

Research Article

Food Consumption Patterns and Physicochemical Characterization of Local Foods for Complementary Feeding in Côte d'Ivoire

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Abstract

This study aimed to investigate food consumption patterns among children aged 6–24 months and characterize the physicochemical, biochemical and antinutritional properties of locally available foods that could be used to formulate complementary foods in Côte d'Ivoire. The study was conducted in Bouna, Man and Mankono, located in the Zanzan, Montagnes and Woroba regions, respectively, which are highly affected by chronic malnutrition. A quantitative survey involving 450 households was conducted, alongside food purchases in six markets, with two markets selected in each study area: one in the main town and one in a randomly selected surrounding village. The survey documented food consumption patterns among young children and informed the selection of locally available foods for laboratory analysis. Cereal-based porridges and cereals were among the most commonly consumed foods by children in the three study areas. Laboratory analyses included physicochemical assessments of pH and dry matter, biochemical determinations of protein, lipid and total fibre contents, and measurements of antinutritional factors, particularly phytates and oxalates. The results revealed significant differences in selected food characteristics across the study areas. Soumbala from Mankono had a significantly higher pH ($p < 0.05$). Dry matter contents were significantly higher in millet from Bouna (94.4 ± 0.01 g), white beans from Bouna (90.4 ± 0.03 g) and Mankono (90.8 ± 0.02 g), and Daloa rice from Man (91.4 ± 0.01 g). Phytate levels were also significantly higher in the local rice varieties from Man ($p < 0.05$). Overall, the findings highlight the importance of cereals in the diets of young children in the three study areas and identify locally available foods, including white beans, millet, sorghum and local rice, as potential ingredients for complementary food formulation. This study provides useful evidence to guide the selection of local food resources for developing complementary foods adapted to the dietary context of children aged 6–24 months in Côte d'Ivoire.

Keywords

Characterization, Physico-chemical, Biochemical, Infant Recipes, Local Foods

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1. Introduction

A fundamental human need, food provides the body with the nutrients and energy it needs to develop and function properly [1, 2]. In fact, from birth to 6 months of age, all a child's nutritional needs are covered by breast milk [20, 21]. Once six months have passed, this milk becomes insufficient to cover the infant's nutritional needs [22, 23, 26, 27]. It is therefore necessary to introduce new foods (liquid, semi-liquid and solid) to supplement breast milk [3, 29, 30]. Today, malnutrition and micronutrient deficiencies are a reality in many developing countries [4]. According to the INS and ICF survey [5] in Côte d'Ivoire, stunting affects 26% of children aged 24-59 months and 12% of children aged 6-11 months. What's more, the Zanzan (31% and 9% with a severe form), Woroba (30% and 10% with a severe form) and Montagnes (30% and 10% with a severe form) regions present figures considered very high (> 30%) and therefore alarming [5]. As for underweight, the prevalence is around three times higher among children whose mothers have no education than among those whose mothers have higher education (16% vs. 5%). As for overweight, the percentage is eight times higher among children whose mothers have a higher level of education than among those whose mothers have no education (16% vs. 2%). Various ethnobotanical studies carried out in recent years have shown that Ivorian rural communities have significant food resources (fruits, nuts, vegetables, mushrooms and animal products) that could be used in infant recipes to combat chronic malnutrition [6]. Thus, the exploration of local food resources is proving to be one of the most sustainable approaches to combating public health problems of nutritional origin, in particular chronic malnutrition [7, 24]. It is in this sense that, for many years, the valorization of local food resources has played an important role in the fight against malnutrition, as their use has proved to be an effective means [31]. The aim of this pilot study was to characterize the physico-chemical properties of a few local foodstuffs that could be used to formulate infant recipes to combat chronic malnutrition in Côte d'Ivoire, while determining the dietary diversity score of the towns of Bouna, Man and Mankono.

2. Materials and Methods

2.1. Material

Fifteen (15) foods were purchased in the towns of Bouna, Man and Mankono. In Bouna and Mankono, ten foods were purchased, including white beans (HBB and HBM), red sorghum (SRB and SRM), millet (MB and MM), soumbala (SB and SM) and local rice (riz Panzani and riz M'bappé). For the town of Man, five foods were tested, including five local rice varieties (riz Malo Oussou, riz Gbagbo, riz Koubi, riz Danané, riz Daloa). Biochemical, physico-chemical and anti-nutritional analyses were carried out on the fifteen (15) foods collected.

2.2. Methods

2.2.1. Study Period and Population

This was a descriptive cross-sectional study using a quantitative approach. The field survey took place over 10 days in June 2023. The study population consisted of mothers/caregivers of infants or fathers of infants aged 6 to 24 months. Targets who were ill at the time of the survey were excluded. The overall sample size was 450 households, i.e. 150 households per town representing the region. Fifteen foods were purchased for biochemical analysis.

2.2.2. Quantitative Survey and Food Purchasing

Data were collected during a face-to-face interview with the mothers. A questionnaire was used to gather information. It collected information on the socio-demographic characteristics of the infants and the household, and on the infants' feeding practices. The Shakir tape measure was used to measure brachial perimeter and assess the nutritional status of infants. The foodstuffs selected were purchased in urban markets.

2.2.3. Physico-chemical Analysis

(i). Hydrogen Potential (pH)

pH was determined using a Hanna-type pH meter (HI991001, Romania) [8]. The instrument was calibrated using two buffer solutions at pH 7.0 and 4.0, systematically prior to pH measurements.

(ii). Moisture and Dry Matter Content

Moisture and dry matter content were determined using the AOAC method [8]. A 5 g sample was weighed into a crucible of known mass. The assembly (sample + crucible) (m_1) was placed in a ventilated oven (BIOBASE® Shandong, China) at 105°C for 3 hr. It was then weighed and the mass recorded (m_2). This process was repeated for each sample until a constant mass was obtained in each case. Moisture (H) was determined according to the following relationship:

$$H = (m_1 - m_2) / m_1 \times 100 \quad (1)$$

The dry matter content (MS) will be determined by the following expression:

$$\text{TMS (\%)} = 100 - H (\%) \quad (2)$$

2.2.4. Biochemical Analysis

Proximal composition was determined using the AOAC method [8]. Moisture content was determined by drying in an oven at 105 °C to constant weight. Subtraction gave the dry matter content. Total crude protein content was obtained by the Kjeldahl method. The total lipid content of the samples was determined gravimetrically after Soxhlet extraction. Fiber

content was obtained after acid boiling under reflux cooling.

2.2.5. Anti-nutritional Properties

(i). Phytate Content

The phytate content of the flours was determined using the method described by Latta and Eskin [9]. A quantity of 1 g of each finely ground sample was weighed and homogenized in 20 mL HCl (0.65 N) under stirring for 12 h at room temperature. The mixtures were then centrifuged at 4200 rpm for 30 min using a centrifuge (SIGMA® 3-16P, Germany). Phytate content was determined using a calibration line based on a 10 mg/mL sodium phytate stock solution:

$$\text{phytates} \left(\frac{\text{mg}}{100} \right) = \frac{DO_{490} \times 4}{0.033 \times m_e} \quad (3)$$

With: Calibration line: $DO_{490} = 0.033 \text{ mass } (\mu\text{g}) \text{ sodium phytate}$; $R_2: 0.99$

(ii). Oxalate Content

The oxalate content of the samples was determined using the method described by Day and Underwood [10]. A 1 g quantity of finely ground sample was homogenized in 75 mL H_2SO_4 (3 M) under magnetic stirring for 1 hr. The mixture was filtered through WHATMAN filter paper, then 25 mL of the filtrate was removed and hot-titrated with 0.05 M potassium permanganate ($KMnO_4$) solution until the color turned persistent pink for 30 s.

$$\text{Oxalates (mg/100g)} = \frac{2.2 \times V_{eq}}{V_e} \times 100 \quad (4)$$

With: me: Mass (g) of sample 2.2: Mass of oxalate (mg) equivalent to 1 mL of $KMnO_4$ (0.05 M). V_{eq} : Volume (mL) of $KMnO_4$ poured at equivalence.

2.2.6. Statistical Analysis

The data collected were entered in Excel and processed using IBM SPSS 26, Max QDA and XLSTAT 2016. Graphical representations were made using Excel 2019. Experimental results are expressed as arithmetic means with standard error

($m \pm \text{SEM}$).

2.2.7. Ethical Aspects

Ethical approval was obtained from the National Committee on Ethics of Life and Health Sciences (CNESVS). Permission to conduct the study was secured from all relevant authorities in the study area. Each participant in the study was informed about the research and given the opportunity to ask questions. Subsequently, informed consent was obtained from each participant before their involvement in the study, and the data remained confidential.

3. Results and Discussion

3.1. Results

3.1.1. Foods most Frequently Consumed by City

Respondents were asked how many times a day their child had eaten a particular food. The arithmetic mean was then calculated from the responses collected for each type of food. The average daily consumption frequencies of the various foods were presented by city (Tables 1, 2 and 3). Cereal porridges were the most consumed by infants living in Bouna. They ranked first, with an average daily consumption of 1.8 times a day. Next came cereals (1.72 times a day) and bouillon cubes (1.7 times a day). Eggs and offal ranked 18th and 20th respectively (Table 1).

Infants in Man were very frequent consumers of spicy foods. The average consumption of spicy foods was 2 times a day. Vegetables were consumed frequently, with a daily average of 1.9, followed by cereals (1.75 times) and fish (1.73 times). On the other hand, eggs and yellow-fleshed starches were consumed less frequently, on average 1 time a day (Table 2).

Cereal porridges were consumed most by infants in Mankono, with an average of 1.8 times a day. Vegetables and bouillon cubes came second and third, with average daily intakes of 1.58 and 1.56 times a day respectively. Offal, dairy products (yoghurt, curdled milk, cheese, etc.) and yellow-fleshed starches were the least consumed (Table 3).

Table 1. Foods most eaten by infants living in Bouna.

Foods eaten the most	Frequency of consumption average/day	Rank
Cereal porridges	1.79	1
Cereal	1.72	2
Stock cubes	1.70	3
Spices	1.62	4
Dark green leaves	1.57	5

Foods eaten the most	Frequency of consumption average/day	Rank
Vegetables	1.56	6
The oil	1.51	7
Milk	1.45	8
Red oil	1.42	9
Yellow-fleshed starches	1.33	10
Starchy foods	1.23	11
Plant proteins	1.22	12
Yoghurt / curd or cheese	1.21	13
The fish	1.18	14
The fruit	1.14	15
Sweet foods	1.12	16
Meat	1.08	17
Eggs	1.08	18
Sugary drinks	1.05	19
Offal (liver, kidney, heart, etc.)	1.00	20

Source: DIVARAL 2023 survey

Table 2. Foods most eaten by infants living in Man.

Foods eaten the most	Frequency of consumption average/day	Rank
Spices	2.00	1
Vegetables	1.91	2
Cereal porridges	1.75	3
The fish	1.73	4
Cereals	1.68	5
The oil	1.66	6
Milk	1.62	7
Stock cubes	1.6	8
Red oil	1.55	9
Dark green leaves	1.44	10
Offal (liver, kidney, heart, etc.)	1.33	11
Sweet foods	1.33	12
Starchy foods	1.31	13
Meat	1.29	14
Plant proteins	1.24	15
Yoghurt / curd or cheese	1.20	16
The fruit	1.15	17
Eggs	1.13	18

Foods eaten the most	Frequency of consumption average/day	Rank
Sugary drinks	1.13	19
Yellow-fleshed starches	1.00	20

Source: DIVARAL 2023 survey

Table 3. Foods most eaten by infants living in Mankono.

Foods eaten the most	Frequency of consumption average/day	Rank
Cereal porridges	1.79	1
Vegetables	1.58	2
Stock cubes	1.56	3
Cereals	1.51	4
Oil	1.50	5
Red oil	1.47	6
Spices	1.45	7
Milk	1.43	8
Sweet foods	1.41	9
The fruit	1.34	10
Dark green leaves	1.29	11
Sugary drinks	1.25	12
The fish	1.23	13
Starchy foods	1.20	14
Meat	1.19	15
Eggs	1.16	16
Plant proteins	1.15	17
Offal (liver, kidney, heart, etc.)	1.11	18
Yoghurt / curd or cheese	1.08	19
Yellow-fleshed starches	1.00	20

Source: DIVARAL 2023 survey

3.1.2. Infant Dietary Diversity Score (IDDS)

The majority of infants had good dietary diversity (86.9%).

However, there were disparities between zones. The town of Bouna had the highest proportion of children with low dietary diversity (14%) (Figure 1).

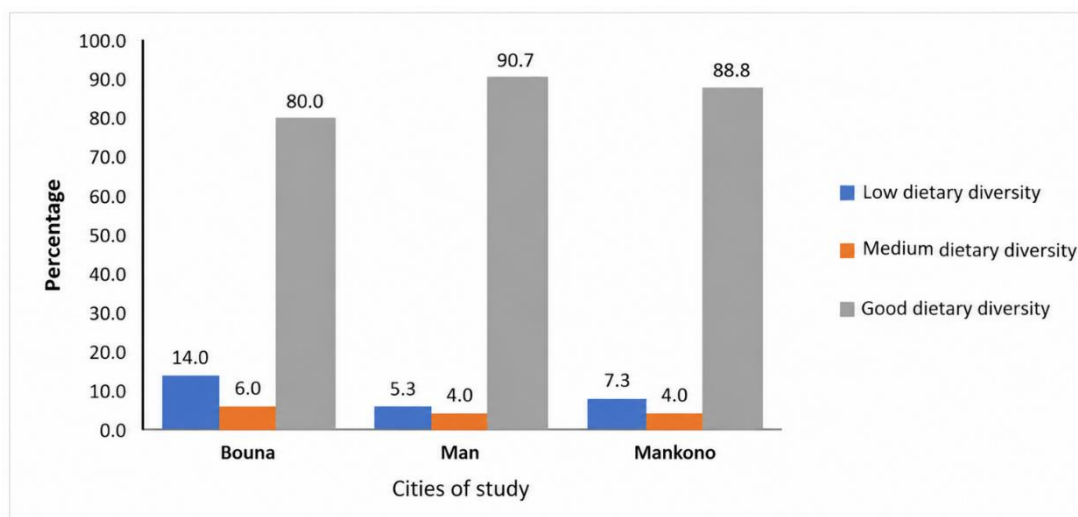


Figure 1. Dietary diversity score for infants by city.

3.1.3. Physicochemical, Biochemical and Anti-nutritional Analyses of Foodstuffs

The results of the physicochemical, biochemical and anti-nutritional analyses of the collected foodstuffs are presented in [Tables 4–15](#).

The pH of soumbala, a seasoning used in the preparation of children's meals, ranged from 4.80 ± 0.06 to 4.84 ± 0.06 in Bouna and Mankono, respectively. During the study period, soumbala was not commonly used in the diets of children in Man. The pH of soumbala from Mankono was significantly higher than that of soumbala from Bouna ($p < 0.05$; [Table 4](#)).

Dry matter content ranged from 84.8 ± 0.03 to 94.4 ± 0.01 g/100 g ([Tables 4, 6, 8, 10, 12 and 14](#)). Millet from Bouna (94.4 ± 0.01 g/100 g), white beans from Bouna (90.4 ± 0.03 g/100 g) and Mankono (90.8 ± 0.02 g/100 g), and Daloa rice from Man (91.4 ± 0.01 g/100 g) had significantly higher dry matter contents than the other foods analyzed ($p < 0.05$).

Regarding biochemical composition, protein content ranged from 0.6 ± 0.02 to 17.8 ± 0.04 g/100 g ([Tables 4, 6, 8, 10, 12 and 14](#)). The highest protein contents were recorded for white beans from Bouna (17.0 ± 0.09 g/100 g) and Mankono

(17.8 ± 0.04 g/100 g), with significant differences compared with the other foods analyzed ($p < 0.05$).

Crude fiber content ranged from 3.5 ± 0.03 to 11.5 ± 0.2 g/100 g. The highest values were observed in millet from Bouna (11.5 ± 0.2 g/100 g), white beans from Bouna (10.3 ± 0.10 g/100 g) and red sorghum from Mankono (10.98 ± 0.06 g/100 g). These values were significantly higher than those of the other foods analyzed ($p < 0.05$).

Total lipid content ranged from 0.2 ± 0.002 to 31.5 ± 0.2 g/100 g. Soumbala from Bouna (31.28 ± 0.2 g/100 g) and Mankono (31.5 ± 0.2 g/100 g) had significantly higher lipid contents than the other foods analyzed ($p < 0.05$).

Regarding antinutritional factors, phytate content ranged from 19.3 ± 0.04 to 309.34 ± 0.3 mg/100 g ([Tables 5, 7, 9, 11, 13 and 15](#)). The five local rice varieties collected in Man had significantly higher phytate contents than the other foods analyzed ($p < 0.05$).

Oxalate content ranged from 76.2 ± 0.22 to 414.2 ± 0.04 mg/100 g. The highest values were recorded for red sorghum from Bouna (414.2 ± 0.04 mg/100 g) and Mankono (411.6 ± 0.02 mg/100 g), as well as millet from Bouna (398.3 ± 0.4 mg/100 g). These values were significantly higher than those of the other foods analyzed ($p < 0.05$; [Tables 7 and 14](#)).

Table 4. Biochemical composition of white beans from the towns of Mankono and Bouna.

Parameter	Bouna white beans (HBB)	Mankono white beans (HBM)
pH	6.6 ± 0.017^b	5.9 ± 0.02^a
Total fibre (g / 100 g)	10.3 ± 0.10^b	6.8 ± 0.09^a
Total fat (g / 100 g)	0.9 ± 0.01^a	1.4 ± 0.18^b
Protein (g / 100 g)	17 ± 0.09^a	17.8 ± 0.04^b
Dry matter (g / 100 g)	90.4 ± 0.03^a	90.8 ± 0.02^b

Table 5. Anti-nutritional factors in white beans from the towns of Mankono and Bouna.

Parameter	Bouna white beans (HBB)	Mankono white beans (HBM)
Phytates (mg / 100 g)	98.3 ± 0.35 ^a	99.42 ± 0.30 ^b
Oxalates (mg / 100 g)	114.28 ± 0.21 ^b	76.2 ± 0.22 ^a

Table 6. Biochemical composition of red sorghum from the towns of Mankono and Bouna.

Parameter	Bouna red sorghum (SRB)	Mankono red sorghum (SRM)
pH	6.3 ± 0.05 ^a	6.8 ± 0.15 ^b
Total fibre (g / 100 g)	9.6 ± 0.55 ^a	10.98 ± 0.06 ^b
Total fat (g / 100 g)	2.9 ± 0.42 ^b	1.94 ± 0.21 ^a
Protein (g / 100g)	11 ± 0.02 ^b	9.4 ± 0.03 ^a
Dry matter (g / 100 g)	89.7 ± 0.013 ^b	89.4 ± 0.03 ^a

Table 7. Anti-nutritional factors in red sorghum from the towns of Mankono and Bouna.

Parameter	Bouna red sorghum (SRB)	Mankono red sorghum (SRM)
Phytates (mg / 100 g)	96.09 ± 0.29 ^a	126.34 ± 0.23 ^b
Oxalates (mg / 100 g)	414.2 ± 0.04 ^b	411.6 ± 0.02 ^a

Table 8. Biochemical composition of soumbala from the towns of Mankono and Bouna.

Parameter	Bouna Soumbala (SB)	Mankono Soumbala (SM)
pH	4.8 ± 0.06 ^a	4.84 ± 0.06 ^b
Total fibre (g / 100 g)	9.6 ± 0.1 ^b	9.18 ± 0.01 ^a
Total fat (g / 100 g)	31.28 ± 0.2 ^a	31.5 ± 0.2 ^b
Protein (g / 100 g)	4.32 ± 0.03 ^b	0.6 ± 0.02 ^a
Dry matter (g / 100 g)	84.8 ± 0.03 ^a	87.3 ± 0.01 ^b

Table 9. Anti-nutritional factors in the towns of Mankono and Bouna.

Parameter	Bouna Soumbala (SB)	Mankono Soumbala (SM)
Phytates (mg / 100 g)	19.6 ± 0.03 ^a	19.3 ± 0.04 ^a
Oxalates (mg / 100 g)	136.7 ± 0.06 ^a	141.4 ± 0.06 ^b

Table 10. Biochemical composition of local rice varieties in the Man area.

Parameter	Mallo Oussou rice	Gbagbo rice	Koubi rice	Danané rice	Daloa rice
pH	6.2 ± 0.05 ^{ab}	6.51 ± 0.01 ^b	6.04 ± 0.03 ^a	6.3 ± 0.34 ^{ab}	6.2 ± 0.1 ^a
Total fibre (g / 100 g)	6.56 ± 0.3 ^c	4.8 ± 0.01 ^c	4 ± 0.03 ^b	3.5 ± 0.03 ^a	5.03 ± 0.1 ^d
Total fat (g / 100 g)	0.63 ± 0.01 ^b	0.72 ± 0.01 ^c	0.54 ± 0.2 ^a	0.72 ± 0.01 ^c	0.54 ± 0.01 ^a
Protein (g / 100 g)	7.71 ± 0.02 ^b	8.10 ± 0.02 ^d	7.9 ± 0.01 ^c	7.50 ± 0.01 ^a	7.88 ± 0.03 ^c
Dry matter (g/100 g)	89.7 ± 0.03 ^c	88.9 ± 0.03 ^b	89.8 ± 0.03 ^c	88.3 ± 0.03 ^a	91.4 ± 0.01 ^c

Table 11. Anti-nutritional factors of local rice varieties in the city of Man.

Parameter	Mallo Oussou rice	Gbagbo rice	Koubi rice	Danané rice	Daloa rice
Phytates (mg / 100 g)	176.3 ± 0.2 ^a	225.3 ± 0.4 ^b	251.7 ± 0.4 ^c	305.2 ± 0.2 ^d	309.34 ± 0.3 ^e
Oxalates (mg / 100 g)	374.3 ± 0.2 ^c	266.4 ± 0.4 ^b	326.1 ± 0.04 ^c	208.6 ± 0.4 ^a	349.1 ± 0.06 ^d

Table 12. Biochemical composition of two local rice varieties from the towns of Mankono and Bouna.

Parameter	Panzani rice	M'Bappé rice
pH	6.13 ± 0.03	6.03 ± 0.11
Total fibre (g / 100 g)	7.6 ± 0.05	9.60 ± 0.01
Total fat (g / 100 g)	0.52 ± 0.001	0.53 ± 0.01
Protein (g / 100 g)	7.84 ± 0.01	7.74 ± 0.01
Dry matter (g / 100 g)	88 ± 0.02	88.92 ± 0.01

Table 13. Anti-nutritional factors of two local rice varieties in the towns of Mankono and Bouna.

Parameter	Panzani rice	M'Bappé rice
Phytates (mg / 100 g)	153.4 ± 0.43	175.24 ± 0.3
Oxalates (mg / 100 g)	239.3 ± 0.2	241.30 ± 0.47

Table 14. Biochemical composition of millet from the towns of Bouna and Mankono.

Parameter	Bouna millet	Mankono millet
Ph	6.8 ± 0.01 ^b	6.5 ± 0.05 ^a
Total fibre (g / 100 g)	11.5 ± 0.2 ^b	5.2 ± 0.4 ^a
Total fat (g / 100 g)	3.4 ± 0.2 ^b	0.2 ± 0.002 ^a
Protein (g / 100 g)	2.00 ± 0.006 ^a	6.6 ± 0.003 ^b

Parameter	Bouna millet	Mankono millet
Dry Matter (g / 100 g)	94.4 ± 0.01 ^b	90.3 ± 0.03 ^a

Table 15. Anti-nutritional factors in millet from the towns of Bouna and Mankono.

Parameter	Bouna millet	Mankono millet
Phytates (mg / 100 g)	105.2 ± 0.3 ^a	128.5 ± 0.04 ^b
Oxalates (mg / 100 g)	398.3 ± 0.4 ^b	307.3 ± 0.4 ^a

3.2. Discussions

The results obtained for the foods most consumed in the towns of Bouna, Man and Mankono show a high daily consumption of cereals and cereal-based porridge. Indeed, cereals, like roots and tubers, are crops intended for human consumption [11]. This observation is in line with the findings of Kouamé and Enoh [12], who noted that the roots and tubers and cereals subgroups cumulatively contribute more than 60% of calorific availability in Côte d'Ivoire. It should be noted that an excessive intake of these foods could lead to certain chronic diseases such as obesity, type 2 diabetes and hypertension, the incidence of which is rising steadily in Côte d'Ivoire [25]. This high consumption of cereals was also confirmed by the work of Yoboué and colleagues [2], who highlighted the consumption of cereals by the Ivorian population; and Macauley and Ramadjita [13], who stated that cereals such as sorghum, millet, wheat, maize and rice are essential staple foods for the majority of the Senegalese population.

In terms of dietary diversity score, we observe that infants in the towns of Bouna, Man and Mankono show very good dietary diversity. However, we note a low consumption of proteins (animal and vegetable) by infants in all towns. This could be one of the reasons for the high rates of chronic malnutrition in these three regions [5].

The values of the physico-chemical parameters of the foods studied fall within the required range proposed by the West African food composition table [14].

The results obtained for the different varieties of local rice from the three towns of Man, Mankono and Bouna are in line with the values for the different forms of local rice listed in the West African food composition table for dry matter (between 87.6 and 88.1 g / 100 g), protein (between 6.0 and 7.7 g / 100 g), lipid (between 0.6 and 1.6 g / 100 g) and crude fiber (between 2.4 and 4.4 g / 100 g) content. These results highlight the quality of local rice produced in these local regions [14]. Among the different local rice varieties studied, danané rice from the town of Man has values closer to the nutritional composition of rice listed in the West African food composition

table version 2019. In fact, the town of Man has plenty of good land and good rice growers for growing rice. This finding is in line with studies by Ruf [15] and Yoboué *et al* [2], who state that the inhabitants of Man are major consumers of rice.

For red sorghum from the towns of Bouna and Mankono, the values for the parameters analyzed (protein content, lipids, crude fiber) are slightly lower than those in the West African food composition table. However, for water content, they are more or less the same as for red sorghum in the West African food composition table. The water content values for the towns of Bouna and Mankono were 10.3% and 10.6% respectively, compared with 10.2% for the West African food composition table [14].

The white bean values obtained compared with those of the West African food composition table are lower for most of the parameters analyzed (protein, lipid and fiber content); and virtually identical for water content. The values for the towns of Bouna and Mankono are 9.6% and 9.2% respectively, compared with 9.8% for the West African food composition table, version 2019.

A comparison of the soumbala values for the towns of Bouna and Mankono and the millet values for the towns of Bouna and Mankono with those of the West African composition table shows that they are largely different for all parameters, with the exception of moisture content, which is more or less identical. Soumbala values for the towns of Bouna and Mankono, were 15.2% and 12.7% versus 15.1% for the West African food composition table version 2019 [14].

These findings reflect the fact that the food resources studied, in comparison with the West African food composition table version 2019, have nutritional values favorable to consistent use in children's diets. They can therefore be used to formulate recipes for children, as indicated by a number of authors, including Dally [6], Fogny [7], Traoré and colleagues [16].

With regard to the high phytate content in rice varieties from the town of Man, soil treatment strategies should be implemented. Studies have shown that phytic acid is the main chelating agent reducing the bioavailability of divalent cations [17-19, 28].

4. Conclusion

This study highlighted the high consumption of cereals and cereal-based porridges among young children in Bouna, Man and Mankono. It also identified locally available foods, including white beans, millet, red sorghum and local rice, as potential ingredients for developing complementary foods for children aged 6–24 months. These findings support the development of locally adapted recipes using food resources that are accessible in the study areas and consistent with existing dietary practices.

In a context where access to therapeutic foods may be affected by shortages and supply constraints, promoting the use of local food resources could contribute to diversifying complementary food options. However, these foods should not be considered direct substitutes for therapeutic foods without appropriate nutritional validation. In Man, particular attention could be given to Danané rice, which showed favorable nutritional characteristics compared with the other local rice varieties assessed. Further studies should evaluate the nutritional adequacy, safety, acceptability and feasibility of incorporating these ingredients into complementary food formulations for children aged 6–24 months in both urban and rural settings.

Abbreviations

CNESVS	National Committee on Ethics of Life and Health Sciences
pH	Hydrogen Potential
HBB	Bouna White Beans
HBM	Mankono White Beans
SRB	Bouna Red Sorghum
SRM	Mankono Red Sorghum
MB	Millet from Bouna
MM	Millet from Mankono
SB	Soumbala from Bouna
SM	Soumbala from Mankono

Author Contributions

Adeh Ahoua Hans Noël: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Visualization, Writing – original draft

Assanvo Bomo Justine: Methodology, Supervision, Validation, Writing – review & editing

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The data is available from the corresponding author Adeh Ahoua Hans Noel upon reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

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Biography



Adeh Ahoua Hans Noël is a doctoral student at the UFR Sciences et Technology of Alassane OUATTARA University in Bouaké (Ivory Coast). He obtained his Master's degree in Nutrition and Food Safety, and then entered the world of scientific research by joining the sustainable agriculture and nutrition division of the Centre susse of scientific research in Côte d'Ivoire (CSRS). He took part in several research projects funded by the Ivorian government as a master and doctoral student. Having already published an article in the medical field and he is taking his first steps as a researcher through this scientific publication.



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Research Field

Adeh Ahoua Hans Noël: Biochemistry and food science, nutrition and food safety, science and technology.

Assanvo Bomo Justine: Biotechnology, Biochemistry, Food fermentation, food quality and human nutrition.