

State of the Nutritional Quality of Three Local Infant Flours Sold in Chad

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Abstract The nutritional quality of infant flours used in dietary diversification as complementary foods for infants and young children is crucial. This study aims to assess the nutritional quality of local infant flours produced in N'Djamena. The methodology consisted of determining several biochemical parameters of 15 samples. Except for total carbohydrates, standard methods determined mean values for biochemical parameters, which ranged from 6.62 ± 0.00 to $7.30 \pm 0.14\%$ for moisture content; from $1.82 \pm 0.09\%$ to $2.42 \pm 0.02\%$ for ash content; and from $9.98 \pm 0.18\%$ to $11.06 \pm 0.03\%$ for protein; from $9.70 \pm 0.61\%$ to $16.04 \pm 0.24\%$ for lipids, and from $63.22 \pm 0.07\%$ to $71.29 \pm 0.48\%$ for carbohydrates. For the energy values per 100g of flour, the average values were between 409.01 ± 1.96 and 441.53 ± 1.79 kcal. The aflatoxin concentrations varied between 2.78 ppb and 50.61 ppb. This study showed that the flours analyzed presented an appreciable nutritional quality. However, improving protein contents and controlling production processes to reduce aflatoxin concentrations are essential.

Keywords: nutritional quality, local infant flours, Chad

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1. Introduction

Complementary foods help address protein, energy and mineral deficiencies in malnourished children [1].

In sub-Saharan Africa, the first complementary foods are most often porridges made from cereals, roots, or tubers, with or without sugar. They are rich in carbohydrates and low in protein [2,3].

The compositions of cereal flours (red sorghum, rice), oilseeds (soybeans, peanuts, sesame), and vegetables (carrots, beets) have been studied by several authors.

[4,5,6,7,8] showed that water content is a determining parameter in flour storage. [2,9,10,11] reported that the nature of the packaging is the cause of the increase in water content in a food, due to its lack of water vapor tightness in the storage environment. [12] noted the rapid deterioration by water transfer in poorly stored food in an environment with high relative humidity (53-97%) and an ambient temperature of 20 to 30°C.

[13] showed that mineral salts are essential elements for the proper functioning of the body and growth.

[11,14,15] showed that regular consumption of low-protein foods would expose infants and young children to malnutrition. If the lipid and carbohydrate levels in flour are low, the energy value of its composites would decrease

over its shelf life [10].

[16,17,18] reported a potential risk to infant health when tolerable levels for aflatoxins are not met in foods. This study is part of the quality control of foodstuffs intended for infant feeding during the weaning period. It specifically targets the nutritional quality of three types of artisanal infant flours commonly found in stores in N'Djamena.

2. Materials and Methods

This is a cross-sectional, analytical, and descriptive study. It was conducted between June and August 2024 in the municipality of N'Djamena. Biochemical analyses were performed in the physicochemistry laboratory of the Food Quality Control Center (CECOQDA) in N'Djamena.

2.1. Description of Study Material

The materials used in this study consisted of three local baking flours. These three flours are made from local ingredients available and accessible in the various markets of the capital.

- BLOKADJI flour (FC1): made from corn, sesame, peanuts, rice, and red sorghum;
- NUTRINAT flour (FC2): made from red sorghum,

cowpeas, peanuts, carrots, and beets;

- Flour (FC3): made from red sorghum, soybeans, and peanuts. The name of this flour does not appear on the packaging.



Figure 1. Photograph of the 3 composite flours in the study

2.2. Sample Collection and Preparation

Five samples packaged in 500g containers for each flour were purchased from three different retail outlets in the city of N'Djamena. These are the BOKADJI store in N'Djari for FC1, the Bon Samaritain University Hospital Center for FC2 and the Our Lady of the Apostles Hospital for FC3. Five 500g bags were purchased from each point of sale. The 5 samples from each point of sale were mixed and 500g were taken for each type of analysis. Then, these samples were transported, under adequate hygienic conditions, to the CECOQDA physicochemical and microbiological analysis laboratories.

2.3. Determination of Biochemical parameters

All analyses were performed according to standard methods used in CECOQDA laboratories, with the exception of the determination of total carbohydrate content. The latter was performed using the difference method based on a literature review.

2.3.1. Water and Dry Matter Content

Water and dry matter (D.M.) contents were determined after drying 5g of the ground sample at 105°C in an oven, according to the NF EN ISO 712-1:2024 Reference Method [19]. Water content is calculated using the following formula:

$$\% \text{H}_2\text{O} = (M_1 - M_2) / (M_1 - M_0) \times 100;$$

M0: weight of the empty crucible; M1: weight of the crucible containing the sample to be dried; M2: Weight of the crucible and sample assembly after drying.

The dry matter content was calculated as follows:

$$\% \text{DM} = 100 - \% \text{H}_2\text{O}.$$

2.3.2. Crude Protein Content

The crude protein content was determined after total nitrogen determination using the Kjeldahl method [20], after total sulfuric mineralization of the biological material in the presence of copper sulfate as a catalyst. The nitrogen content was calculated using the formula:

$$\text{WN} = ((0.014) \times (V - V_0) \times (0.05)) / \text{mPE};$$

V₀ denotes the volume of the blank; V, the volume of

the titrant used; mPE, the mass of the test sample in grams. 0.014 is the expression in grams of the amount of nitrogen equivalent to using 1 ml of a 0.5 mol/l sulfuric acid solution.

The crude protein content is obtained by multiplying the total nitrogen content by 6.25 as follows:

$$\text{The mass of crude protein WP} = \text{WN} \times 6.25 \text{ [21].}$$

2.3.3. Lipid Content

Lipid extraction was performed with n-hexane using a Soxhlet apparatus [22]. After extraction and separation, the resulting fat was placed in an oven at 105°C to evaporate the remaining solvent. The calculation of the total fat or lipid content is done according to the formula:

$$(\%) \text{ lipids} = ((P_1 - P_0) / \text{Test Sample}) \times 100;$$

P₀: empty flask weight;

P₁: Weight of the flask containing the lipids

2.3.4. Ash Content

The ash content was obtained after incinerating the ground material at a temperature of 550°C in an electrically heated furnace for 8 hours until a constant mass was obtained [23].

The total ash content was calculated using the following formula:

$$\% \text{C} = ((P_1 - P_2) / P) \times 100;$$

% C: the ash content; P1: the weight of the empty crucible; P2: the weight of the ash after incineration at 550°C + the weight of the crucible; P: the weight of the test sample.

2.3.5. Carbohydrate Content

Carbohydrate content was determined using the difference method [6]:

$$\% \text{ Total Carbohydrate} = 100 - (\% \text{ Water} + \% \text{ Protein} + \% \text{ Fat} + \% \text{ Ash})$$

2.3.6. Determination of Theoretical Energy Value

The theoretical energy value was calculated using the specific coefficients of Merrill and Watt [24], adopted by FAO [21], for protein, fat, and carbohydrate.

$$\text{Theoretical energy value (Kcal/100g)} = (P \times 4) + (G \times 4) + (L \times 9); \text{ where}$$

P: percentage of crude protein; G: percentage of total carbohydrate; L: percentage of total fat.

2.3.7. Detection of Total Aflatoxins B1, B2, G1 and G2

The determination of aflatoxins B1, B2, G1 and G2 was carried out using the immunoaffinity column purification method followed by high-performance liquid chromatography (HPLC) with post-column derivatization [25]. The results are expressed in ppb or µg/kg according to the following formula:

$$C = (C_m \times V_1 \times V_E) / (P_E \times V_2);$$

C denotes the concentration of total aflatoxins in the sample.

C_m denotes the cumulative concentration of aflatoxins in µg; V₁ the volume of the extraction solvent (75 ml); V_E the extracted volume (5 ml); P_E the test sample in grams; V₂ the volume after filtration (10 ml).

3. Results

Biochemical analyses consisted of determining water content or moisture content (WC), total ash (TA), crude protein (CP), total lipid (TL), total carbohydrate (TC), and energy value (EC). The average results obtained for these parameters are shown in [Table 1](#).

Table 1. Summary of the results of analyses of the biochemical parameters of the 4 flours (Mean ±Standard deviation)

Sampl es	%TH	% CT	PB (%)	LT (%)	GT (%)	VE (Kcal/1 00g)
FC1	7,30± 0,14 ^a	2,37± 0,00 ^a	11,06± 0,03 ^a	16,04± 0,24 ^a	63,22± 0,07 ^c	441,53± 1,79 ^a
FC2	7,21± 0,23 ^a	1,82± 0,09 ^c	9,98±0, 18 ^b	9,70±0, 61 ^c	71,29± 0,48 ^a	412,36± 4,34 ^c
FC3	6,62± 0,00 ^b	2,42± 0,02 ^b	10,37± 0,21 ^b	12,24± 0,59 ^b	68,34± 0,35 ^b	425,05± 3,03 ^b
FAO/ WHO Standa rd 2011	5	> 2	12-15	7 - 10	65 -68	400

A, B, C: In the same column, means not sharing any letters are significantly different.

[Table 1](#) presents the results obtained for the biochemical parameters studied:

- **Moisture content (%TH):** All the samples studied presented moisture content ranging from 6.62 to 7.44 higher than the standard norm which is 5%. Statistical analysis of the samples proved that the means obtained are significantly different ($p = 0.033 < 0.05$). However, the two-by-two comparison using the Fischer least significant difference method showed that the values for samples FC1 and FC2 do not present any significant difference. On the other hand, significant differences are revealed between the means for samples FC1 and FC3, as well as for samples FC2 and FC3 ([Table 1](#)). These results show that the infant flours studied are rich in energy macronutrients.

- **Total ash content (%CT):** All samples studied had total ash contents ranging from 1.91 to 2.44, which is within the standard threshold of >2%. Statistical analysis of the samples revealed significant differences ($p=0.00 < 0.05$) between the averages obtained for all samples ([Table 1](#)). Only FC1 flour had a total ash content value that met the threshold (>2%).

- **Crude protein content (CP (%)):** All samples studied had crude protein contents ranging from 10.16 to 11.09, which is lower than the standard threshold of 12 to 15%. Statistical analysis showed that the average values were significantly different for all samples ($p=0.012 < 0.05$).

- **Total lipid content (TL (%)):** All the samples studied had total lipid contents ranging from 10.31 to 16.28 higher than the standard norm which is between 7 and 10%. ANOVA revealed significant differences ($p = 0.001$) between the values of the means of the samples studied. In addition, the Fischer two-by-two comparison test showed that these samples are significantly different ([Table 1](#)). It is the FC2 flour which presents a value (9.70 ± 0.21) close to that of the standard norm (10%). The other two flours (FC1 and FC3) have total lipid contents (respectively 16.04 ± 0.24 and 12.24 ± 0.66) higher than that of the upper limit of the standard threshold. These

values were found to be significantly different at the significance level ($\alpha = 0.05$).

- **Total Carbohydrate Content (TC (%)):** All samples studied had total carbohydrate contents ranging from 63.29 to 71.77, higher than the standard value, which is between 65 and 68%. ANOVA showed that the sample means were significantly different ($p = 0.000$). Furthermore, the Fisher pairwise comparison test revealed that all samples showed significant differences when compared with each other ([Table 1](#)). - **Energy Value (EV (Kcal/100g)):** All samples studied had energy values ranging from 443.32 to 428.08, higher than the standard norm of 400 Kcal/100g. ANOVA showed that the sample means were significantly different ($p = 0.002$).

- **Aflatoxin Concentrations:** The search for total aflatoxins (B1, B2, G1 and G2) showed aflatoxin concentrations ranging from 2.78 ppb to 50.61 ppb ([Table 2](#)). FC2 flour had a value (2.78 ppb) consistent with the standard norm. However, high levels of total aflatoxins were found in FC1 flour (50.61 ppb).

Table 2. Results of analysis of aflatoxins B1, B2, G1 and G2

Floursamples	Total aflatoxin concentrations in parts per million (ppb)
FC1	50,61
FC2	2,78
FC3	14,35
FAO/WHO Standard 2023	≤ 10

4. Discussion

- **Moisture content (%):** All the samples studied have moisture content ranging from 6.62 to 7.44, higher than the 5% threshold set by the standard [1]. [4] obtained higher moisture content on three (3) local flours collected in N'Djamena (6.84 to 9.06). Our results are different from those of [5] who studied 17 cooking flours (4.29 to 4.96 on average). The differences observed between the samples can be attributed to variations in humidity of the raw materials during acquisition, non-standard manufacturing practices, and storage conditions [26].

- **Total ash content (%CT):** All the samples studied presented total ash contents varying from 1.91 to 2.44 in accordance with the standard norm which is >2% [1]. [4] obtained lower total ash contents on three (3) local flours collected in N'Djamena (2.16 ± 0.01). Our results are lower than those of [6] obtained in Cameroon (2.51 ± 0.21). In Nanoro in Burkina-Faso, [26] obtained respectively on Misola and Bamisa flours (2.65 ± 0.00) and (2.99 ± 0.03).

- **Crude protein content (CP (%)):** All the samples studied presented crude protein contents ranging from 10.16 to 11.09 lower than the standard norm which is between 12 and 15%. Our results corroborate those of [11] who studied 60% of the infant flours produced in Burkina Faso. On the other hand, our values are lower than those of [26] ($11.65 \pm 0.13\%$ to $13.24 \pm 0.35\%$) and [6] obtained protein contents ($15.66 \pm 0.11\%$) higher than our results. On the other hand, they are higher than those obtained by [4] on infant flours produced in Chad. [6] reported an average protein content ($15.66 \pm 0.11\%$) significantly higher than that of the present study. Comparing the results of previous studies with those of the present study

reveals that infant flours produced in Chad are characterized by low protein content. However, proteins play several functions in living organisms, including building and metabolic functions. Therefore, regular consumption of these low-protein flours would expose infants and young children to malnutrition linked to nutritional deficiencies [11,14,15].

- **Total lipid content (TL (%)):** All the samples studied presented total lipid contents ranging from 10.31 to 16.28 higher than the standard norm which is between 7 and 10%.

Our results are similar to those of [4] who studied three local flours collected in N'Djamena (10.33 ± 0.57) and Bongor (10.34 ± 1.91). They corroborate those of [26] in a study which reported values ranging from $9.99 \pm 0.44\%$ to $13.05 \pm 0.33\%$.

- **Total carbohydrate content (TC (%)):** All the samples studied had total carbohydrate contents ranging from 63.29 to 71.77 higher than the standard norm which is between 65 and 68%.

[27] in Côte d'Ivoire obtained values between 68.17% and 72.5% higher than our results. They corroborate those reported by the study of [4] in Burkina Faso on two samples of infant flour from N'Djamena (whose average values were $63.16 \pm 0.49\%$ to $64.44 \pm 4.52\%$). On the other hand, they are higher than those obtained by [26] in Burkina Faso ranging from $52.99 \pm 0.08\%$ to $67.2 \pm 0.55\%$.

- **Energy value (VE (Kcal/100g)):** All the samples studied presented energy values ranging from 443.32 to 428.08 higher than the standard norm which is 400 Kcal/100g. In addition, these values corroborate those of the study by [26] ranging between 381.1 ± 4.39 Kcal/100 g and 411.3 ± 5.79 Kcal/100 g of DM, as well as those obtained by [27], which varied between 400 Kcal and 414 Kcal per 100 g of mixed flour. However, they remain higher than those of [4] ranging from 253.73 Kcal/100 g to 385.84 Kcal/100 g of DM. In addition, the high values observed for FC1 (441.53 ± 1.79 Kcal/100 g) and FC3 (425.0 ± 3.03 Kcal/100 g of DM) flours should be noted. The values of these two samples were found to be significantly different by the Fischer pairwise comparison test (Table 1)

- Aflatoxin concentrations

The search for total aflatoxins (B1, B2, G1 and G2) showed aflatoxin concentrations ranging from 2.78 ppb to 50.61 ppb (Table 2). [26] obtained higher aflatoxin concentrations (10 ppb) in a study of infant flours in Burkina Faso. Aflatoxins are mycotoxins produced by filamentous fungi. They are toxic and exhibit carcinogenic and mutagenic properties [28].

5. Conclusion

The study aimed to assess the nutritional quality of infant flours produced locally in N'Djamena, Chad. The methodology adopted highlighted acceptable but insufficient nutritional quality, since the sampled flours had protein contents below the FAO/WHO standard. However, high fat contents were revealed, giving these flours very high theoretical energy values compared to the threshold set by the said standard. Furthermore, this study highlighted the presence of total aflatoxins (B1, B2, G1,

and G2) in very high concentrations compared to the maximum limit set for infant formulas in Africa, with the exception of FC2 flour. This calls for particular attention to the selection and storage of starting matrices pending production, as well as compliance with the production chain and the storage conditions of finished infant formula products. Therefore, to prevent the risk of nutritional deficiencies, it is necessary to develop a formula to obtain infant formulas optimized for nutrients essential for the good nutritional status of infants and young children.

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

- [1] FAO/WHO. Assessment of the public health significance of malnutrition due to micronutrient deficiency. In "Guidelines on the fortification of foods with micronutrients," 412, Italy. 2011.
- [2] Sika, A.E., Kadji, B.R.L., Dje, K.M., Kone, F.T.M., Dabonne, S., Koffi-Nevry, A.R., "Nutritional, microbiological, and organoleptic quality of maize (Zea mays) and safou (Dacryodesedulis) composite flours produced in Côte d'Ivoire." International Journal of Biological and Chemical Sciences, 13: 325–337. February 2019.
- [3] Koné, F.M.T., Kouamé, I.A.D., Faulet, M.B., "Nutritional Quality of Sesame Seeds (Sesamumindicum L.) Cultivated in Côte d'Ivoire." African Agronomy Sp, 33(2): 203-215. December 2021.
- [4] Kayalto, B., Zongo, C., Compaore, R.W., AlySavado, A., Otchom, B.B., Traore, A.S., "Study of the Nutritional Value and Hygienic Quality of Local Infant Flours from Chad, with the Aim of Their Use for Improved Infant Flour Preparation." Food and Nutrition Sciences, 4: 59-68. July 2013.
- [5] Bougma, S., Oboulbiga, E.B., Tarnagda, B., Zongo, O., Kaboré, B., Ouédraogo, H.S., Songré-Ouattara, L.T., Savadogo, A., "Evaluation of the Physicochemical and Microbiological Quality of Some Infant Flours Sold in Ouagadougou, Burkina Faso." PAMJ-One Health, 9(25). December 2022.
- [6] Dongmo, T.D., Mananga, M.J., Tene, S.T., Mangatchaoussou, N., Fogang, A.R.M., Dongmo, H., Demasse, M., Manz Koule, J.C., Nedion, J.N., Kana, M.M.S., "Physicochemical and functional characterization of infant flour based on yellow corn, soy, carrot and date." Food Applied Research, 4(2). November 2024.
- [7] Ould, A.S. & Louzeri, Y., "Influence of flour type on the quality of finished "breakfast cereal" products." Master of Science in Nature and Life Sciences. University of Blida 1. 2022.
- [8] Kobbe, N.D., Adjia, R., BagnamackBabagnack, C.R., "Formulation of an Infant Flour Based on IpomeoaBatatas, VignaUnguiculata and Glycine Max (L.) Merrill. IOSR Journal of Biotechnology and Biochemistry (IOSR-JBB), 9(5): 08-17. October 2023.
- [9] Forsido, S.F., Welelaw, E., Belachew, T., Hensel, O., "Effects of storage temperature and packaging material on physico-chemical, microbial and sensory properties and shelf life of extruded composite baby food flour". Heliyon, 7(2021). April 2021.
- [10] Soumahoro, S., Zoro, A.F., Kouamé, M.L., Acho, F.C., Soro, Y.R., Touré, A., "Physicochemical and Nutritive properties of five infant flours produced in Korhogo in Northern Ivory Coast after conservation". International Journal of Biochemistry Research & Review, 33(3): 42-48. March 2024.

- [11] Bayala-Yaï, L.K.A., Nikiéma, P.A., Sangaré, H., Bationo, F., Bassolé, I.H.N., Simpore, J., "Nutritional and Sanitary Quality of Infants Flours Produced in Ouagadougou, Burkina Faso". *Food and Nutrition Sciences*, 15:727-743. August 2024.
- [12] Abdellah, Z., "Determination of Mycotoxins in Foods and Studies of Aflatoxin Reduction by Lactic Acid Bacteria Isolated from Traditional Bread Ferments." Doctoral Thesis. Sidi Mohammed Ben Abdellah University. October 2004.
- [13] Ponka, R., Goudoum, A., ChamiTchungouelieu, A., Fokou, E., "Nutritional Evaluation of Some Ingredients Used in the Feed Formula for Laying Hens and Pigs on a Livestock Farm in Northwest Cameroon." *International Journal of Biological and Chemical Sciences*, 10(5): 2073-2080. June 2016.
- [14] Tickell, K.D. & Denno, D.M., "Inpatient Management of Children with Severe Actual Malnutrition: A Review of WHO Guidelines." *Bulletin of the World Health Organization*, 94(9): 642-651. September 2016.
- [15] Delzenne, N.M., "Sustainable food and health". *Louvain medical*, 143: 80-84. January 2024.
- [16] Fellingner, A., "Worldwide mycotoxin regulations and analytical challenges". *World Grain Summit: Food and Beverages*, San Francisco, California. September 2006.
- [17] Njobeh, B.P., Dutton, F.M., Makun, H.A., "Mycotoxins and human health: Significance, prevention and control". In *Smart Biomolecules in Medicine*, Ajay KM, Shutosh, Shivani BM (Eds)'. VBRI Press: India, 132-177. January 2010.
- [18] Dieme, E., Fall, R., Sarr, I., Sarr, F., Traoré, D., Seydi, M., "Aflatoxin Contamination of Cereals in Africa: Review of Existing Control Methods." *International Journal of Biological and Chemical Sciences*, 10(5): 2285-2299. October 2016.
- [19] ISO 712-1: 2024 (fr). (September 2024). *Cereals and Cereal Products – Determination of Moisture Content*.
- [20] NF EN ISO 20483. (December 2013). *Cereals and Legumes – Determination of Nitrogen Content and Calculation of Crude Protein Content – Kjeldahl Method*.
- [21] FAO/INFOODS Guidelines for Conversion of Units, Denominators and Expressions, Version 1.0. FAO, Rome, 2015. Retrieved 14 February 2025 from <https://openknowledge.fao.org>
- [22] ISO 11085:2008. *Cereals and cereal products - Determination of total fat content*. New edition.
- [23] NF EN ISO 2171. (June 2010). *Cereals, legumes and derived products. Ash content determination by incineration*.
- [24] Merrill, A.L. & Watt, B.K. (1955). *Energy value of Foods - Basis and Derivation*. USDA Handbook, 74p.
- [25] ISO 1650: 2003(E). *Foodstuffs - Determination of aflatoxin B1 and total aflatoxin B1, B2, G1 and G2 content in cereals, nuts and derived products - High-performance liquid chromatography method*.
- [26] Sanou, A., Tapsoba, F., Zongo, C., Savadogo, A., Traore, Y., "Study of the nutritional and microbiological quality of infant flour from four production units: CMA Saint Camille de Nanoro, CSPS Saint Louis de Temnaoré, CM Saint Camille d'Ouagadougou and CHR de Koudougou". *Nature & Technology*. May 2017.
- [27] Gbogouri, G.A., Bamba, M.S., Digbeu, D.Y., Brou, K., "Development of an infant flour made from local ingredients from Côte d'Ivoire: what strategies for enrichment with omega-3 polyunsaturated fatty acids?" *International Journal of Biological and Chemical Sciences*, 13(1): 63-75. February 2019.
- [28] Aidoo, F.E., Mohamed, S.M., Candlish, A.A., Tester, R.F., Elgerbi, A.M., "Occurrence of Fungi and Mycotoxins in Some Commercial Baby Foods in North Africa". *Food and Nutrition Sciences*, 2: 751-758. September 2011.



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