, or 47.9%, suffer from chronic malnutrition or stunting, and nearly 1.5 million, or 8.2%, suffer from acute malnutrition or wasting. Similarly, 89.9% of children aged 6 to 23 months do not have a balanced diet. Dietary diversity remains insufficient, at around 77% according to PRONANUT, 2023.

In Sankuru Province, located in the heart of the DRC, new epidemiological data show a worrying prevalence of chronic (50% - 55%) and acute (8% - 10%) childhood malnutrition [13] [15] [16]. This alarming situation stems from poverty, unfavorable socio-economic conditions, food insecurity, and limited access to healthcare and clean water. Scientific data for this province remains limited, making it difficult to plan appropriate and effective nutritional interventions [1] [13]. Therefore, it is crucial to have up-to-date information to better understand the severity of the malnutrition problem and its associated factors among children under five in Sankuru. Similarly, a thorough analysis of these factors could help guide public policies and programs to combat malnutrition in this region of the country. This study therefore aims to determine the prevalence of malnutrition in general and to identify predictive factors as well as to analyze the socio-economic, health and cultural factors associated with malnutrition in children under 5 years of age in the Province of Sankuru.

2. Methods

2.1. Study Design

A cross sectional study was conducted from May 2025 to October 2025 and assessed nutritional status and socioeconomic characteristics.

For consistent analysis in children aged 0 - 59 months, this primary endpoint was defined based on weight-for-height (W/H) and the presence of bilateral nutritional edema. A child was considered acutely malnourished if a -Z score or $W/H < -2$ SD and/or bilateral nutritional edema. Acute malnutrition was further subdivided into moderate acute malnutrition ($W/H \geq -3$ SD and < -2 SD, without edema) and severe acute malnutrition ($W/H < -3$ SD and/or the presence of bilateral nutritional edema). For children aged 6 - 59 months, mid-upper arm circumference (MUAC) was used as a supplementary indicator. MUAC was analyzed as an indicator of malnutrition only for children aged 6 - 59 months.

The study included children aged 0 to 59 months. Nutritional status was assessed according to the 2006 World Health Organization (WHO) growth standards, applicable to children from birth to 5 years. The anthropometric indicators used were weight, height, mid-upper arm circumference, and the presence of bilateral nutritional edema.

The different forms of malnutrition were assessed separately to avoid conflating indicators of acute and chronic malnutrition.

2.2. Study Framework

The study was carried out in the Sankuru province, au centre de la RDC.

The study was conducted in three health zones (Dikungu, Lodja, and Tshumbe).

With an estimated population of between 2.6 and 3.9 million inhabitants, including 474,390 children under 5 years old, and an average population density of approximately 22 inhabitants/km², the area exhibits a sparse population density

and a diffuse spatial distribution of rural communities. This geographical arrangement contributes to limited access to basic healthcare services, drinking water, rudimentary hygiene, and a low concentration of rural communities, making it difficult to provide essential health and nutrition services and a crucial factor to consider in the planning and monitoring of public health interventions.

The target population included children under five years of age residing in the targeted areas (Dikungu, Lodja, and Tshumbe) during the study period, accompanied by their mother or legal guardian, available at the time of the survey for anthropometric examination (weight, height, mid-upper arm circumference), possessing a vaccination record accessible through the Expanded Program on Immunization (EPI) registries, and whose parents or legal guardians had given their informed consent to participate in the study. Any child not meeting the inclusion criteria was excluded from the study.

2.3. Sampling

The open-source statistical software SSPropor OpenEpi, version 3, was used to calculate the sample size with a 95% confidence level. This brought the sample size down to 600 children. An additional 30 participants (5%) were added to compensate for non-responses, bringing the final target to 630 children.

The proportional stratification method allowed for the precise distribution of the 630 children to be studied among the villages and health areas, ensuring representativeness of the actual population.

Detailed calculations allowed for the allocation of 346 children to Lodja, 95 to Tshumbe, and 189 to Dikungu, illustrating the methodological rigor. Furthermore, this approach guarantees that each health area contributes to the study according to its demographic importance, avoiding biases of over- or under-representation. The study employed random household selection through systematic sampling from updated community household lists. When more than one child under five years of age resided in the same household, a child was randomly selected. Participant selection was based on a multi-stage sampling process: first, the selection of territories, then health zones, then health areas, and finally, villages. Random or proportional selection at each stage strengthened the statistical validity of the results and ensured coverage of the entire territory while controlling the sample size.

Simple random sampling guided the selection of study units. Health zones were selected based on several criteria, including the prevalence of malnutrition, geographic accessibility, the functional presence of community health workers, and the availability of health data. Within each selected health zone, simple random sampling was used to select the health areas. Second-stage household selection was performed using systematic random sampling with a sampling interval (P). The sampling interval is the number of households separating any two sampled households. The sampling interval for each neighborhood/village was calculated by dividing the number of households (N) by the

number of households to be surveyed in the neighborhood/village. The resulting number (P) is the sampling interval used to select the households for the sample.

3. Data Collection and Analysis

Data was collected by trained and equipped investigators, including nurses and public health physicians, from a sample of 614 children. The clinicians conducted a clinical and anthropometric examination, according to the criteria for screening for acute malnutrition. This approach aims to calculate the prevalence of malnutrition in the target population and to identify associated risk factors from an integrated perspective, taking into account health, social, and community regulations. A structured questionnaire programmed in ODKCollect was used for data collection. ENA for SMART version 2020 was used for checking and analyzing anthropometric data, and IBM SPSS Statistics version 31.0 was used for other statistical analyses (database management, descriptive and analytical statistical analyses, and presentation of results). For the qualitative component, 100 focus groups were organized with parents of children under five years old, community health workers, and healthcare providers, with five groups per health area. Each group comprised an average of six participants, a size chosen to balance diverse viewpoints and ease of interaction. Once saturation was reached, confirmed, and validated by the participants in each focus group (643 participants in total), the interviews ended. To ensure consistency among the evaluators, two scientists with separate expertise performed the coding. A review of the two researchers' ideas helped to resolve any discrepancies in opinion. Triangulation of themes and sources strengthened the validity of the analysis.

The dependent variable was acute malnutrition (yes/no). The explanatory variables were first analyzed using bivariate logistic regression. Variables associated with malnutrition ($p < 0.20$) were retained as candidates for the multivariate model. Variables deemed epidemiologically important were also retained, even when their p -value exceeded this threshold.

For each categorical variable, a reference category was defined before modeling. This was generally the category considered the most favorable or the most frequent.

Missing data were identified prior to analysis. Their frequency and distribution were examined for each variable. When their proportion was small, observations with missing values were excluded from the multivariate analysis using a complete-case analysis approach. No missing value was to be arbitrarily replaced with an assumed value. If the missing data were numerous or non-random, a multiple imputation method was considered.

All candidate variables were included in a binary logistic regression model, with acute malnutrition as the dependent variable. The model allows for the estimation of adjusted odds ratios (ORa) and their 95% confidence intervals, while simulta-

neously controlling for the effect of other variables included in the model. Variables with a p -value < 0.05 were considered statistically associated with acute malnutrition in the final model.

Before interpreting the final model, multicollinearity among the explanatory variables was assessed. This can be evaluated, in particular, using the Variance Inflation Factor (VIF) and tolerance. For practical purposes: $VIF < 5$: no significant collinearity; $VIF \geq 5$: collinearity to be examined; $VIF \geq 10$: strong collinearity.

When two variables were strongly correlated, their clinical and epidemiological relevance was examined to avoid their simultaneous inclusion when it would lead to model instability.

The overall goodness of fit of the model was verified using, among other things, the Hosmer-Lemeshow test. A p -value > 0.05 suggests an acceptable fit between the probabilities predicted by the model and the observations. The quality of the model could also be assessed by the discriminatory power measured by the area under the ROC curve (AUC).

The final model reports, for each factor: adjusted odds ratio (ORa), 95% confidence interval (CI), β coefficient, and p -value. An association was considered statistically significant when $p < 0.05$ and the 95% CI of the OR did not include 1.

4. Quality Control

The training of the interviewers covered anthropometric measurement techniques, questionnaire administration, and conducting qualitative interviews. Daily checks by supervisors helped detect and correct any discrepancies. Consensus meetings for qualitative coding facilitated the harmonization of viewpoints on different themes.

5. Ethical Considerations

Participation was voluntary, subject to obtaining informed consent from parents or guardians. Data confidentiality and anonymity were guaranteed. Participants retained the right to withdraw at any time without consequence. The study received approval from the Bioethics Committee of the University of Lubumbashi, Lubumbashi, Democratic Republic of Congo (Ref. No. 13/CBE//DRC/PMBBL/2024).

6. Results

Women make up 96.1% of the respondents, and the majority of participants have a primary school education. 61.3% of the sample consists of large households (at least six people). In clinical practice, over 50% of the children surveyed suffer from malnutrition, with a slight predominance among boys. Regarding vaccination, many children have received the varicella-zoster vaccine (VAR), but they are unaware of their vaccination status (See **Table 1**).

Table 1. Sociodemographic and cultural characteristics of respondents and households.

Variables	Dikungu n (%)	Lodja n (%)	Tshumbe n (%)	Total n (%)
Gender				
Female	183 (97.4)	316 (95.8)	91 (95.8)	590 (96.1)
Male	6 (2.6)	14 (4.2)	4 (4.2)	24 (3.9)
Total	189 (100%)	330 (100%)	95 (100%)	614 (100%)
Education level				
None	17 (9)	40 (12.1)	26 (27.4)	83 (13.5)
Primary	125 (66.1)	200 (60.6)	46 (48.4)	371 (60.4)
Secondary	31 (16.4)	72 (21.8)	22 (23.2)	125 (20.4)
Higher Education	16 (8.5)	18 (5.5)	1 (1.1)	35 (5.7)
Total	189 (100%)	330 (100%)	95 (100%)	614 (100%)
Household size ≥ 6 people				
Yes	47 (65.3)	76 (59.8%)	21 (58.3%)	144 (61.3%)
No	25 (34.7%)	51 (40.2%)	15 (41.7%)	91 (38.7%)
Total	72 (100%)	127 (100%)	36 (100%)	235 (100%)
What is your child's nutritional status?				
Malnutrition	98 (51.9)	170 (51.5)	52 (54.7)	320 (52.1)
Normal	91 (48.1)	160 (48.5)	43 (45.3)	294 (47.9)
Child's sex				
Female	109 (57.7)	169 (51.2)	43 (45.3)	321 (52.3)
Male	80 (42.3)	161 (48.8)	83 (54.7)	293 (47.7)
Age group				
≤11 months	24 (12.7)	58 (17.6)	14 (14.7)	96 (15.6)
12 to 23 months	62 (32.8)	114 (34.5)	29 (30.5)	205 (33.4)
>23 months	103 (54.5)	158 (47.9)	52 (54.7)	313 (51.0)
Total	189 (100)	330 (100)	95 (100)	614 (100)
Is your child vaccinated?				
Don't know	35 (18.5)	51 (15.5)	24 (25.3)	110 (17.9)
No	143 (75.7)	195 (59.1)	20 (21.1)	358 (58.3)
Yes, card seen	11 (5.8)	84 (25.5)	47 (49.5)	142 (23.1)
Yes, memory	0	0	4 (4.2)	4 (0.7)

Table 2. Distribution of response rates for the household sample by health zone.

Health district (Health zonz)	Households			Children aged 0 to 59 months		
	Expected number of households	Number of households surveyed	Response rate (%)	Number of children planned	number of children interviewed	Response rate (%)
Dikungu	72	72	100.0%	189	189	100.0%
Lodja	132	127	96.5%	346	330	95.4%
Tshumbe	36	36	100.0%	95	95	100.0%
Total	240	235	97.9%	630	614	97.5%

In two health zones (Dikungu and Tshumbe), a 100% response rate was observed. This rate decreased to 96.5% for households and to 95.4% for children under 5 years old in the Lodja health zone (See **Table 2**).

Meal frequency in households: As shown in **Figure 1**, 63.7% of respondents reported eating only once a day, while 36.3% consumed meals more than once a day.

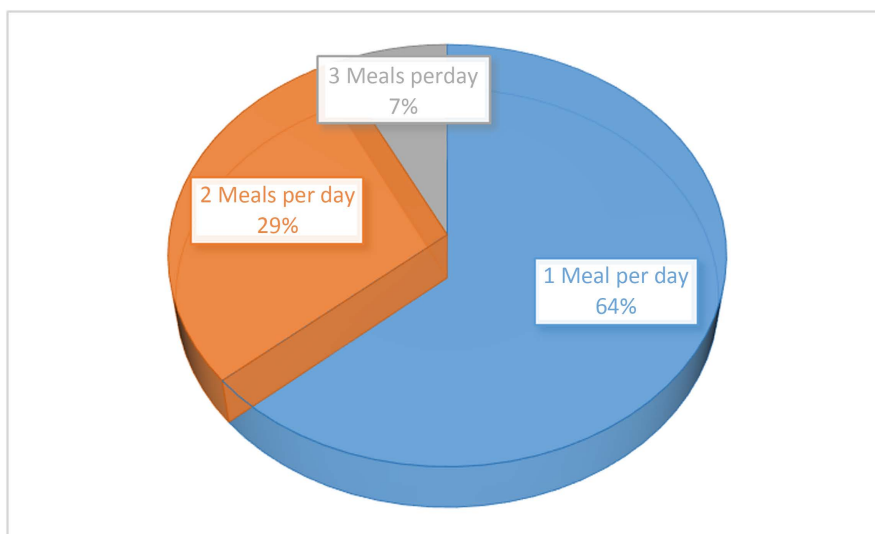


Figure 1. Number of meals per day.

Qualitative results on food safety, food restrictions, and food consumption among children

Analysis of the qualitative results reveals that the main food crops remain rice, cassava, and beans. A large portion of the harvest of these crops is sold. Weaning occurs early, between 12 and 20 months on average, and the introduction of complementary foods in the form of porridge takes place between 3 and 5 months. The choice of ingredients for the porridge flour depends on household resources. Semi-solid foods such as meat, caterpillars, fresh fish, or eggplant are introduced first, followed by solid foods like cassava flour, vegetables, rice, and millet, depending on their availability. There are food taboos for pregnant women, such as the consumption of eggs, bananas, and pineapples. Handwashing is critical before and after eating. These results sufficiently demonstrate that socio-economic factors strongly influence the timing and type of complementary feeding, which has an impact on the child's nutrition and growth.

Analysis of **Table 3** reveals several factors significantly associated with child malnutrition. Respondents with no formal education are at greater risk of malnutrition than those with higher levels of education ($RR = 1.34$; $p = 0.021$). Children of parents living together without being married are at greater risk of malnutrition than children of married couples ($RR = 1.25$; $p = 0.042$). Households that drink water from rivers have a higher risk of malnutrition than those that drink water from improved sources ($RR = 1.35$; $p = 0.008$) (See **Table 3**).

Table 3. Relationship between child characteristics, household/respondent characteristics, living conditions, environment and malnutrition.

Variables	Modalities	RR	CI95%	p-value
1. Child's characteristics				
Presence of edema	Oui vs Non	1.19	[1.02 - 1.40]	0.047
Vaccination history	Non vs Oui carte vue	1.04	[0.88 - 1.23]	0.689
2. Household/respondent characteristics				
Education level	None vs. Superior	1.34	[1.05 - 1.71]	0.021
Respondent's occupation	Housewife vs. Civil Servant	1.31	[1.07 - 1.61]	0.009
3. Living conditions and environment				
Drinking Water Source	River vs. Developed Spring	1.35	[1.08 - 1.69]	0.008
Water Storage Instructions	Not Clean/Open vs. Clean/Closed	1.41	[1.11 - 1.79]	0.005
Handwashing (after using the toilet)	No vs. Yes	1.32	[1.07 - 1.63]	0.011
Handwashing (before breastfeeding)	No vs. Yes	1.27	[1.02 - 1.58]	0.031

Table 4. Predictors of malnutrition in children under five years of age.

Variables	adjusted OR	CI 95%	p-value
Level of education (none)	1.32	[1.05 - 1.66]	0.018
Occupation (housewife)	1.29	[1.07 - 1.56]	0.009
Knowledge of malnutrition (no)	1.38	[1.12 - 1.70]	0.004
Water source (river)	1.33	[1.08 - 1.64]	0.007
Method of water storage (unclean/open)	1.41	[1.12 - 1.78]	0.005
Handwashing (after using the toilet: no)	1.28	[1.04 - 1.58]	0.022
Non-consumption of meat and eggs	1.25	[1.02 - 1.53]	0.030
Non-consumption of fruit (yes)	1.72	[1.58 - 1.91]	0.008
Registration with the CPS (no)	1.27	[1.03 - 1.56]	0.025
Recollection of treatment (poor)	1.31	[1.06 - 1.62]	0.011

Multivariate analysis of predictors of malnutrition in children under 5 years of age in **Table 4** identified several significant factors: No level of education (OR = 1.32; $p = 0.018$), domestic work (OR = 1.29; $p = 0.009$), and lack of awareness of malnutrition (OR = 1.38; $p = 0.004$) presented a highly significant risk. Living conditions and environment: Children who drink water from the river (OR = 1.33; $p = 0.007$), or water stored in an unclean or open container (OR = 1.41; $p = 0.005$), and those whose parents do not wash their hands after using the toilet (OR = 1.28; $p = 0.022$) are at high risk of malnutrition. The lack of consumption of meat and eggs (OR = 1.25; $p = 0.030$) and fruit (OR = 1.72; $p = 0.008$), determinants strongly associated with malnutrition, is also a significant risk factor. Children not registered with the CPS (OR = 1.27; $p = 0.025$) and those whose parents had negative experiences with the care provided (OR = 1.31; $p = 0.011$) are at greater risk.

These results highlight the multifactorial nature of childhood malnutrition, including factors related to the child, the household, the environment, diet, and access to care (See **Table 4**).

7. Discussion

The main objective of the research is to determine the overall prevalence of malnutrition and to identify the true predictors as well as to analyze the socio-economic, health and cultural factors associated with malnutrition in children under 5 years of age in the Sankuru Province.

7.1. The Prevalence of Acute Malnutrition

The results obtained in this study highlight an overall malnutrition prevalence of 52.1% (**Table 1**) and an acute malnutrition prevalence of 18.9% among children aged 0 to 5 years in Sankuru Province, higher than the national values for the DRC, where the prevalence of acute malnutrition is estimated at approximately 7% - 10% according to the DHS [17]. This situation is part of a worrying national and regional trend, characterized by the persistence of child malnutrition in the Democratic Republic of Congo (DRC). Comparable studies in other African countries also show high prevalence rates in similar contexts: for example, in Nigeria, Mada SB *et al.* found an acute malnutrition prevalence of 17.5% among children under five years of age, while in Ethiopia, Nigusie Shifera *et al.* reported 19.2%. This confirms that rural and isolated areas are particularly vulnerable [18] [19]. These results corroborate the increased vulnerability of rural and isolated areas [20]. They indicate that the situation in Sankuru reflects a national reality rather than an isolated case. This high prevalence can be explained by the combination of several interdependent factors, in accordance with UNICEF's conceptual framework, which distinguishes between the immediate, underlying, and root causes of malnutrition [1] [13].

7.2. Sociodemographic, Economic, and Educational Factors

Children aged 12 to 23 months are at higher risk of acute malnutrition (AOR = 1.9) (**Table 4**). This trend corresponds to the critical weaning period when children are exposed to complementary foods that are often low in nutrients and to infections [21]. Abdoul Salam Diarra *et al.* in Mali also reported an increased risk of malnutrition in this age group [22]. Malnutrition observed in Sankuru shows a strong association with household poverty and low parental education levels (**Table 1**, **Table 3**, and **Table 4**). This lack of maternal education significantly increases the risk of malnutrition (aOR = 1.32; $p = 0.018$), which corroborates the results of several African studies. The UNICEF report on food poverty in 2024 notes that children from disadvantaged households are more likely to suffer from malnutrition than children from low-income or high-income families [23]. This finding underscores the importance of socioeconomic factors in the occurrence of childhood malnutrition. In our study, children of housewives were at increased

risk of malnutrition (aOR = 1.29; $p = 0.009$). This result can be explained by increased economic dependence and limited access to food resources. Similar studies have shown that household socioeconomic status is a major determinant of childhood malnutrition [24]. The study also showed a significant association between lack of knowledge and malnutrition (aOR = 1.38; $p = 0.004$). This finding aligns with the results of studies conducted in West Africa, where a lack of nutritional education among mothers is strongly associated with childhood malnutrition [11].

7.3. The Main Factors Related to Eating Habits

Non-consumption of meat and eggs (ORa = 1.25; $p = 0.030$) and non-consumption of fruit (ORa = 1.72; $p = 0.008$) are significantly associated with malnutrition. The factor “non-consumption of fruit” shows the strongest association in this study (Table 4). These results are consistent with international data showing that low dietary diversity is one of the main determinants of childhood malnutrition [25]. Indeed, the absence of foods rich in protein and micronutrients (vitamins, iron, zinc) compromises growth and weakens the immune system [25].

7.4. The Main Environmental Factors

The use of river water (ORa = 1.33; $p=0.007$), poor water storage (ORa = 1.41; $p=0.005$), and lack of handwashing after using the toilet (ORa = 1.28; $p=0.022$) are significantly associated with malnutrition. Our results are consistent with several studies demonstrating that poor access to water, sanitation, and hygiene (WASH) significantly increases the risk of malnutrition in children. In the DRC, insufficient access to safe drinking water and sanitation infrastructure is a major contributor to diarrheal diseases, which in turn lead to undernutrition. The mechanism is based on a vicious cycle of infection and malnutrition, characterized by repeated diarrhea, intestinal malabsorption, and increased nutritional needs [23].

7.5. Factors Related to the Healthcare System

Failure to register for preschool health consultations (OHCs) (aOR = 1.27; $p = 0.025$) and negative recollection of care (aOR = 1.31; $p = 0.011$) were also associated with malnutrition (Table 4). These results are consistent with studies showing that insufficient use of preventive health services limits growth monitoring, early case detection, and nutritional counseling [26]. Furthermore, negative perceptions of the quality of care constitute a significant barrier to the use of health services [27].

7.6. Biological Factors

The presence of edema is significantly associated with malnutrition (ORa = 1.45; 95% CI: 1.18 - 1.78; $p = 0.001$) (Table 4). These results are consistent with clinical observations in the Democratic Republic of Congo, particularly in Lubumbashi, where edema is associated with increased severity and a high risk of complications

[27]. The rapid SMART survey conducted in the Alimbongo health zone in North Kivu, DRC, revealed a prevalence of 3.5% of acute malnutrition (AMG) with 2% of severe acute malnutrition (SAM). Edema, representing 1.5%, contributes disproportionately to infant mortality and thus appears to be not only a diagnostic but also a prognostic indicator [11] [28].

8. Limitations of the Study

Cross-sectional study not allowing for the determination of causality; Reporting bias by mothers; Geographically limited study to Sankuru; Absence of biological measurements (iron, zinc, vitamin A).

The high prevalence of malnutrition and associated factors identified indicates the need for multi-sectoral interventions, including nutrition education, improved access to safe drinking water, strengthening of health systems and the fight against poverty.

9. Conclusions

This study highlights a high prevalence of malnutrition among children under 5 years of age, confirming the scale of the public health problem in the studied context, particularly in isolated rural areas like Sankuru. This situation aligns with the trend observed in the Democratic Republic of Congo, where national (DHS) and provincial (SMART) surveys still report concerning levels of acute and chronic malnutrition. Multivariate analysis identified several independent determinants, reflecting the multifactorial nature of malnutrition. Biologically, the presence of edema ($ORa = 1.45$; 95% CI: 1.18 - 1.78; $p = 0.001$) confirms its role as a marker of severity. From a socio-economic perspective, the lack of maternal education ($ORa = 1.32$; $p = 0.018$) and the status of housewife ($ORa = 1.29$; $p = 0.009$) reflect the decisive influence of poverty, economic dependence, and low levels of female empowerment on children's nutritional status. Demographic and educational factors, particularly the lack of knowledge about malnutrition ($ORa = 1.38$; $p = 0.004$), highlight the importance of nutritional education and human capital in adopting practices that promote child health. From a health and environmental perspective, inadequate access to safe drinking water ($ORa = 1.33$; $p = 0.007$), poor water storage ($ORa = 1.41$; $p = 0.005$), and insufficient hygiene practices ($ORa = 1.28$; $p = 0.022$) confirm the central role of WASH factors in the development of malnutrition, through the infection-malnutrition cycle. Dietary practices also appear to be key factors, with a particularly strong effect of non-consumption of fruit ($ORa = 1.72$; 95% CI: 1.58 - 1.91; $p = 0.008$), indicating that low dietary diversity is the most influential factor in this context. Finally, health system-related factors, particularly the underutilization of preventive healthcare services (CPS) ($ORa = 1.27$; $p = 0.025$) and negative perceptions of the quality of care ($ORa = 1.31$; $p = 0.011$), highlight limitations in access to and adherence to essential health interventions.

Overall, our research findings support the multifactorial nature of childhood

malnutrition in Sankuru, with complex associations involving immediate, underlying, and fundamental factors, in accordance with UNICEF's conceptual framework. Appropriate, efficient, and integrated multisectoral interventions focused on: improving food security and nutritional diversity; strengthening WASH infrastructure; promoting maternal education and nutrition awareness; and expanding access to quality health services contribute to a sustainable improvement in children's nutritional status. Adopting such a systemic approach is essential to breaking the intergenerational transmission of malnutrition and leads to the long-term improvement of children's development and survival.

Author Contributions

Joseph Oyombo Wamu, Lambert Longombe Ndjate: Data conception; Simon Ilunga Kandolo: Data analyses; Georges Lomami Osakanu: Data collection and analyses; Paul Makan Mawaw, Albert Mwembo Tambwe-A-Nkoy: Supervision and study conception.

Conflicts of Interest

The authors declare no conflicts of interest.

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