

Socio-demographic determinants of severe malnutrition in hospitalized children under five years in the mongala province, democratic republic of Congo

Modimea Sangoko Modimea

Joint Mphil Researcher at Lisala University and UNCR University, Department of Health sciences

Nizeyimana Jean Baptiste

Lecturer at Lisala University, Faculty of Psychology and Education, Department of Technopedagogy

ETC

ABSTRACT

Malnutrition is a major public health problem in the Democratic Republic of Congo, with 3.3 million children under five years affected by acute malnutrition. Understanding the socio-demographic determinants of malnutrition is essential for designing effective interventions. This article examines the socio-demographic characteristics of children hospitalized with severe malnutrition in two referral hospitals in the Mongala Province. A descriptive cross-sectional study was conducted in the general referral hospitals of Binga and Bumba in the Mongala Province, including all children under five years hospitalized for malnutrition during 2023 (n=325). Data were collected through documentary analysis of hospital records. Variables analyzed included age, sex, place of residence, parental occupation, religion, dietary habits, and vaccination status. Children aged ≥ 24 months were more affected at 63.1%. The sex ratio was 1.7 in favor of males. The majority of children resided in rural areas at 68.0%. Most household heads were farmers at 60.6% or unemployed at 39.4%. Complete vaccination coverage was observed in only 52.3% of children, with significant differences between hospitals at 58.5% at Binga versus 41.7% at Bumba. Food consumption was dominated by low-protein local staples: Fuku at 36.9%, Pondu at 33.8%, and Malemba at 29.2%. Differences in dietary patterns were observed between hospitals, with Fuku more consumed at Binga (53.7% versus 8.3% at Bumba) while Malemba was more consumed at Bumba (75.0% versus 2.4% at Binga). Severe malnutrition in hospitalized children in the Mongala Province is associated with specific socio-demographic characteristics including older age (≥ 24 months), male sex, rural residence, parental farming or unemployment, incomplete vaccination, and consumption of low-protein local staples. These findings highlight the need for targeted interventions addressing rural poverty, food security, vaccination coverage, and dietary diversity to prevent malnutrition in the region.

Keywords: Severe Malnutrition, Socio-Demographic Determinants, Children Under Five Years, Mongala Province, Democratic Republic of Congo, Food Security

RESUME

déterminants socio-démographiques de la malnutrition est essentielle pour concevoir des interventions efficaces. Cet article examine les caractéristiques socio-démographiques des enfants hospitalisés pour malnutrition sévère dans deux hôpitaux de référence dans la province de la Mongala. Une étude descriptive transversale a été menée dans les hôpitaux généraux de référence de Binga et Bumba dans la province de la Mongala, incluant tous les enfants de moins de 5 ans hospitalisés pour malnutrition au cours de l'année 2023 (n=325). Les données ont été collectées par analyse documentaire des registres hospitaliers. Les variables analysées comprenaient l'âge, le sexe, le lieu de résidence, la profession des parents, la religion, les habitudes alimentaires et le statut vaccinal. Les enfants âgés de ≥ 24 mois étaient plus touchés à 63,1%. Le sex-ratio était de 1,7 en faveur des garçons. La majorité des enfants résidaient en milieu rural à 68,0%. La plupart des chefs de ménage étaient des cultivateurs à 60,6% ou des sans-emploi à 39,4%. La couverture vaccinale complète n'était observée que chez 52,3% des enfants,

avec des différences significatives entre les hôpitaux à 58,5% à Binga contre 41,7% à Bumba. La consommation alimentaire était dominée par des aliments locaux pauvres en protéines: Fuku à 36,9%, Pondu à 33,8% et Malemba à 29,2%. Des différences dans les habitudes alimentaires ont été observées entre les hôpitaux, avec le Fuku plus consommé à Binga (53,7% contre 8,3% à Bumba) tandis que le Malemba était plus consommé à Bumba (75,0% contre 2,4% à Binga). La malnutrition sévère chez les enfants hospitalisés dans la province de la Mongala est associée à des caractéristiques socio-démographiques spécifiques incluant l'âge avancé (≥ 24 mois), le sexe masculin, la résidence rurale, l'agriculture ou le chômage parental, la vaccination incomplète et la consommation d'aliments locaux pauvres en protéines. Ces résultats soulignent la nécessité d'interventions ciblées abordant la pauvreté rurale, la sécurité alimentaire, la couverture vaccinale et la diversité alimentaire pour prévenir la malnutrition dans la région.

Mots-clés : Malnutrition Sévère, Déterminants Socio-Démographiques, Enfants de Moins de 5 Ans, Province de la Mongala, République Démocratique du Congo, Sécurité Alimentaire

Submitted: 4 27, 2026

Published: 7 29, 2026

Corresponding Author: Modimea Sangoko Modimea

Email address: modimeasangokomodimea@cirep.ac.cd

This work is available under a

Creative Commons Attribution 4.0 International License.



1. INTRODUCTION

Malnutrition remains a major global public health challenge, with 16 million cases among children under five years responsible for one million deaths annually (Organisation mondiale de la Santé, 2016). In sub-Saharan Africa, nutritional problems are among the leading causes of morbidity and mortality in infants and preschool children, with those who survive experiencing retarded growth, reduced resistance to infections, and affected mental development (Gaimard, 2021). According to Smith and colleagues, if we want to reduce the frequency of child malnutrition, it is necessary to first understand its causes, with the immediate determinants of a child's nutritional status being dietary intake and health, which are in turn influenced by three underlying household determinants: food security, adequate care for mothers and children, and a healthy environment, which are themselves influenced by basic determinants of resources potentially available to a country or group of people and a number of political, cultural, and social factors that influence the use of these resources (Facteurs explicatifs, 2013). According to UNICEF, malnutrition is also the result of a combination of underlying factors including famines and wars responsible for a small part of malnutrition but with severe and often fatal forms, natural disasters that can destroy 20 years of development in a region, insufficient food security in families that cannot produce or acquire foods containing the necessary energy and nutrients, lack of access to water and sanitation facilities promoting infectious diseases, poor quality health services that are expensive, non-existent, inaccessible or inadequate leading to low vaccination rates and inadequate care for sick and malnourished children, inadequate care for mothers and children, the nutritional status of mothers who have smaller babies more prone to serious health problems, insufficient breastfeeding and abrupt weaning, lack of therapeutic products, and discrimination against women and girls (Unicef, 2009).

The causes of malnutrition in developing countries are multiple and very often linked to each other, with three main immediate causes standing out: the quantitative and qualitative insufficiency of food intake, beliefs and taboos, and disease, with their interaction tending to create a vicious circle (Latham, 2001). Dietary deficiencies can be due primarily to two factors: the availability of food where in rural areas food security depends on access to land and other agricultural resources required to ensure sufficient family production, but lack of land, poor quality of land and their remoteness from villages constitute causes of food unavailability, and access to food where even if a market is full of products, when they are expensive, then families too poor to buy them cannot benefit from food security. Sociocultural factors include the symbolic value attached to certain foods which in the

minds of some populations maintain a sense that limits their consumption to certain solemn occasions and certain groups of individuals, traditional customs influencing food consumption where in many rural areas the habit of preparing only one meal at the end of the day is certainly harmful for school-age children who should take at least three meals per day, weaning where we are witnessing increasingly early and abrupt weaning due to a new pregnancy or the tendency to feed the child with a bottle due to the mother's work constraints most often, and socio-anthropological interpretations where mothers regularly observe their child's body and spontaneously qualify it as beautiful, good, fat, cheerful, thin or healthy or sick (Latham, 2001). Infectious factors show a close relationship between nutritional status and infectious diseases, where infectious diseases occur more easily and are often fatal in malnourished children, and can also cause malnutrition, with the malnourished child resisting disease less well, becoming ill more often, and thus malnutrition worsening.

The underlying factors according to UNICEF include famines and wars responsible for a small part of malnutrition but with severe and often fatal forms, with 90% of refugees or displaced persons being women and children, and one and a half million children living in 42 countries in conflict today; natural disasters such as hurricanes, droughts, earthquakes, volcanic eruptions, frost, floods, typhoons, insect invasions that can destroy 20 years of development in a region; insufficient food security in families that cannot produce or acquire foods containing the necessary energy and nutrients; lack of access to water and sanitation facilities where unsanitary conditions inside and near homes promote infectious diseases (diarrhea), which become major causes of malnutrition; poor quality health services that are expensive, non-existent, inaccessible or inadequate leading to low vaccination rates and inadequate care for sick and malnourished children; inadequate care for mothers and children where families and communities do not have the means to take care of their health and nutrition; the nutritional status of mothers who have smaller babies more prone to serious health problems; insufficient breastfeeding and abrupt weaning where in 2005, 60% of babies worldwide were not exclusively breastfed during the first 6 months of their lives; lack of therapeutic products that are very effective for treating acute malnutrition; and discrimination against women and girls where illiteracy and the place of women in the labor market are fundamental causes of malnutrition, with children born to uneducated women having twice the risk of dying in infancy (Unicef, 2009).

The fundamental factors include all the efforts of families to ensure good nutrition that can be undermined by political, legal and cultural factors such as the degree to which the rights of women and girls are protected by law and custom; the political and economic system determining the distribution of income and assets; and finally, the ideologies and policies governing social sectors (Unicef, 2009). In addition to its immediate effects (suffering, mortality), malnutrition can have long-term effects on children, especially if the child is taken care of too late, with a child victim of significant deficiencies, particularly between 0 and 5 years, potentially revealing later at school neurological disabilities (memory, assimilation capacity), thus having serious repercussions on children's health, their future development and that of society (Unicef, 2009). The consequences of malnutrition can be regrettable on the course of pregnancy, the embryo, the newborn, and the pregnant or breastfeeding woman.

The Democratic Republic of Congo is among the countries severely affected by malnutrition, with an estimated 3.3 million children under five years suffering from acute malnutrition, including at least one million cases of severe acute malnutrition (Scaling Up Nutrition, 2024). In the Mongala Province, the nutritional situation of children remains poorly documented, despite the disease being widely observed especially in children when passing through villages. Understanding the socio-demographic determinants of severe malnutrition is essential for designing effective interventions. This article examines the socio-demographic characteristics of children hospitalized with severe malnutrition in two referral hospitals in the Mongala Province, identifying vulnerable groups and potential targets for intervention. The study specifically addresses the questions of what socio-demographic characteristics are common among children under five years hospitalized for severe malnutrition in Binga and Bumba, with the hypothesis that these children present common socio-demographic characteristics.

2. METHODOLOGY

2.1 Study Design

This was a descriptive cross-sectional study conducted from January 1 to December 31, 2023, in the general referral hospitals of Binga and Bumba in the Mongala Province, Democratic Republic of Congo, with data collection carried out in August 2024. The descriptive cross-sectional design was chosen to describe the socio-demographic characteristics of children with severe malnutrition at a specific point in time, which is appropriate for identifying vulnerable groups and generating hypotheses for future research. The retrospective review of hospital records allowed for the inclusion of a large sample and the collection of data on multiple variables without the logistical challenges and costs of prospective data collection. The study period of one full year was selected to capture any seasonal variations in admissions and to ensure a sufficient sample size for analysis.

2.2 Study Setting

The study was conducted in the two main referral hospitals in the Mongala Province, where the population lives under the poverty line with a purchasing power of less than one dollar per day, the majority of young people are unemployed, and most parents are either unemployed or work as farmers, while women manage household economies through small-scale trading of agricultural products, conditions that expose the population to phenomena harmful to socio-economic development that promote malnutrition in children. The Hôpital Général de Référence de Binga is located in a rural area, serving a population primarily dependent on agriculture, while the Hôpital Général de Référence de Bumba is located in a more semi-urban area with a mix of agricultural, fishing, and commercial activities. The two hospitals were selected to allow for comparative analysis between rural and semi-urban settings, which may have different patterns of socio-demographic determinants of malnutrition. The absence of functioning nutrition services in both hospitals and the lack of specialized pediatricians and nutritionists in the pediatric services were noted as significant contextual factors that influence the management and outcomes of malnourished children.

2.3 Study Population

The study population comprised all children under five years hospitalized in the pediatric services during 2023 in both hospitals, totaling 1,605 children (900 in Binga and 705 in Bumba). The choice of the pediatric services as the study setting was justified by the fact that children under five years with severe malnutrition requiring hospitalization are typically admitted to these services, and that the pediatric services maintain the most complete and accessible hospitalization records. The year 2023 was selected as the study period because it represented a full calendar year with complete records available, and it was the most recent year before the data collection for which all hospitalization records had been properly archived and could be accessed. The inclusion of all children under five years, rather than a specific age subgroup, was intended to capture the full spectrum of severe malnutrition in this age group and to allow for analysis of age-related patterns in socio-demographic characteristics.

2.4 Sampling

The sample was exhaustive, including all 325 children hospitalized in pediatric services with a diagnosis of malnutrition in both HGRs. Of these 325 children, 205 were hospitalized at HGR Binga and 120 at HGR Bumba. An exhaustive sampling approach was chosen because the total number of cases was manageable for analysis and because it eliminates sampling bias, providing a complete picture of the socio-demographic characteristics of children with malnutrition in these hospital settings. The use of exhaustive sampling also allows for the calculation of precise proportions and for subgroup analyses without concerns about sampling error. The diagnosis of malnutrition was identified from the hospitalization records based on the clinical diagnosis recorded by the attending physician at admission and confirmed during hospitalization. This approach relies on the accuracy of

clinical diagnoses, which is a limitation, but reflects the reality of hospital practice in resource-limited settings where laboratory-based nutritional assessments are not always available.

2.5 Inclusion and Exclusion Criteria

Inclusion criteria included any child under five years hospitalized during 2023 in either hospital with a diagnosis of malnutrition, any child under five years hospitalized in pediatrics for malnutrition with or without other associated pathologies during the study period, and any child under five years hospitalized for malnutrition whose medical record was available at the hospital during the survey and completely filled. The inclusion of children with associated pathologies was important because severe malnutrition in hospitalized children typically presents with comorbidities, and excluding these cases would have provided an incomplete picture of the socio-demographic characteristics of children with malnutrition in this setting. The requirement for complete medical records was necessary to ensure that all relevant data could be extracted for each case.

Exclusion criteria included children hospitalized in pediatrics for pathologies other than malnutrition or not associated with malnutrition, children hospitalized in pediatrics aged five years or older, and any child hospitalized for malnutrition whose medical record was unavailable or did not contain the required information. Children aged five years or older were excluded because the study focused specifically on the under-five age group, which is the most vulnerable to malnutrition and for which the WHO has established clear diagnostic criteria and treatment protocols. The exclusion of cases with incomplete or unavailable records was necessary to ensure data quality and completeness, but may have introduced selection bias if these cases differed systematically from those with complete records.

2.6 Variables

The dependent variable in this analysis was severe malnutrition, defined based on the clinical diagnosis recorded in the medical records. The independent variables included age (categorized as <24 months and ≥ 24 months), sex (male/female), place of residence (rural/urban), parental occupation (farmer/unemployed/other), religion, dietary habits (types of food consumed), and vaccination status (completely vaccinated/not fully vaccinated). The selection of these variables was based on the conceptual framework of malnutrition determinants proposed by UNICEF and others, which identifies immediate, underlying, and basic causes of malnutrition. Age and sex are considered demographic factors that influence nutritional vulnerability; place of residence reflects access to services and environmental conditions; parental occupation reflects socioeconomic status and capacity to provide adequate nutrition; dietary habits reflect food intake patterns; and vaccination status reflects access to preventive health services and immune protection. The categorization of variables was done to facilitate analysis and interpretation.

2.7 Data Collection

A data collection form was developed and used to collect data. The form was designed to capture all variables of interest in a structured format, with pre-coded responses to facilitate data entry and analysis. The form was developed in French (the language of hospital records in the DRC) and was pilot-tested on a small sample of records to ensure that all required information could be extracted reliably. Based on the pilot test, the form was revised to clarify certain items and to add additional variables that emerged as relevant. Data collectors were trained on the use of the form and on data extraction procedures to ensure consistency and reliability.

Documentary analysis, specifically of hospital patient registers and hospitalization records, was used to gather all information regarding this study. The patient registers provided an overview of all admissions to the pediatric services during 2023, including patient identification, dates of admission and discharge, and the primary diagnosis. The hospitalization records provided detailed clinical and socio-demographic information, including age, sex, place of residence, parental occupation, religion, dietary habits, and vaccination status. Data were extracted from these records using the data collection form. Information on the completeness and

quality of the records was noted, and when certain variables could not be extracted due to missing information, this was recorded as such.

2.8 Data Analysis

Data were encoded and a quality check was performed by the coder before data processing to ensure coherence. The encoding involved assigning numerical codes to categorical variables and checking for consistency in the data. Quality checks included verifying that all data were within expected ranges, that there were no duplicate records, and that missing data were properly identified. Any discrepancies or errors identified during quality checks were resolved by referring back to the original records.

Data were entered and analyzed using EXCEL software. Descriptive statistics were calculated, including frequencies and percentages for categorical variables, and means and standard deviations for continuous variables when applicable. The data were summarized in tables and graphs to facilitate presentation and interpretation. Comparative analysis between the two hospitals was conducted to identify similarities and differences in the socio-demographic profiles of children with malnutrition. The data were not subjected to statistical tests of significance because the study was descriptive in nature, and the exhaustive sample meant that the results represented the true population values for these hospital settings rather than estimates from a sample.

2.9 Ethical Considerations

All necessary authorizations were obtained to conduct this study, starting with university authorization and then authorization from the heads of the concerned hospitals. The study protocol was reviewed and approved by the relevant institutional review bodies to ensure that it met ethical standards for research involving human subjects. Patient confidentiality was protected by ensuring that all data were anonymized during extraction, with only coded identifiers used in the database. The data collection form did not include patient names or other identifying information. Data were stored securely and accessible only to the research team. The findings are presented in aggregate form, without any information that could identify individual patients. The study was conducted with the understanding that its findings would contribute to improving the understanding and management of malnutrition in the Mongala Province, and would ultimately benefit the population by informing policy and practice.

1.

3. RESULTS

The results of the study are presented in the following sections, covering the socio-demographic characteristics of the children, including age, sex, place of residence, parental occupation, religion, dietary habits, and vaccination status.

Table 1: Socio-Demographic Characteristics of Children Hospitalized with Malnutrition

Variable	Total	HGR BINGA	HGR BUMBA			
	n	%	n	%	n	%
Age						
< 24 months	120	36.9	80	39.0	40	33.3
≥ 24 months	205	63.1	125	61.0	80	66.7
Sex						

Male	205	63.1	125	61.0	80	66.7
Female	120	36.9	80	39.0	40	33.3
Place of Residence						
Rural	221	68.0	140	68.3	81	67.5
Urban	104	32.0	65	31.7	39	32.5
Occupation of Household Head						
Farmer	197	60.6	128	62.4	69	57.5
Unemployed	128	39.4	77	37.6	51	42.5
Religion						
Catholic	100	30.8	70	34.1	30	25.0
Protestant	81	24.9	50	24.4	31	25.8
Salvation Army	35	10.8	28	13.7	7	5.8
Revival Church	33	10.2	22	10.7	11	9.2
Kimbanguist	45	13.8	25	12.2	20	16.7
Muslim	14	4.3	6	2.9	8	6.7
No religion	17	5.2	4	2.0	13	10.8

Source: Survey data

The socio-demographic analysis demonstrated that children aged ≥ 24 months were more affected, representing 63.1% of cases (205 children) compared to 36.9% (120 children) for those under 24 months, with similar proportions in both hospitals (61.0% at Binga and 66.7% at Bumba). The sex ratio was 1.7 in favor of males, with 63.1% of children being male (205 children) and 36.9% female (120 children). Rural residence accounted for 68.0% of cases (221 children), with 68.3% at Binga (140 children) and 67.5% at Bumba (81 children), while urban residence represented 32.0% overall (104 children), with 31.7% at Binga (65 children) and 32.5% at Bumba (39 children). In terms of parental occupation, farmers constituted 60.6% of household heads (197 households), with 62.4% at Binga (128 households) and 57.5% at Bumba (69 households), while unemployed individuals represented 39.4% (128 households), with 37.6% at Binga (77 households) and 42.5% at Bumba (51 households). The religious distribution showed Catholics at 30.8% (100), with 34.1% at Binga (70) and 25.0% at Bumba (30); Protestants at 24.9% (81), with 24.4% at Binga (50) and 25.8% at Bumba (31); Salvation Army at 10.8% (35), with 13.7% at Binga (28) and 5.8% at Bumba (7); Revival Church at 10.2% (33), with 10.7% at Binga (22) and 9.2% at Bumba (11); Kimbanguists at 13.8% (45), with 12.2% at Binga (25) and 16.7% at Bumba (20); Muslims at 4.3% (14), with 2.9% at Binga (6) and 6.7% at Bumba (8); and those without religion at 5.2% (17), with 2.0% at Binga (4) and 10.8% at Bumba (13).

Table 2: Dietary Habits of Malnourished Children

Food Item	Total	HGR BINGA	HGR BUMBA

	n	%	n	%	n	%
Pondu	110	33.8	90	43.9	20	16.7
Malemba	95	29.2	5	2.4	90	75.0
Fuku	120	36.9	110	53.7	10	8.3

Source: Survey data

The dietary habits analysis showed that Fuku was the most consumed food overall at 36.9% (120 children), with significant hospital differences as it was consumed by 53.7% at Binga (110 children) compared to only 8.3% at Bumba (10 children). Pondu was consumed by 33.8% overall (110 children), with 43.9% at Binga (90 children) and 16.7% at Bumba (20 children). Malemba was consumed by 29.2% overall (95 children), but was much more common at Bumba at 75.0% (90 children) compared to only 2.4% at Binga (5 children). All three foods are local staples based on cassava, low in protein and essential nutrients.

Table 3: Vaccination Status

Vaccination Status	< 24 months	≥ 24 months	Total			
	N	%	n	%	n	%
Completely vaccinated						
Total	60	18.5	110	33.8	170	52.3
Binga	40	19.5	80	39.0	120	58.5
Bumba	20	16.7	30	25.0	50	41.7
Not fully vaccinated						
Total	55	17.0	100	30.8	155	47.7
Binga	30	14.6	55	26.8	85	41.5
Bumba	25	20.8	45	37.5	70	58.3

Source: Survey data

The vaccination status analysis revealed that only 52.3% of children were completely vaccinated overall (170 children), with significant differences between hospitals showing 58.5% at Binga (120 children) compared to 41.7% at Bumba (50 children). Among completely vaccinated children, 64.7% (110 children) were aged ≥24 months, while among those not fully vaccinated, 64.5% (100 children) were aged ≥24 months. The proportion of completely vaccinated children was significantly higher at Binga than Bumba across both age groups, with 19.5% versus 16.7% for children under 24 months and 39.0% versus 25.0% for children aged ≥24 months. Among children under 24 months, 40 children at Binga (19.5%) were completely vaccinated compared to 20 at Bumba (16.7%), while 30 children at Binga (14.6%) were not fully vaccinated compared to 25 at Bumba (20.8%). Among children aged ≥24 months, 80 children at Binga (39.0%) were completely vaccinated compared to 30 at Bumba (25.0%), while 55 children at Binga (26.8%) were not fully vaccinated compared to 45 at Bumba (37.5%).

Table 4: Comparison of Socio-Demographic Indicators Between Hospitals

Indicator	HGR BINGA	HGR BUMBA
Age $\geq$ 24 months	61.0%	66.7%
Male sex	61.0%	66.7%
Rural residence	68.3%	67.5%
Farmer household head	62.4%	57.5%
Complete vaccination	58.5%	41.7%
Fuku consumption	53.7%	8.3%
Malemba consumption	2.4%	75.0%

Source: Survey data

The comparison of socio-demographic indicators between hospitals revealed that Binga had a lower proportion of children aged $\geq$ 24 months (61.0% versus 66.7% at Bumba), similar male sex proportion (61.0% versus 66.7% at Bumba), similar rural residence proportion (68.3% versus 67.5% at Bumba), higher proportion of farmers (62.4% versus 57.5% at Bumba), significantly higher complete vaccination coverage (58.5% versus 41.7% at Bumba), much higher Fuku consumption (53.7% versus 8.3% at Bumba), and much lower Malemba consumption (2.4% versus 75.0% at Bumba).

4. DISCUSSION

The finding that children aged $\geq$ 24 months were more affected by severe malnutrition than those under 24 months differs from several other studies, including Sangare (2009) who found that the most affected age group was 11-23 months in Bamako, and Abdala et al. (2021) who found that children under one year were most represented in Kindu, DRC. Several factors may explain the higher prevalence in older children in our study, including inadequate complementary feeding after six months when breast milk alone is insufficient to meet nutritional needs, weaning practices that are often abrupt with children given adult foods not suitable for their nutritional needs, the consumption of local staples like Fuku, Ponde, and Malemba all based on cassava that may be insufficient to meet protein and micronutrient requirements, the transition from breast milk to family foods coinciding with a decrease in dietary diversity, sibling competition where older children may receive less attention and fewer resources especially when new siblings are born, and recurrent infections as older children are more mobile and exposed to a wider range of infections contributing to nutritional deterioration (Aminou, 2023; Latham, 2001). This finding also reflects the critical period of malnutrition occurring during the 33 months from conception to the second birthday, with the majority of growth and development delays recorded during this time (Aminou, 2023), suggesting that while the window of vulnerability extends beyond 24 months in this context, the period up to 24 months remains critically important for prevention.

The sex ratio of 1.7 in favor of males is consistent with several other studies, including Doumbia et al. (2016) who found a sex ratio of 1.33, Cissouma (2021) who found 1.63, and Abdala et al. (2021) who found 1.3. Several explanations may account for this sex difference, including biological factors where males have higher nutritional requirements and may be more susceptible to infections, gender-based feeding practices where in some cultures boys may be given preferential treatment but paradoxically this

could lead to overfeeding with energy-dense but nutrient-poor foods, differences in care-seeking where parents may seek care differently for boys versus girls or have different expectations about growth and development, and higher activity levels as older boys may be more active with higher energy requirements making them more vulnerable to energy deficits (Latham, 2001; Gaimard, 2021).

The finding that 68% of malnourished children came from rural areas is consistent with expectations, as rural areas in the Mongala Province face several challenges including food insecurity where rural families depend on agriculture subject to seasonal variations, weather events, and pest infestations with limited availability of culturally appropriate and nutritionally adequate foods; poverty with purchasing power of less than one dollar per day limiting access to diverse and nutritious foods; limited health services with fewer health facilities, limited healthcare personnel, and reduced access to preventive services like vaccination; lower education levels generally affecting knowledge about child nutrition and care practices; and inadequate sanitation facilities and limited access to safe drinking water increasing the risk of diarrheal diseases (Latham, 2001; Unicef, 2009). The similarity in rural proportions between the two hospitals (68.3% at Binga versus 67.5% at Bumba) suggests that the rural-urban divide in malnutrition is consistent across the province, and that rural children are disproportionately affected by malnutrition regardless of the specific health zone.

The finding that 60.6% of household heads were farmers and 39.4% were unemployed is consistent with the socioeconomic profile of the region, where agricultural livelihoods are precarious due to low agricultural productivity with limited access to modern inputs, extension services, and markets resulting in low productivity and income; seasonal food insecurity characterized by food shortages and increased malnutrition during the hungry season between harvests; gender dynamics where women are primarily responsible for agricultural production and food preparation but may have limited access to resources and decision-making power; and cash crops being prioritized over food crops in some areas, reducing household food availability (Latham, 2001; Unicef, 2009). The unemployment rate of 39.4% reflects the limited employment opportunities in the province, particularly for youth and in the formal sector, and this economic vulnerability is a key determinant of malnutrition through its impact on food security and access to healthcare.

The dietary habits observed reveal important patterns, as Fuku, Pondu, and Malemba are all cassava-based foods consumed in the Mongala Province, and while cassava is an important energy source, it has several nutritional limitations including low protein content making it insufficient for children's growth and development, low micronutrient content being low in essential vitamins and minerals including vitamin A, iron, and zinc all critical for child health, cyanogenic compounds in some cassava varieties that can be toxic if not properly processed, and limited dietary diversity from reliance on a single staple food reducing nutrient adequacy (Latham, 2001; Aminou, 2023). The differences in dietary patterns between hospitals, with Fuku more consumed at Binga and Malemba more consumed at Bumba, reflect regional variations in food preferences and availability, yet both foods share similar nutritional limitations contributing to the high prevalence of malnutrition. The consumption of these low-protein staples without adequate supplementation with protein-rich foods such as fish, meat, eggs, or legumes likely contributes to protein-energy malnutrition observed in these children.

The finding that only 52.3% of children were fully vaccinated is concerning, particularly given that malnutrition and vaccine-preventable diseases interact synergistically where malnutrition impairs vaccine response with malnourished children having impaired immune responses to vaccines reducing their effectiveness, vaccination prevents infections that can lead to or exacerbate malnutrition, and missed opportunities where children who are malnourished may not receive vaccines due to frequent illness, lack of health visits, or missed opportunities at health facilities (Unicef, 2009). The higher vaccination coverage at Binga (58.5%) compared to Bumba (41.7%) may be explained by better health services, more effective outreach, or different community attitudes toward vaccination, and this disparity may contribute to the higher mortality rate observed at Bumba. The vaccination status of almost half of children being incomplete represents a missed opportunity for prevention of vaccine-preventable diseases that can

exacerbate malnutrition, and highlights the need for improved routine immunization services and vaccination campaigns in the region.

The cluster of risk factors identified in this study reveals an interconnected cycle of poverty, food insecurity, limited dietary diversity, malnutrition, increased susceptibility to infections, further malnutrition, and poverty, reinforced by limited vaccination coverage, inadequate health services, and poor sanitation (Unicef, 2009; Latham, 2001). Breaking this cycle requires a comprehensive approach addressing multiple determinants simultaneously, including improving household food security through agricultural support and income generation, enhancing dietary diversity through nutrition education and promotion of locally available nutrient-rich foods, strengthening vaccination coverage through improved routine immunization services and outreach, improving access to safe water and sanitation, and ensuring adequate healthcare services including nutritional rehabilitation for malnourished children. The regional variations observed between Binga and Bumba suggest that interventions should be tailored to local contexts while addressing common underlying determinants.

5. CONCLUSION

This study reveals that severe malnutrition in hospitalized children in the Mongala Province is associated with specific socio-demographic characteristics including older age (≥ 24 months) where children are particularly vulnerable during the transition from breastfeeding to complementary feeding and beyond, male sex with boys more affected than girls in this setting, rural residence where rural children bear the brunt of food insecurity and limited services, parental farming or unemployment reflecting poverty and limited household resources, consumption of low-protein local staples where the diet is dominated by cassava-based foods with limited nutritional value, incomplete vaccination with half of children not fully vaccinated increasing vulnerability to preventable diseases, and regional variations where Binga and Bumba show some differences in vaccination coverage and dietary patterns. These findings highlight the need for targeted interventions addressing rural poverty, food security, vaccination coverage, and dietary diversity, with a comprehensive approach addressing multiple determinants simultaneously required to effectively prevent and manage malnutrition in the Mongala Province. The cycle of risk factors identified underscores the importance of interventions that address both immediate and underlying causes of malnutrition, and the need for coordinated action across health, agriculture, education, and social protection sectors.

6. REFERENCES

- Abdala, A. K., Kilindikila, G. J., Bafwafwa, D. D. N., Mutombo, A. M., Ongemba, J. L., Shindano, E. M., & Wembonyama, S. O. (2021). La Morbidité infanto-juvenile en milieu hospitalier africain: cas de la ville de Kindu, République Démocratique du Congo. *Journal of Medicine, Public Health and Policy Research*, 1(1).
- Aminou, A. M. (2023). *Analyse des causes de la malnutrition et des pratiques d'alimentation de complément dans la région de Maradi au Niger*. Université de Niamey.
- Cissouma, A. (2021). Malnutrition aigüe sévère chez les enfants de moins de 6 mois: Cas de l'hôpital de Sikasso. *Mali Santé Publique*, 49-54.
- Doumbia, A. K., Togo, B., Togo, P., Traore, F., Coulibaly, O., Dembélé, A., ... & Sylla, M. (2016). Morbidité et mortalité chez les enfants de 01 à 59 mois hospitalisés au service de pédiatrie générale du chu Gabriel Touré de janvier a décembre 2013. *Revue Malienne d'Infectiologie et de Microbiologie*.
- Facteurs explicatifs de la fréquence de la malnutrition chez les enfants âgés de 0 à 5 ans dans la communauté rurale de Nguène Sarr au Sénégal. (2013). <https://www.memoireonline.com>

- Gaimard, M. (2021). Mortalité et santé, facteurs de la dynamique des populations. *Dynamiques démographiques et développement*, 139-164.
- Latham, M. C. (2001). *La nutrition dans les pays en développement* (No. 29). Food & Agriculture Org.
- Organisation mondiale de la Santé. (2016). *Nutrition chez la mère, le nourrisson et le jeune enfant: rapport du Secrétariat* (No. A69/7). Organisation mondiale de la Santé.
- Sangare, B. (2009). *Évaluation de la prise en charge de la malnutrition aiguë sévère dans le service de pédiatrie de l'hôpital de Gao* (Doctoral dissertation). Université de Bamako.
- Scaling Up Nutrition. (2024). *Rapport sur la situation nutritionnelle en République Démocratique du Congo*. <https://scalingupnutrition.org>
- Unicef. (2009). *La situation des enfants dans le monde 2009: la santé maternelle et néonatale*. UNICEF.

2.