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Links between Feeding Practices and Hemato-Parasitological Profile in Children Aged 6 to 59 Months in the Prefecture of Fria

Amadou Sylla[1,2], Ismaël Teta[3], Amadou Sadio Diallo[3], Demba Magassouba[3], Nènè Adama Sow[2], Ouo Marcel Loua[4], Tady Camara[4]

[1]Department of Laboratory Techniques, Higher Institute of Technology, Mamou, Guinea
[2]National Office for Quality Control (ONCQ), Conakry, Guine
[3]Department of Biology, Gamal Abdel Nasser University, Conakry, Guinea
[4]Ministry of Health and Public Hygiene, Food and Nutrition Division, Conakry, Guinea
Email: amadousylla2505@gmail.com

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Abstract

This descriptive cross-sectional study investigates the relationship between feeding practices and the hemato-parasitological profile of children aged 6 to 59 months in the prefecture of Fria. Data were collected from November 4 to December 4, 2024, from a sample of 450 children, including 116 aged 6 to 24 months, incorporating socio-demographic, anthropometric, hematological, parasitological, and nutritional parameters. Although 83.3% of the children exhibit normal nutritional status, acute malnutrition remains a concern, affecting 8.9% of them. Anemia is prevalent in 41.1% of the children and is strongly correlated with parasitic infections. Indeed, 69.7% of anemic children are infected with Plasmodium, while other infections, such as hookworm disease and schistosomiasis, further exacerbate this condition. Feeding practices are inadequate and unbalanced, particularly among children aged 6 to 24 months. Fewer than 21% of infants receive immediate breastfeeding at birth, and only 5.2% achieve a minimally acceptable diet, exposing them to an increased risk of malnutrition and essential micronutrient deficiencies. The study also reveals that over 60% of caregivers are unaware of basic nutritional principles, including the importance of food diversification and essential micronutrients like iron and iodine. Additionally, many caregivers do not follow hygienic food preparation practices, and a significant proportion of households lack adequate food preservation techniques. These gaps contribute to the high prevalence of anemia and parasitic infections among children. These

findings underscore the urgent need to strengthen infant nutrition interventions, particularly by promoting dietary diversification, enhancing iron and micronutrient supplementation, and intensifying efforts to combat parasitic infections.

Keywords

Infant Malnutrition, Anemia, Feeding Practices, Parasitic Infections, Dietary Diversification, Guinea, Fria

1. Introduction

Malnutrition remains a major public health challenge, particularly in developing countries, where it is implicated in 45% of deaths among children under five. Globally, it accounts for 11% of the total disease burden, leading to long-term sequelae, disabilities, and adverse effects on children's education and development [1]. According to the World Health Organization (WHO), in 2022, 149 million children under five suffered from stunting, 45 million from wasting, and 37 million were overweight or obese [2].

In the Democratic Republic of Congo (DRC), an estimated 3.3 million children under five were affected by acute malnutrition in 2021, including at least one million with severe acute malnutrition. These alarming figures are primarily due to ongoing insecurity, the socio-economic consequences of the COVID-19 pandemic, and limited access to essential services for vulnerable children and families [3].

In Guinea, the Fifth Demographic and Health Survey (DHS-5) of 2018 reported that 30% of children under five suffer from stunting, 9% from wasting, and 16% from underweight. Additionally, 75% of children aged 6 to 59 months suffer from anemia, with 2% presenting severe forms. In the Boké region, the prevalence of chronic malnutrition reaches 57.7%, with 18.6% classified as severe. The prevalence of wasting is 11.6%, with 3% in severe forms. Furthermore, 69% of children suffer from anemia [4].

The 2022 Standardized Monitoring and Assessment of Relief and Transitions (SMART) survey in Guinea revealed a national prevalence of 6.7% for global acute malnutrition among children aged 6 to 59 months, classifying the country's nutritional situation as precarious according to WHO standards. The study also indicated that 25.5% of children suffer from stunting and 14.6% are underweight. In contrast to the 2018 DHS-5 findings, which reported an exclusive breastfeeding rate of 33%, the SMART survey found that 43.7% of children were exclusively breastfed, with 25.8% receiving early initiation of breastfeeding [5].

Establishing a direct link between global and regional data, particularly regarding child malnutrition and health and the demographic and nutritional profile of Fria, is essential. Such an approach would provide a clearer understanding of the local situation in relation to global trends. Furthermore, discussing previous stud-

ies or interventions conducted in the Fria region would offer valuable context, serving as a reference for assessing past efforts and guiding future strategies. Malnutrition primarily affects children between 6 and 59 months, often resulting from inadequate exclusive breastfeeding or improper transition to complementary feeding. This period represents a critical window of vulnerability, as insufficient energy and nutrient intake fail to meet the child's growing physiological needs. Inadequate complementary feeding, both quantitatively and qualitatively, combined with recurrent infections and limited access to healthcare, plays a pivotal role in the onset and worsening of various forms of malnutrition, including both acute and chronic forms [6].

The first 12 months of life constitute a crucial phase in nutritional development, during which children are particularly vulnerable to growth faltering, nutritional deficiencies, and infectious diseases. During this period, inadequate dietary intake, compounded by recurrent infections, can compromise nutritional status and lead to severe acute malnutrition. This condition is often associated with anemia, which results from metabolic adaptations to significant weight loss and the onset of nutritional edema, reflecting disruptions in protein-energy metabolism. This silent yet pervasive public health issue is primarily driven by iron deficiency, intestinal parasitoses, and malaria, disproportionately affecting children under five—a particularly vulnerable population [7].

Iron deficiency plays a central role in the development of anemia, leading to diminished physical and cognitive capacities, weakened immune function, and the exacerbation of malnutrition in all its forms. This complex interplay significantly heightens the risk of morbidity and mortality in children, underscoring the urgent need for targeted nutritional and healthcare interventions [8].

A child's nutritional status is fundamentally shaped by three key factors: diet, environment, and caregiving practices. Children who receive a diversified, nutrient-rich diet, alongside proper healthcare and a healthy environment, are more likely to achieve optimal health outcomes. Poor breastfeeding practices and inadequate complementary feeding are among the leading contributors to high infant mortality. The failure to introduce appropriate complementary feeding at six months significantly impairs growth and increases the risk of stunting over the subsequent year [9]. Given the gravity of this situation, the interplay of these multiple factors, and the absence of prior research addressing these specific issues, this study seeks to explore the relationship between feeding practices and the hematological-parasitological profile of children aged 6 to 59 months in the prefecture of Fria.

1.1. Research Question

- What is the link between feeding practices and the hematological-parasitological profile of children aged 6 to 59 months in the Fria Prefecture?

1.2. Hypothesis

- Feeding practices significantly influence the hematological-parasitological

profile of children aged 6 to 59 months in the Fria Prefecture.

1.3. General Objective

- To analyze the links between feeding practices and the hematological-parasitological profile of children aged 6 to 59 months in the Fria Prefecture.

1.4. Specific Objectives

- To describe the feeding practices of children aged 6 to 24 months in the Fria Prefecture;
- To analyze the hematological-parasitological profile of malnourished children, particularly parasitic infections in children aged 6 to 59 months;
- To identify risk factors related to feeding practices and environmental conditions that promote malnutrition and parasitic infections in children aged 6 to 59 months;
- To propose appropriate nutritional and healthcare strategies to prevent and mitigate malnutrition.

2. Materials and Methods

- Electronic Scale (Brand: Tanita, Ref: Tanita BC-545N, Series: TAN-BC545N-1024).
- Contaminated Waste Containers (Brand: Sharps Compliance, Ref: Sharps Container 3.2L, Series: SHC-32-0015).
- Cotton Balls Soaked in Alcohol (Brand: Tuff-Check, Ref: Sterile Cotton Balls, Series: TUFF-BA-001).
- Arm Cuff (Brand: Omron, Ref: Omron M6 Comfort, Series: OMR-M6C-1987).
- Survey Forms Ref: ENV-001-FRIA.
- Latex Gloves (Brand: Medline, Ref: Medline Curad Latex Exam Gloves, Series: MED-CLG-5002).
- Self-Retractable Lancets (Brand: Accu-Chek, Ref: Accu-Chek FastClix, Series: ACCU-FC-0224).
- Hemocue Microcuvettes (Brand: Hemocue, Ref: Hemocue Hb 201+ Microcuvettes, Series: HEM-HB201-001).
- Hemocue Hb 301 Photometer (Brand: Hemocue, Ref: Hemocue Hb 301, Series: HEM-HB301-1548).
- Height Rod (Brand: seca, Ref: seca 217, Series: SECA-217-005).
- Centrifuge (Brand: Eppendorf, Ref: Eppendorf 5702, Series: EPP-5702-021).
- Reagents for Parasitological Tests (Brand: Bio-Rad, Ref: Bio-Rad Parasitology Test Kit, Serial Number: BIO-PAR-0501).
- Parasitological Sampling Kit (Brand: Thermo Fisher, Ref: Thermo Fisher Stool Collection Kit, Serial Number: THF-STK-0730).
- Microscope and Slides (Brand: Olympus, Ref: Olympus CX23, Series: OLY-CX23-1125).

2.1. Working Methods

2.1.1. Study Area

The Fria prefecture, located in Lower Guinea within the Boké administrative region, covers an area of 1811 km^2 and has a population of around 82,000 inhabitants, with a population density of 45 inhabitants/km^2. It is traversed by the Konkouré River and lies 160 km north of Conakry. Historically, Fria is known for the presence of Africa's first alumina plant, built in 1957 by Péchiney. Connected to Conakry by both a road and a railway, this industry was once a major economic driver. However, its closure has had profound socio-economic consequences, worsening food insecurity and the nutritional vulnerability of the local population. Administratively, the prefecture is divided into four sub-prefectures (Baguinet, Banguingny, Fria-Centre, and Tormelin) and several urban neighborhoods. The Fria prefecture was selected as the study area due to the impact of the industrial crisis on food security and child malnutrition. This situation justifies the need for an in-depth analysis of the nutritional and socio-economic factors influencing dietary practices and the hematological-parasitological profile of children under five in Fria Prefecture [10]. As shown in **Figure 1**, the map of the Prefecture of Fria highlights the enumeration areas.

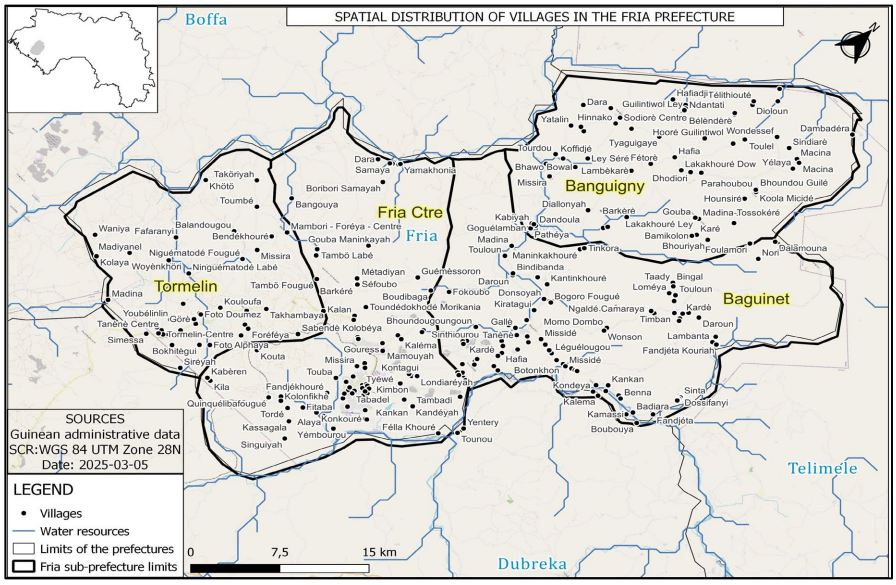

Figure 1. Map of the Prefecture of Fria with enumeration areas.

2.1.2. Study Framework

The study was conducted in collaboration with the Department of Statistics and Data Analysis at the Faculty of Science of Gamal Abdel Nasser University of Conakry, and the National Quality Control Office (ONCQ) of Matoto. This collaboration was essential to ensure a rigorous methodological approach and guarantee the quality of the data collected throughout the analysis [11]. As shown in **Figure 2**, maps illustrate the location of Gamal Abdel Nasser University of Conakry and the Laboratory of the National Office of Quality Control in Matoto.

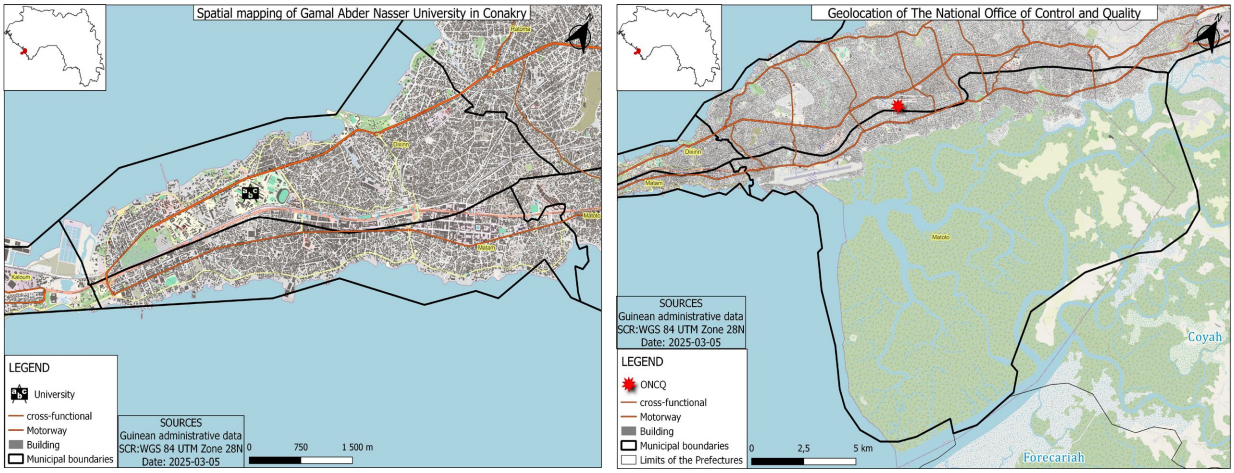

Figure 2. Maps showing the location of Gamal Abdel Nasser University of Conakry and the Laboratory of the National Office of Quality Control in Matoto.

2.1.3. Study Type

This is a cross-sectional descriptive study conducted over one month, from November 4 to December 4, 2024. It aims to collect data on sociodemographic, anthropometric, hemoglobin, hematological, parasitological variables, and dietary practices of children aged 6 to 59 months. L'étude transversale descriptive a utilisé un questionnaire validé et testé pour mesurer les pratiques alimentaires et les facteurs influençant le profil hémato-parasitologique des enfants. La validité du questionnaire a été assurée par une révision d'experts en nutrition et en santé publique, et sa fiabilité a été testée par un test-retest auprès d'un échantillon pilote, avec un coefficient de corrélation de 0.85. Ce questionnaire comprenait 20 items couvrant les pratiques alimentaires, les connaissances nutritionnelles et les caractéristiques socio-économiques.

2.1.4. Target Population

All children aged 6 to 59 months residing in the Fria prefecture.

2.1.5. Study Population

The sample includes children aged 6 to 59 months whose mothers or guardians have given their consent for participation in the study.

2.1.6. Inclusion Criteria

- Reside in Fria prefecture.
- Age between 6 and 59 months.
- Be present during data collection.
- Informed consent from parents or guardians.

3. Sampling

3.1. Sampling Frame

The sampling frame is based on the enumeration areas (EA) derived from the 2014 General Population and Housing Census (RGPH). Each EA is a geographical unit

with defined boundaries, including a known number of households and people [12].

3.2. Cluster Selection

Cluster selection, the primary unit of sampling, was carried out by proportional allocation to the population size of the strata to ensure representativeness.

3.3. Household Selection

Households were selected by systematic random sampling after a prior census of the primary sampling units.

3.4. Child Selection

All children aged 6 to 59 months present in the selected households were included in the sample, regardless of the number of children per household.

3.5. Sample Size Calculation

The sample size was determined using the Emergency Nutrition Assessment (ENA) software version 2016, considering a non-response rate of 3%. A maximum prevalence of 5% for Global Acute Malnutrition (GAM) in the Fria prefecture was taken into account, and the following formula was applied:

$$N = \frac{z^2 \times p \times (1-p) \times e}{D^2 \times r}$$

- *z*: Statistic corresponding to the required confidence level. For a 95% confidence level, the value used is 1.96.
- *p*: Estimated prevalence of Global Acute Malnutrition (GAM) in the Boké region, assessed at 5% according to the SMART Guinea survey, 2022.
- *e*: Effect of the sampling plan, expressing the ratio between the actual variance and the theoretical variance of a simple random sample. Given the use of cluster sampling, a default value of 1.5 is used to account for the high homogeneity among individuals within the same cluster.
- *r*: Expected response rate, adjusted to reflect the specifics of surveys in Guinea. For the SMART Guinea 2022 survey, this rate was 96%.
- *D*: Tolerated absolute margin of error, set at 0.08 (i.e., 8% of the phenomenon under study) for this survey.

By applying these parameters, the sample size was calculated to be 428 children. According to WHO guidelines for this sample size, it is recommended to use between 20 and 30 enumeration areas (EAs). Given the critical importance of this study, we randomly chose to use the maximum of 30 EAs for the Fria prefecture, in accordance with these recommendations.

4. Study Variables

4.1. Anthropometric Variables

- Weight
- Height

- Arm circumference

4.2. Clinical Variables

- Nutritional edema

4.3. Biological Variables

- Hemoglobin
- Complete blood count
- Stool parasitology

4.4. Epidemiological Variables of Children

- Age
- Educational level
- Residence
- Gender

4.5. Dietary Variables

- Early initiation
- Exclusive breastfeeding practice
- Duration of breastfeeding
- Continuation of breastfeeding
- 24-hour dietary recall

5. Data Collection

Data collection was conducted using a questionnaire developed from pre-established survey forms.

6. Data Analysis

Anthropometric indices were calculated based on WHO standards (2006), using the Emergency Nutrition Assessment (ENA) software version January 2020. Analysis was then carried out using Epi Info version 7 software to account for the sampling design. Weighting was done using sampling weights based on the population figures for each stratum and the number of households counted in each enumeration area (or cluster). Data on dietary practices and hemoglobin levels were analyzed using the Statistical Package for the Social Sciences (SPSS) version 22.

7. Limitations

The lack of data on the income of families with children aged 6 to 59 months is a significant limitation to our study. This gap restricts the analysis of the impact of household economic conditions on children's nutritional status, thus complicating the identification of socio-economic factors influencing malnutrition and access to adequate nutrition. Furthermore, the use of a cross-sectional model in this study limits causal inference capabilities. Although associations between variables

were observed, it is not possible to establish direct causal relationships due to the cross-sectional nature of the data. Additionally, potential confounding factors, such as unmeasured socio-economic variables or feeding practices not fully captured by the questionnaire, may also influence the results, requiring caution in the interpretation of the data.

8. Constraints

Our study was limited by the lack of data on household income, making the assessment of its impact on the children's nutritional status more complex. Difficulties in accessing certain areas also hindered data collection, while some families' reluctance to share sensitive information reduced the availability of complete and representative data.

9. Ethical Considerations

Before the study began, each mother was given clear information about the study's objectives, its voluntary, non-coercive, and non-paid nature. Verbal informed consent was systematically obtained before any participation. The study was conducted in strict adherence to the prevailing ethical principles. It received approval from the National Ethics Committee, ensuring its compliance with ethical standards and participant protection. In respect for the confidentiality and privacy of participants, the anonymity of the questionnaires was rigorously guaranteed, thus protecting the information collected.

10. Results and Discussions

10.1. Epidemiological Profile of Mothers and Children Aged 6 to 59 Months Included in Our Study

The results from Table 1 show that the majority of mothers are aged between 18 and 35 years (86.6%), which corresponds to the age range where women are generally in their childbearing years. The lower proportion of mothers aged ≥36 years (13.3%) may be due to a decrease in fertility rates with age. Our results are similar to those reported by Samuel KEÏTA in his doctoral thesis in medicine in Bamako, Mali, where 63.1% of the mothers of children included in his study were in the 20-40 age range [13].

Table 1. Distribution of mothers by age.

No.	Age range (years)	Number	%
1	18 - 25	182	40.4
2	26 - 35	208	46.2
3	≥36	60	13.3
	Total	450	100

The results from Table 2 show that 30.2% of the mothers are illiterate, and only

20.4% have reached a higher education level, which may influence their understanding of nutrition and food hygiene recommendations. A low education level may limit the adoption of good dietary and health practices, thereby increasing the risk of malnutrition and infections. Our results are lower than those reported by Samuel KEÏTA in his doctoral thesis in Bamako, Mali, where 38.6% of the mothers of children included in his study had no education [13].

Table 2. Distribution of mothers by education level.

No.	Education level	Number	%
1	None	136	30.2
2	Primary	48	10.7
3	Secondary	174	38.7
4	Higher	92	20.4
	Total	450	100

The results from **Table 3** show that 47.1% of the mothers live in urban areas, mainly in Fria, while 52.9% live in rural areas, particularly in the localities of Baguinet, Banguinyi, and Toromelin. This distribution is significant because it highlights disparities in access to health infrastructure, nutritional follow-up services, and varied diets. Indeed, rural areas often face major challenges such as distance from healthcare centers, limited availability of foods rich in essential nutrients, and sometimes insufficient awareness of good dietary practices. These factors contribute to increasing the risk of child malnutrition, necessitating targeted interventions to improve nutritional care for children in these regions.

Table 3. Distribution of mothers by place of residence.

No.	Residence (ZD)	Number	%
1	Urban Commune of Fria	212	47.1
2	Baguinet	96	21.3
3	Banguinyi	40	8.9
4	Toromelin	102	22.7
	Total	450	100

The distribution of children by age and gender, as shown in **Table 4**, revealed a G/F ratio of 0.9 in favor of boys. The percentage of boys is slightly higher in the 6 to 17-month (55.7%) and 42 to 53-month (66.7%) age groups, which may suggest biological or behavioral differences influencing the survival and nutritional status of boys. The proportion of children aged 6 to 17 months is the highest (35.1%), corresponding to a critical period for growth and development, requiring adequate nutrition to avoid malnutrition. Our results are consistent with those reported by Élie Mutombo in 2023 in the Democratic Republic of Congo, where

50.8% of the children included in his study were male compared to 49.2% female, with a boy/girl ratio of 1.03 in favor of boys [14].

Table 4. Distribution of children included in our study by age and gender.

Age	Boys		Girls		Total		Ratio
(Months)	no.	%	no.	%	no.	%	G/F
6 - 17	88	55.7	70	44.3	158	35.1	1.2
18 - 29	54	50.0	54	50.0	108	24.0	1.0
30 - 41	34	35.8	61	64.2	95	21.1	0.8
42 - 53	48	66.7	24	33.3	72	16.0	0.8
54 - 59	10	58.8	7	41.2	17	3.8	1.0
Total	234	52	216	48	450	100	0.9

10.2. Nutritional Profile of Children Aged 6 to 59 Months Included in Our Study

The distribution of acute malnutrition by age group is shown in Table 5. Severe Acute Malnutrition (SAM) affects 3.3% of children, and Moderate Acute Malnutrition (MAM) affects 5.6%, for a total of 8.9% of children in a state of acute malnutrition. The 54 to 59-month age group is the most affected (SAM: 29.4%; MAM: 17.6%), indicating increased vulnerability as children grow older. This may be related to insufficient access to protein-rich and micronutrient-rich foods. Overall, 83.3% of children have normal nutritional status, indicating a moderate prevalence of acute malnutrition compared to WHO thresholds. Our results are lower than those reported by Élie Mutombo in 2023 in the Democratic Republic of Congo, where the overall prevalence of acute malnutrition was 19.8%, with 13.9% presenting severe forms and 5.9% with moderate acute malnutrition. Only 80.2% of children had normal nutritional status [14].

Table 5. Prevalence of acute malnutrition by weight-for-height z-scores and/or edema by age group.

Âge	Total	SAM		MAM		Normale	
		(<−3 z-score)		(≥−3 et < −2 z-score)		(≥−2 z score)	
(Months)	no.	no.	%	no.	%	no.	%
6 - 17	158	4	2.5	5	3.2	149	94.3
18 - 29	108	2	1.9	7	6.5	99	91.7
30 - 41	95	3	3.2	4	4.2	88	92.6
42 - 53	72	1	1.4	6	8.3	30	41.7
54 - 59	17	5	29.4	3	17.6	9	52.9
Total	450	15	3.3	25	5.6	375	83.3

10.3. Hemoglobin Profile of Children Aged 6 to 59 Months Included in Our Study

The distribution of children by hemoglobin level is shown in Table 6. This table shows that 41.1% of children have anemia with a hemoglobin level lower than 12 g/dL, while 58.9% have normal hemoglobin levels (≥12 g/dL), which is a major public health problem. The high prevalence of anemia may be due to deficiencies in iron, vitamin B12, and folic acid, as well as parasitic infections. Our results are higher than those reported by Djidita Hagré *et al*. in 2022 in two hospitals in the southern district of N'Djamena, Chad, where 34% of children had anemia defined by hemoglobin levels lower than 12 g/dL [15].

Table 6. Distribution of children by hemoglobin (Hb) level.

N°	Category	Hb Level (g/dL)	Number	%
1	Normal	Hb ≥ 12	265	58.9
2	Anormal	Hb < 12	185	41.1
	Total		450	100

10.4. Parasitological and Hematological Profile of Children Aged 6 to 59 Months with Abnormal Hemoglobin Levels in Our Study

As shown in Table 7, among children with an abnormal hemoglobin level, 69.7% of anemic children are parasitized by Plasmodium (malaria), confirming the link between anemia and parasitic infections. Among them, 18.9% of children suffer from moderate anemia associated with hookworm infection, a condition that can cause chronic blood loss, and 11.4% of severe anemia cases are linked to schistosomiasis, another parasitic infection frequently associated with malnutrition and chronic infections. Our results differ from those of Soumana *et al*. (2011) in Niamey concerning the types of parasitic infections. Their study reported 86.4% protozoa and 13.6% helminths (nematodes). The identified protozoa were Giardia intestinalis (50%), Entamoeba histolytica (31.8%), and Trichomonas intestinalis (4.6%). Among the helminths, species transmitted via the fecal-oral route were predominant: Ascaris lumbricoides (4.5%), Enterobius vermicularis (4.5%), and Trichuris trichiura (1.5%). Ankylostoma duodenale (1.5%) was the only nematode transmitted through skin contact [16].

Table 7. Distribution of anemic children by type of anemia and parasitic infections.

N°	Type of Anemia	Parasitic Infections	Number	%
1	Mild (10 ≤ Hb < 12)	Plasmodium	129	69.7
2	Moderate (7 ≤ Hb < 10)	Hookworm	35	18.9
3	Severe (< 7)	Schistosoma	21	11.4
	Total		185	100

As shown in Table 8, the distribution of children based on hematocrit levels shows that 10.8% of anemic children have a severely decreased hematocrit (< 20%), indicating an advanced form of anemia. This critical level requires urgent medical intervention to prevent severe complications and ensure prompt action to restore the blood balance and general health of the children.

Table 8. Distribution of anemic children according to hematocrit levels.

N°	Types	Values (%)	Number	%
1	Slightly decreased	30 - 35	100	54.1
2	Moderately decreased	20 - 30	65	35.1
3	Severely decreased	<20	20	10.8
	Total		185	100

As shown in Table 9, 64.9% of anemic children exhibit microcytosis (MCV < 80 fL), suggesting that most cases of anemia are due to deficiency, particularly iron deficiency. This microcytosis is a key indicator of iron deficiency, which is essential for red blood cell production and oxygen transport in the body. A targeted nutritional intervention is necessary to correct this deficiency and prevent long-term effects on the growth and development of children [17].

Table 9. Répartition des enfants anémiés en fonction du VGM.

N°	Types	Values (fL)	Number	%
1	Microcytosis	<80	120	64.9
2	Normocytosis	80 - 100	55	29.7
3	Macrocytosis	>100	10	5.4
	Total		185	100

10.5. Dietary Profile of Children Aged 6 to 24 Months Included in Our Study

As shown in Table 10, among the children aged 6 to 24 months included in our study, only 20.7% were breastfed immediately after birth, while 47.4% were breastfed late, after several hours or within the day. The WHO recommends breastfeeding within the first hour of birth, as it strengthens immunity and helps prevent infections, both of which are crucial for infant health.

As shown in Table 11, 78.4% of children consume primarily energy foods, while only 12.9% consume builder foods and 8.6% consume protective foods. This imbalanced food distribution is concerning as it exposes children to nutritional deficiencies, particularly in proteins and essential micronutrients. Insufficient intake of builder foods (rich in proteins) and protective foods (rich in vitamins and minerals) can lead to deficits in growth, development, and immunity, thereby increasing the risk of chronic malnutrition and associated diseases. It is crucial to diver-

sify children's diets to prevent these deficiencies and improve their overall nutritional status.

Table 10. Distribution of children aged 6 to 24 months according to early initiation of breastfeeding.

No.	Time of Breastfeeding	Number	%
1	Immediately after birth	24	20.7
2	Within the first hour	37	31.9
3	Within the day following birth	55	47.4
	Total	116	100

Table 11. Distribution of children aged 6 to 24 months according to early initiation of breastfeeding.

No.	Food Groups	Number	%
1	Builder foods	15	12.9
2	Energy foods	91	78.4
3	Protective foods	10	8.6
	Total	116	100

As shown in Table 12, 78.4% of children primarily consume energy foods, while only 12.9% consume builder foods and 8.6% consume protective foods. This imbalanced food distribution is concerning, as it exposes children to nutritional deficiencies, particularly in proteins and essential micronutrients. Insufficient intake of builder foods (rich in proteins) and protective foods (rich in vitamins and minerals) can lead to deficits in growth, development, and immunity, thereby increasing the risk of chronic malnutrition and associated diseases. It is crucial to diversify children's diets to prevent these deficiencies and improve their overall nutritional status.

Table 12. Distribution of children aged 6 to 24 months according to food diversification.

No.	Food Diversification	Number	%
1	One food group	65	56.0
2	Two food groups	29	25.0
3	Three food groups	22	19.0
	Total	116	100

As shown in Table 13, among the 116 children, only 6 (5.2%) received a minimum acceptable diet, including three food groups and four meals a day. In contrast, 94.8% of children did not receive the recommended minimum diet. This dietary insufficiency partly explains the high prevalence of malnutrition and ane-

mia observed in the studied population, highlighting the urgent need to improve access to a diverse and balanced diet to ensure children's health and development. Our results are higher than those reported in the 2016 Guinea MICS survey, which indicated that only 0.6% of children aged 6 to 24 months in the Boké region received a diversified diet [18].

Table 13. Distribution of children aged 6 to 24 months according to receipt of minimum acceptable diet.

No.	Minimum Acceptable Diet	Number	%
1	Received	6	5.2
2	Did not receive	110	94.8
	Total	116	100

As shown in Table 14, among the children aged 6 to 24 months included in our study, 30.2% receive only two meals per day, which is insufficient according to the World Health Organization (WHO) recommendations. The WHO advises at least three to four daily meals for this age group to ensure adequate nutrient intake. Only 24.2% of children meet the minimum recommended frequency of four meals per day, while 35.3% consume three meals daily. A similar proportion (24.2%) benefits from a higher meal frequency, which positively contributes to their nutritional development. These findings highlight a concerning dietary insufficiency among a significant proportion of children, exposing those who do not meet the minimum meal frequency to an increased risk of nutritional deficiencies and growth retardation. Enhancing both the frequency and quality of meals is therefore essential to reduce the prevalence of childhood malnutrition and ensure adequate energy and micronutrient intake for optimal growth and development.

Table 14. The distribution of children aged 6 to 24 months is included in our study based on the frequency of meals per day.

No.	Meal Frequency/Day	Number	%
1	1 meal	12	10.3
2	2 meals	35	30.2
3	3 meals	41	35.3
4	4 or more meals	28	24.2
	Total	116	100

As shown in Table 15, the results indicate that 67.2% of households rely on prolonged cooking methods, which, while effective in eliminating certain pathogens, may lead to the loss of essential nutrients. Among these households, 54.3% use boiled or potable water, a critical factor in reducing the risk of foodborne contamination. However, only 43.1% adhere to hygienic cooking practices, potentially com-

promising the microbiological safety of prepared foods. Furthermore, 35.3% of households implement food preservation techniques, such as refrigeration or proper storage, which play a crucial role in preventing bacterial proliferation and ensuring food safety. These findings highlight the need for targeted interventions to promote safe and nutritionally adequate food preparation and storage practices, thereby reducing the risk of foodborne illnesses and nutrient depletion.

Table 15. Food preparation methods.

No.	Food Preparation Method	Number	%
1	Prolonged cooking (more than 10 minutes)	78	67.2
2	Use of boiled or potable water for preparation	63	54.3
3	Use of hygienic cooking methods	50	43.1
4	Food preservation after preparation	41	35.3
	Total	116	100

As shown in Table 16, over 60% of caregivers lack knowledge of basic nutritional principles, including the importance of essential micronutrients such as iron and iodine. This lack of awareness significantly contributes to the high prevalence of anemia and parasitic infections observed in the children studied. Specifically, 59.5% of caregivers are unaware of the importance of food diversification, which could lead to nutritional deficiencies in children if not addressed. Additionally, 62.9% of caregivers fail to recognize the signs of malnutrition, which may delay timely intervention for malnourished children. Finally, 70.7% of caregivers are unaware of the role that iron and iodine play in preventing anemia and micronutrient deficiencies, further exacerbating the risk of malnutrition. These findings emphasize the critical need for nutritional education programs targeting caregivers to raise awareness about the essential micronutrients necessary for children's growth and development and to promote early identification and intervention for malnutrition.

Table 16. Nutritional knowledge of caregivers of children aged 6 to 24 months included in our study.

No.	Nutritional Knowledge	Number	%
1	Do not know food groups	74	63.8
2	Do not know the importance of food diversification	69	59.5
3	Ignore signs of malnutrition	73	62.9
4	Do not know that iron and iodine are essential	82	70.7
	Total	116	100

11. Conclusions

Our study highlights several major challenges related to the nutritional and health

status of children aged 6 to 59 months in the Fria prefecture, as well as the socio-demographic characteristics of their mothers. The majority of the mothers surveyed are of childbearing age, but low levels of education and disparities between urban and rural areas limit the adoption of good nutritional and health practices.

From a nutritional perspective, although 83.3% of children have a normal nutritional status, acute malnutrition still affects 8.9% of children, with increased vulnerability among the older children. The high prevalence of anemia (41.1%) is a public health issue, largely associated with nutritional deficiencies and parasitic infections.

The link between anemia and malaria is particularly concerning, as 69.7% of anemic children are infected with Plasmodium, and other infections like hookworm and schistosomiasis contribute to worsening anemia. The diet of children aged 6 to 24 months remains generally insufficient and unbalanced. Less than 21% of infants benefit from immediate breastfeeding at birth, and food diversification is very limited, with only 5.2% of children receiving a minimally acceptable diet.

This situation is further compounded by significant gaps in caregivers' knowledge of basic nutrition and food safety practices. Nearly 60% of caregivers are unaware of the importance of food diversification, while over 60% lack awareness of essential micronutrients like iron and iodine, contributing to high rates of anemia and parasitic infections. Furthermore, hygienic food preparation practices are not consistently followed, and many households do not implement proper food preservation techniques.

This situation exposes children to an increased risk of malnutrition and deficiencies in essential micronutrients. These findings underline the urgency of strengthening interventions in nutrition and child health. Targeted actions, including the improvement of food diversification, iron and micronutrient supplementation, and the fight against parasitic infections, are essential to improving the nutritional and health status of children in this region.

12. Recommendations

Based on the results obtained, we propose the following recommendations aimed at improving the nutritional status of children aged 6 to 59 months in the Fria prefecture, with a particular focus on promoting optimal breastfeeding, improving dietary diversity, and combating parasitic infections.

12.1. Promotion of Optimal Breastfeeding

- **Awareness for mothers and caregivers**: Organize awareness sessions focused on the benefits of exclusive breastfeeding until six months, emphasizing its essential role in preventing malnutrition and parasitic infections.
- **Training of community health workers**: Train local health workers to effectively advise mothers on the importance of breastfeeding, good practices, and recognizing signs of complications such as infections.
- **Support for breastfeeding in the workplace**: Implement workplace policies

supporting breastfeeding, such as flexible hours or designated spaces for breastfeeding mothers.

12.2. Improvement of Dietary Diversity

- **Community nutrition programs**: Develop educational programs aimed at promoting the consumption of foods rich in micronutrients (such as vegetables, fruits, legumes, and animal or plant-based proteins) to improve the dietary diversity of children.
- **Strengthening local distribution chains**: Support local producers in diversifying the food supply and facilitating access to fresh, nutritious products in both rural and urban areas of the Fria prefecture.
- **Encouraging the introduction of fortified foods**: Promote the consumption of porridge or meals enriched with dietary supplements (such as vitamin A, minerals like iron and iodine, as well as additional proteins) to improve the nutritional status of children.

12.3.Combating Parasitic Infections

- **Deworming campaigns**: Organize regular deworming campaigns for children aged 6 to 59 months in collaboration with local health centers.
- **Improvement of hygiene conditions**: Raise awareness of the importance of simple hygiene practices, such as washing hands before meals and purifying water, to prevent parasitic infections.
- **Parent education**: Educate parents about the symptoms of parasitic infections and the importance of seeking early and effective treatment from health facilities.

Conflicts of Interest

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

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Appendix I: Data Collection Form

Survey Form: Dietary Practices and Hemato-Parasitological Profile of Children (6 to 59 Months)

Demographic Information:

1.1) Child's Name: _____

1.2) Child's Age (in months): _____

1.3) Child's Gender: ☐ Male ☐ Female

1.4) Parent/Guardian's Name: _____

1.5) Parent/Guardian's Education Level: ☐ None ☐ Primary ☐ Secondary ☐ Higher

1.6) Socio-economic Status (monthly income): ☐ Low ☐ Medium ☐ High

Child's Dietary Practices:

2.1) Number of meals per day: ☐ 1 meal ☐ 2 meals ☐ 3 meals ☐ 4 or more meals

2.2) Types of foods consumed by the child (check all that apply): ☐ Cereals ☐ Vegetables ☐ Fruits ☐ Animal Proteins ☐ Plant Proteins ☐ Dairy

2.3) How often does the child consume fruits and vegetables? ☐ Never ☐ Rarely ☐ Sometimes ☐ Frequently

2.4) What beverages does the child consume? ☐ Water ☐ Fruit juice ☐ Milk ☐ Sugary drinks ☐ Other (specify): _____

2.5) Are any supplements or fortifiers added to the child's meals? ☐ Yes ☐ No

2.6) If yes, which ones? (check all that apply): ☐ Vitamin A ☐ Iron ☐ Iodine ☐ Other (specify): _____

Methods of Food Preparation:

3.1) What cooking method is used for meals? ☐ Boiling ☐ Steaming ☐ Grilling ☐ Other (specify): _____

3.2) Is the food stored after preparation? ☐ Yes ☐ No

3.3) If yes, how is it stored? ☐ Refrigeration ☐ Freezing ☐ Room temperature

3.4) Do you use boiled or potable water to prepare meals? ☐ Yes ☐ No

Nutritional Knowledge of Parent/Guardian:

4.1) Are you aware of food groups (energy, building, protection)? ☐ Yes ☐ No

4.2) Do you know the importance of fruits and vegetables for the child's health? ☐ Yes ☐ No

4.3) Do you know the signs of malnutrition? ☐ Yes ☐ No

4.4) Do you have knowledge about the effects of iron and iodine in nutrition? ☐ Yes ☐ No

Hygiene and Care Practices:

5.1) Does the child wash their hands before eating? ☐ Yes ☐ No

5.2) Are the foods washed before preparation? ☐ Yes ☐ No

5.3) Is the cloth used for meals clean? ☐ Yes ☐ No

Additional Information:

6.1) Has the child been sick in the last 30 days? ☐ Yes ☐ No

6.2) If yes, what illnesses were diagnosed? _____

Parent/Guardian Signature

Name: _____ Date: _____ Signature: _____

Validation and Reliability

This questionnaire was validated by experts in nutrition and public health and tested for reliability through a test-retest with a pilot sample, yielding a correlation coefficient of 0.85. This process ensures the consistency and accuracy of the information collected.