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Research Article

An Insight Into The Two Most Consumed Traditional Foods From The Eastern Region Of Cameroon: Assessment Of The Nutritional Composition And Antioxidant Content.

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Abstract

This work aimed to assess the nutritional value an antioxidant content of two traditional foods (*Koko and Mbol*) from the Eastern Region of Cameroon (ERC) to provide additional data that can be used to improve the nutritional status of the inhabitants of this region. A survey on traditional food cooked and consumed was conducted among 120 households in the cities of Bertoua, Yokadouma, and Gari-Gombo using a participatory approach. Following these surveys, samples of food (*Koko and Mbol*) were collected, and their physicochemical and nutritional characteristics were evaluated. The macronutrient and micronutrient contents, as well as the antinutrient and antioxidant contents, were determined. The survey revealed that the ERC has a great diversity of traditional recipes, among which *Koko and Mbol* prepared with *Beilschmiedia anacardioides* and *Gnetum africanum*, respectively, are the most consumed. Physicochemical analysis revealed that the dry weight (DW) was 35.20 g/100 × g for *Koko* and 15.20 g/100 × g for *Mbol*. The ash content was 5.98 for *Koko* and 7.45 g/100 × g for *Mbol*, the pH was 6.25 for *Koko* and 5.35 for *Mbol*, and the soluble solid content (SSC) was 54.70 for *Koko* and 23.20 g/l for *Mbol*. The iron content ranged from 81.19-423.68 mg/100 g DW, and the zinc content ranged from 10.03-22.81 mg/100 g DW for *Koko* and *Mbol*. The total titratable acidity (TTA) is between 2.47 for *koko* and 4.98 meq/100 g DW for *Mbol*. It appears from this study that *Koko* and *Mbol* are more beneficial in terms of nutritional intake for consumers, and they should be further encouraged in the ERC in particular and in Cameroon in general to increase the food needs of the population and to correct some problems of malnutrition.

Keywords : Traditional Dishes, Koko And Mbol; Nutritional Value, East Cameroon,

INTRODUCTION

Nutritional value is an indicator of the quantity of nutrients present in a product or food preparation. A nutrient is a food substance that can be directly assimilated by the body to sustain life. For this reason, these nutrients must be provided in adequate proportions to guarantee the harmonious functioning of the body. The population must consume the nutritious food of various origins (animal or vegetable) necessary to meet its needs [1]. Indeed, balanced nutrition guarantees health, well-being, physical and cognitive development, and economic productivity [2]. However, the nutritional value of food can be altered by inappropriate food preparation techniques, which most often lead to changes in both the structure and the texture of these foods. This can lead to nutritional disorders in consumers of these foods [3]. Globally, nutrition-related diseases are a major public health problem. These diseases are the consequence of a nutritional imbalance either in favour of a deficit or an overload, better known as malnutrition. Malnutrition, whatever its form, is very expensive for governments and at all income levels [4]. The malnutrition management strategy is essentially based on the correction of diet and lifestyle. The identification and promotion of local foods with nutritional qualities for

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the management of certain nutritional diseases are strongly encouraged in the context of local resilience, as advocated by the World Health Organization [5]. Hence, it is important to assess traditional foods commonly eaten in communities. The ERC is not spared by the rapid emergence of nutrition-related noncommunicable diseases. The populations of this region feed themselves by exploiting their heritage. They feed on foods of animal and vegetable origin for food diversification. Gnetum africanum and Beilschmiedia anacardioides are commonly used in a wide variety of dishes. Gnetum africanum and Beilschmiedia anacardioides are protein-rich leafy vegetables that are present in many Cameroonian markets and are prepared in different ways. Each food recipe contains some ingredients that contribute, by their very nature, to the nutritional quality of the food. Despite the relatively high food production and nutrient richness of the traditional dishes of the ERC, the risk of malnutrition remains greater in Cameroon and in this region in particular [6]. According to the 2018 Cameroon Demographic and Health Survey, the prevalence of stunting among children under 5 years old is very high (>30 percent) according to WHO thresholds in the Eastern Region (37 percent). According to the same survey, 32.2% of women aged 15-49 years and 64.8% of children under 5 years suffer from anaemia [7]. Moreover, the latest studies in Cameroon underlined the lack of knowledge about the composition of a healthy diet as an obstacle to healthy eating behaviors [8]. For Cameroon, food composition facts are incomplete, equally in terms of the nutrients listed and the amount of food. Additionally, food composition data comprise ordinary nutritional assessments of single-item foods rather than composite meals [9]. Nevertheless, the availability of these food composition data could facilitate advanced nutrition-related studies, which can further increase the value of healthy traditional foods for people's culture, health, environment, economy, and food security. The present work aimed to assess the nutritional composition and antioxidant content of Koko and Mbol, the two traditional foods most widespread and most consumed in the ERC.

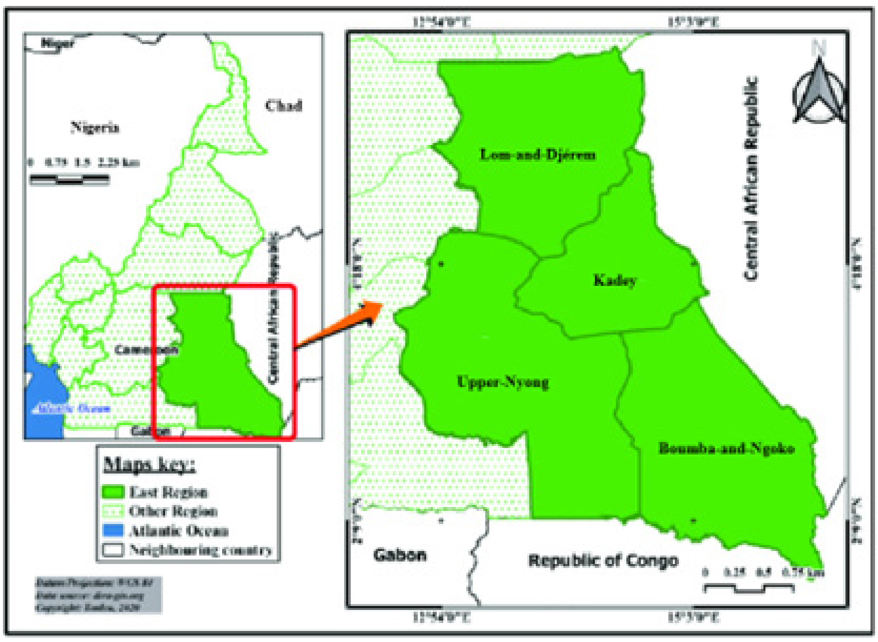
MATERIALS AND METHODS

Study area and data collection

Area of Study

Preliminary meetings with the key informants across the Eastern Region (chiefdoms), self-observations during field visits, and personal interviews were previously conducted, and the participants were permitted to notice the traditional foods of the ERC. On this basis, a survey was organized in the localities identified as important zones for the production and consumption of Gnetum africanum and Beilschmiedia anacardioides. These two plant materials are used by the population to prepare Koko and Mbol, the most consumed traditional foods of the region. Therefore, the municipalities of Bertoua (Division of Lom-et-Djérem), Yokadouma, and Gari-gombo (Division of Boumba-et-Ngoko) were identified as the producers and most consumers of G. africanum and B. anacardioides, and the surveys were performed in these areas.The ERC, which is the largest region, is located in the southeastern area of Cameroon and has an estimated total population of 1,226,797 inhabitants in 2023 [10]. It is bordered in the north by the Adamaoua region, in the south by the Republic of Congo, in the west by the South and Centre Regions of Cameroon, and finally in the east by the Central African Republic (**Fig. 1**).

Figure 1. A map showing the eastern region of Cameroon



Ethnofood survey and sample collection

A survey was performed using a developed questionnaire to investigate the target population. According to the aim of the study, the questionnaire comprised 3 sections. Each question was designed in such a way that it might deliver the most precise information for each part. The first section included questions about the sociodemographic characteristics of the participants, especially permanent residency, age, sex, civil status, level of education, and job situation. The second section included questions that were designed to assess information on common traditional foods in the region and the most consumed foods. The frequency of traditional food consumption was also investigated. Finally, in the third section, participants were led away on questions designed to provide information about traditional cooking or processing methods for the most consumed traditional foods.

To guarantee the quality of the information collected through the survey, the questionnaire was pretested with 10 respondents. This duty was essential to assume that the questions were comprehensible and clear so that the participants could respond without difficulties. Additionally, the survey was conducted via a participatory approach. Before the administration of the questionnaires, a clear explanation of the aim of the survey was given to the participants to obtain approval. The answers provided were anonymous. Then, no personal data were collected or linked with any of the answers to protect the participants.

The survey occurred in the targeted cities between March and May 2023 and involved 120 households. For the questionnaire, one individual was selected to answer the questions from each household, which means that a total of 120 respondents (representing 624 people) were interviewed.

After the survey, an appointment was scheduled with 3 households randomly chosen per city to complete the cooking of the 2 most consumed traditional dishes (Koko and Mbol). During the cooking demonstration, the different ingredients, cooking steps, and durations were recorded. For the nutritional analysis of freshly cooked traditional foods, samples were immediately collected after preparation (500 g per food and household) in plastic bags, placed in an icebox, and transported to the laboratory for analysis.

Physicochemical characterization and proximate nutrient content evaluation of traditional foods

Physicochemical characterization and nutrient content evaluation were conducted to evaluate the pH, moisture content, fat content, protein content (N × 6.25), carbohydrate content (by difference), crude fibre content, and ash content in triplicate according to the Association of Official Analytical Chemists (AOAC) standard procedures [11]. The dry weight (DW) content was determined by the AFNOR method [12]. The energy value of the samples was calculated by the energy conversion factors [13] applied to protein, fat, carbohydrate, and alcohol concentrations. W (Kcal) = 9 L+4P+4G. where L is the lipid content, P is the protein content, and G is the hydrolysable carbohydrate content expressed as a percentage of dry matter. The energy values of the samples are expressed in kcal/100 g.

The total titratable acidity (TTA) and soluble solids content (SSC) were determined using the procedures described by Dadzie and Orchard [14].

Mineral analysis (Fe, Cu, Zn, and Se) was performed using the microwave digestion technique to process the samples, followed by flame atomic absorption spectrophotometry to quantify the mineral concentrations via the AOAC method [11]. The total carotenoid content was also determined according to the method of AOAC [11].

Determination of the antinutrient and antioxidant contents of the foods

Determination of antinutrients in the foods

Oxalate Content

The oxalate content was determined according to the method described by Day and Underwood [15]. Two (2) g samples of the dried and ground samples were homogenized in 25 mL of H2SO4 (3 M) under magnetic stirring for 1 h. The mixture was filtered using Watman filter paper, and the filtrate was titrated with a solution of KMnO4 (0.05 M) until the color changed to persistent pink. The oxalate content was calculated using the following formula:

$$\text{Oxalates (mg/100 g)} = \frac{2.2x\ Vep\ x100}{Ve\ x\ Ws}$$

where Vep is the volume of KMnO4 required to reach the endpoint, Ws is the weight of the sample, and Ve is the volume of the extract.

Phytate Content

The phytate content was determined by the spectrophotometric technique described by Kirk and Sawyer [16]. Briefly, two grams (2 g) of the sample was weighed into a 500 mL flat-bottom flask. The flask containing the sample was mixed in a shaker, and the sample was extracted with 100 mL of 24% HCl (1 h/25°C). Then, the samples were decanted and filtered. A volume of 5 mL of sodium chloride (0.1 M) was added to 10 mL of the diluted sample and transferred to Whatman No. 1 filter paper to elute the organic phosphorus, and 15 mL of sodium chloride (0.7 M) was further added to elute the phytate, which was mixed for 5 s using a vortex mixer. After centrifuging the mixture for 10 min, a UV spectrophotometer was used to read the supernatant at a wavelength of 520 nm. The concentration of phytate was determined from the standard curve, which was prepared with standard inositol phytate. The values are expressed in mg/100 g according to the following formula:

Phytate (mg/100 g) = concentration of phytate from standard curve x dilution factor/weight of the sample.

Tannin content

The tannin content was determined using the method described by Van-Burden and Robinson [17]. In a 250 ml beaker, 5 g of sample was added, and 100 ml of distilled water was added. This mixture was then shaken for 1 h using a mechanical shaker. After that, the solution was filtered into a 100 ml volumetric flask. Subsequently, 1 ml of the obtained filtrate was pipetted into a test tube and mixed with 0.4 ml of 0.1 M $FeCl_2$ in 0.008 M potassium ferrocyanide and 0.1 N HCl. Finally, the absorbance was measured 10 min later at 550 nm, and the tannin concentration was determined using the following formula:

$$Concentration\ of\ \tan nin\left(\frac{mg}{100g}\right)Cu=\frac{Au}{As}\ x\ Cs\ x\ 1000$$

Cu = concentration of unknown sample, Au = absorbance of unknown sample, As = absorbance of standard, Cs = concentration of standard, and 1000 = conversion factor to mg/100 g.

Determination of the antioxidant content of the foods

Total phenolic content

Total polyphenolic compounds were determined according to the method described by Wafa et al. [18]. Briefly, after the extraction of phenolic compounds (in 70% methanol/6 h), 20 μL of the extract was placed in a tube containing 2980 μL of distilled water. Subsequently, 500 μL of Folin-Ciocalteu 1/10 reagent and 400 μL of a 20% Na_2CO_3 solution were added. All the tubes containing the samples and those of the blank were vortexed. After the mixture was allowed to stand for 20 min at room temperature in the dark, the absorbance was measured at 760 nm. The concentration of phenol was expressed as milligrams of gallic acid equivalent per gram of dry weight (mg GAE/g DW).

Flavonoid content

Total flavonoids were assessed by a colorimetric method described by Dewanto et al. [19]. An aliquot of 0.1 mL of the extract was added to 2.4 mL of distilled water and 0.15 mL of Na_2NO_2 (5%). After 6 min, 0.3 mL of freshly prepared $AlCl_3,6H_2O$ (10%) was added to the mixture. Five minutes later at room temperature, 1 mL of NaOH (1 M) was added, and the absorbance was determined at 510 nm against a blank containing the extraction solvent instead of the sample. The absorbance of the mixture was determined at 510 nm. The total flavonoid content was expressed as mg catechin per gram of DW (mg CE/g DW).

Statistical analysis

The data collected were processed using Excel software, and their statistical analysis was performed using the appropriate Statgraphics 5.0 software. The correlations were determined by the Waller-Duncan test at a probability level of 5%.

RESULTS

Sociocultural characteristics of the people surveyed

Thirty (30) households in the towns of Bertoua, Yokadouma, and Gari-gombo were surveyed. The people surveyed who all originated from the ERC were permanent residents (100%) and were composed of women (60%) and men (40%). The most represented age groups were those between 30-40 years (46.6%) and 41+ (30%). Concerning education level, most of the people had reached the secondary school level (60%), and only 10% had reached the university level (10%). They were mostly single (80%). Employment status was dominated by rural farmers (56.6%) and jobless workers/unemployed workers (30%) (**Table 1**).

Table 1. Sociodemographic characteristics of the sample.

Variable	Groups	Frequency	Percentage
East origin and permanent resident	Yes	120	100%
	No	0	0
Age	30-40	56	46.6%
	41+	36	30%
Sex	Male	72	60%
	Female	48	40%
Education level	None/Primary school	36	30%
	Secondary/High school	72	60%
	University	12	10%
Job situation	Rural farmers	68	56.6%
	Employed	16	13.3%
	Unemployed	36	30%

Civil state	Single	96	80%
	Married	16	13.3%
	Divorced	4	3.3%
	Widow/Widower	4	3.3%

Traditional foods of the ERC

Table 2 presents the traditional foods listed and best known by the households in the ERC and their frequency of consumption. Mbol (56.7%) and koko (46.7%) were the main known as designated by the respondents and were the most frequently consumed in the households surveyed (at least twice a week).

Table 2. Traditional food best known and frequency of consumption by households in the ERC.

Ethnic name (English meaning)*	Households know the food n (%)	Households consuming n (%)	Intake (times/week)	Intake (times/month)
Mbol (a sticky soup)	68 (56.7)	52 (43.3)	2	8
Koko (Gnetum)	56 (46.7)	44 (36.6)	2	8
Kwa ni ndong (fish seasoned with pepper and salt)	16 (13.3)	4 (3.3)	1	
Föss (Maybug-based food)	4 (3.3)	8 (6.7)		2
Local chicken soup	8 (6.7)	16 (13.3)		1
Mushroom based food	4 (3.3)	12 (10.0)		2
Poseh/Bekouala (Caterpillar, Augosama larvae)	12 (10.0)	24 (20)		
Congo meat (Snail meat)	4 (3.3)	4 (3.3)		1
Dengué (mashed plantain)	4 (3.3)	12 (10.0)	1	
Kpwem (Crushed cassava leaves)	12 (10.0)	32 (26.2)	1	
Guendi (smoked meat)	8 (6.7)	4 (3.3)		1
Siglisigli (fried black nightshade)	4 (3.3)	4 (3.3)		2

**Some ethnic names were not available*, N=120.

Table 3 shows a description of the two main traditional dishes of the ERC, and **Fig. 2** shows their pictures. The main ingredients of Mbol for Koko are *Beilschmiedia anacardioides* and *Gnetum africanum*. Moreover, there was little difference among the additional ingredients.

Table 3. Description of the two main traditional foods of the ERC.

Characteristics	Traditional foods	
Ethnic name	*Mbol*	*Koko*
Form of the foods	Paste	Paste
Carbohydrates staples	Fufu corn (cassava)	Cassava tuber, rice
Ingredients	Smoked meat, smoked fish, crayfish, pumpkin seed, kanda powder (*Beilschmiedia*), fresh or dry leaves of ava (an aromatic herb), pepper, chilli pepper lemon, salt, water.	Minced *okok* (*Gnetum*), groundnut, palm refined oil, smoked meat (beef, chicken ...), smoked fish, crayfish, onion, ginger, garlic, rock salt, pepper (optional), salt, water.
The scientific name of the mainingredient	*Beilschmiedia anacardioides*	*Gnetum africanum*
Duration of cooking after preparing the ingredients	30 min	30 min

Figure 2. The two main traditional foods of the ERC. (A) *Mbol*, (B) *Koko*

(A) (B)

Physicochemical characteristics and proximate nutritional composition

Table 4 presents the dry matter nutrient content of the foods. The ash content obtained from Mbol (7.45 g/100 g DW) was significantly greater than that obtained from koko (5.98 g/100 g DW). The lipid content of koko (20.21 g/100 g DW) was also significantly greater than that of Mbol (13.43 g/100 g DW). Koko (6.35 g/100 g DW) exhibited a greater protein content than did Mbol (3.83 g/100 g DW). In general, koko had greater macronutrient and energy contents, soluble solid contents, and dry weights than did Mbol.

The pH of Koko was lower (6.25±0.21) than that of Mbol (5.39 ±0.17), contrary to the total titratable acidity.

The microelement contents of the two samples are given in Table 3. The iron (423.68 mg) and copper (13.43 mg) contents of koko were significantly greater than those of Mbol (81.19 mg/100 × g for iron and 2.00 mg for copper). Moreover, the zinc and selenium contents were significantly greater in Mbol (22.81 mg and 0.24 mg, respectively) than in koko (10.03 mg and 0.08 mg of zinc and selenium, respectively).

Table 4. Proximate composition of koko and Mbol per 100 g of DW

Nutrients/characteristic	Food	
	Koko	***Mbol***
Lipids (g/100 g DW)	20.21 ± 0.94 a	13.43 ± 0.23 b
Proteins (g/100 g DW)	6.35 ± 0.11 a	3.83 ± 0.06 b
Carbohydrates (g/100 g DW)	67.46 ± 1.21 a	75.29 ± 1.08 b
Fibres (g/100 g DW)	9.78 ± 1.04 a	6.25 ± 0.08 b
Energy (kcal/100 g DW)	477.13 ± 2.45 a	437.35 ± 2.12 b
Ash (g/100 g DW)	5.98 ± 0.24 a	7.45 ± 0.31 b
Moisture content (%)	7.72 ± 0.82 a	11.65 ± 1.23 b
Dry Weight (%)	30.12 ± 0.65 a	11.55 ± 1.60 b
Total carotenoïds (mg/100 g DW)	7.18 ± 0.15 a	4.94 ± 0.26 b
pH	6.25 ± 0.21 a	5.39 ± 0.17 b
Total titratable acidity (mg eq citric acid/100 g DW)	2.47 ± 0.15 a	4.98 ± 0.41 b
Soluble Solid Content (g/L)	35.20 ± 1.42 a	15.20 ± 1.73 b
Zinc (mg/100 g DW)	10.03 ± 0.14 a	22.81 ± 0.40 b
Copper (mg/100 g DW)	13.43 ± 0.21 a	2.00 ± 0.20 b
Selenium (mg/100 g DW)	0.08 ± 0.01 a	0.24 ± 0.01 b
Iron (mg/100 g DW)	423.68 ± 0.20 a	81.19 ± 0.07 b

[a, b] *Values with different superscript letters in the same row are significantly different.*

Antinutritional and antioxidant contents

Table 5 shows the antinutritional and antioxidant contents of koko and Mbol. The results showed that the antioxidant content of koko (0.918 ± 0.12 mg GAE and 0.541 ± 0.21 mg CE of polyphenols and flavonoids, respectively) was significantly greater than that of Mbol (0.622 ± 0.27 mg GAE and 0.332 ± 0.23 mg CE). However, compared with those of koko, the anti-nutrient content (tannin, phytate, and oxalate) of Mbol was significantly lower than that of koko, as shown in **Table 5**.

Table 5. Antinutritional and antioxidant contents of *Koko* and *Mbol*

Components (100 g DW)		Food	
		Koko	**Mbol**
Antioxidants	Polyphenol content (mg GAE)	0.918 ± 0.12 a	0.622 ± 0.27 b
	Flavonoid content (mg CE)	0.541 ± 0.21 a	0.332 ± 0.23 b
Anti-nutriments	Tannin content (mg)	0.215 ± 0.35 a	0.148 ± 0.08 b
	Phytates (mg)	39.12 ± 0.11 a	21.45 ± 0.59 b
	Oxalates (mg)	464.35 ± 10.12 a	212.25 ± 9.47 b

a, b Values with different superscript letters in the same row are significantly different.

DISCUSSION

The sociodemographic characteristics of the respondents revealed a heterogeneous distribution among the different categories. Cameroon comprises various ethnic groups whose food habits and behaviors differ from one another. The people surveyed all originated from the ERC and permanent residents.

The survey revealed that *Mbol* and *koko* are mainly known as designated by the respondents and are the most frequently consumed in the households. In fact, in a survey carried out in 2021 by the Ministry of Tourism in all the regions of Cameroon, *Mbol* was mentioned as a traditional food originating from the Eastern Region. It was among the 20 main culinary traditions listed for its national and international notoriety, its contribution to gastronomic tourism, and its potential to be promoted by intellectual property rights [20]. Moreover, Cameroon was selected by the World Intellectual Property Organization together with other countries (Peru, Morocco, and Malaysia) to implement the project "Intellectual property and gastronomic tourism: promoting the development of gastronomic tourism through intellectual property". *Mbol* would be a culinary treasure of the ERC. This origin is attributed to him. Its potential to please those who have tried the experience is quite clear. It is easy to cook due to its stickiness, and it requires few spices, as does Koko. Their nutritional compositions were evaluated.

The moisture contents of the different foods varied between 7.72% (*koko*) and 11.65% (*Mbol*). These values were significantly different (p<0.05). Indeed, the amount of water used during the preparation of foods influences their water content. It is therefore understood that *Koko* and *Mbol*, prepared with approximately 1 L of water for 400 g of chopped Koko and 50 g of Kanda powder (*Mbol*), have a low water content compared to the value (50%) obtained by Okeke and Eze [21] in Akara, a traditional food in Nigeria. The variation may also result from the nonhomogeneous quantity of water used to prepare this food in all the households.

Koko had significantly greater amounts (p<0.05) of protein and lipids than *Mbol*. These foods are prepared with many ingredients (animals and vegetables) and might be used to increase protein intake, especially for pregnant women and young children. The protein content varied from 3.83 ± 0.06 to 6.35 ± 0.11 g/100 g DW. The protein content of *Koko* is greater than that reported by Sharma et al. [9] in Pap (0.8 g/100 g), a hot cereal consumed in central Cameroon, unlike that of *Mbol*. The protein value of *koko* is close to that obtained in Côte d'Ivoire by Dally et al. [22] with *Djladrè seka*, a traditional dish where one of the main ingredients is *Thaumatococcus danielli* leaves. The lipid content ranged from 13.43 ± 0.23 to 20.21 ± 0.94. This is similar to the value obtained by Sharma et al. [9] for Eru and okra-leaves-soup, two traditional foods consumed in Cameroon. The carbohydrate content ranged between 67.46 ± 1.21 (*koko*) and 75.29 ± 1.08 (*Mbol*). These values were significantly different (p<0.05). The high carbohydrate content can be explained by the presence of carbohydrates in the diet of energy-rich foods such as fufu corn cassava, cassava tuber (*Manihot sp.*), and rice (*Oriza sativa*).

Furthermore, *Koko* and *Mbol* also had high fibre contents (ranging from 6.25-9.78 g/100 g). The dietary fibre contents of these foods were greater than those found in *Ekwang, Eru*, and *Keleng-Keleng* (0.2 g/100 g, 0.40 g/100 g, and 1.40 g/100 g, respectively), which are traditional foods cooked with vegetables and consumed in many regions of Cameroon [9, 23]. Fibres are important because they protect the body against colon cancer, diabetes, and cardiovascular disease. Fibre has been linked to lower cholesterol, improved insulin sensitivity, and lower blood pressure [24].

The TTA was 2.47 for *Koko* and 4.98 for *Mbol*, while the pH was 6.25 and 5.39, respectively. The pH decreased as the acidity of the food increased. Indeed, the elevated acidity of the lemon used for the *Mbol* recipe could be the cause. The soluble solid content (SSC) provides information on the stage of fruit maturity [14] that was used in the recipe. The values of SSC and TTA were significantly different (p>0.05), while the pH was not significantly different. In general, the SSC increases with fruit ripening [14, 25]. However, *mbol* has a lower SSC than *koko*, which does not support this hypothesis. However, when the lemon is ripe, metabolic processes occur in the fruit during ripening; in this case, the hydrolysis of starch and the accumulation of simple sugars such as glucose and fructose [26] are responsible for the sweet taste of the ripe fruit. These results are different from those of Ngoh et al. [25], who observed during the ripening of some plantain cultivars and hybrids grown in Cameroon.

The iron content was between 0.32 mg/100 g DW for *Koko* and 0.05 mg/100 g DW for *Mbol*. These values are lower than those found by Ponka et al. [27] (6.08-2.99 mg/100 g DW) in three Cameroonian foods. Iron deficiency results in well-known anaemia, which is accompanied by a decline in physical and intellectual capacity, a reduction in resistance to infection, and a decrease in the risk of mortality for the foetus [28]. Hence, food diversification is important. Zinc is another microelement found in different dishes. It was significantly ($p<0.05$) greater in *Mbol* (22.81 mg/100 g DW) than in *Koko* (10.03 mg/100 g DW). These values are higher than those reported by Honfo et al. [29] (0.41-0.22 mg/100 g DW) for certain banana and plantain-based food products consumed in Cameroon. Zinc is an important microelement for cell renewal, healing, and immunity [30]. Moreover, the copper content was greater in *Koko* (13.43 mg/100 g DW) and lower in *Mbol* (2.00 mg/100 g DW). Copper is necessary for the formation of red blood cells and the replication of lymphocytes; therefore, it stimulates the immune system [31]. The values obtained were higher than those of Kana et al. [32] (0.12-0.33 mg/100 g DW) for certain household preparations consumed in Douala (Cameroon). For all the dishes studied, the selenium content varied between 0.08 mg/100 g DW (*Koko*) and 0.24 mg/100 g DW (*Mbol*). These values are higher than those reported by Sharma et al. [9] (0.2-1.3 µg/100 g DW) for some frequently consumed dishes (*Sanga, Koki-corn, Koki-Beans, Eru*) from the central region of Cameroon.

The ash content of the foods used in this study ranged from 5.98 ± 0.24 to 7.45 ± 0.31 g/100 g DW. These values were comparable to those reported by Kana et al. [32] for several traditional household foods consumed in Cameron (such as rice with tomato sauce, plantain with leafy vegetable sauce, Cocoyam and leafy vegetables (*Vernonia sp*.)). The ash content usually indicates the mineral content of food. The iron content ranged between 423.68 ± 0.2 mg/100 g DW (for *Koko*) and 81.19±0.07 mg/100 g DW (for *Mbol*). These values were higher than those found by Ponka et al. [27] (6.08-2.99 mg/100 g DW) and Kana et al. [32] (5.90±0.28- 1.42±0.55 mg/100 g DW) in various traditional dishes consumed in Cameroon (Plantain with Leaf Vegetable Sauce, Jall of Rice, *Corn Chaff, Nnam Owondo/Ebobolo and Nnam Ngon/Ebobolo*). Flavonoids and phenolics are important food components that inhibit oxidant compounds by inactivating lipid free radicals or inhibiting the transformation of hydroperoxide into free radicals [33]. Eating antioxidant-rich foods is the most effective and simplest method for preventing or preventing diseases associated with oxidative damage. The results of the present study showed that the phenolic content ranged from 0.918 ± 0.12 to 0.622 ± 0.27 mg GAE/100 g, while the total flavonoid content ranged from 0.541 ± 0.21 to 0.332 ± 0.23 mg CE/100 g, with the highest levels of both found in koko. Polyphenols are powerful in vitro antioxidants, principally due to their low redox potential and ability to provide many hydrogens or electron atoms. Consequently, via the inhibition of oxidative stress, dietary polyphenols might protect against some chronic diseases [34].

CONCLUSION

It appears from this study that in addition to consuming *Koko* and *Mbol*, the populations of the ERC have more than ten traditional dishes that they consume more or less regularly. The consumption of *Koko* and *Mbol* should be further encouraged to help cover the nutrient and energy needs of the populations of the ERC in particular and of Cameroon in general. Due to their wealth of macronutrients and micronutrients, they should be further encouraged in the ERC in particular and in Cameroon in general. This study contributes to the increasing knowledge of the composition of traditional Cameroon foods. Many of these traditional foods, such as *Koko* and *Mbol*, are worthy of being inserted into the food composition table of Cameroon, and they may contribute to valorizing foods from central and whole Africa. It is expected that these data will be of interest to studies wishing to encourage traditional foods and thus improve the nutritional status of the population.

Author Contributions

Ulrich Landry Kamdem Bemmo: Conceptualization (lead); investigation (equal); methodology (equal); writing – original draft (equal); writing – review and editing (equal). Jean Marcel Bindzi: Datacuration (equal); formal analysis (equal); writing – original draft (equal); writing – review and editing (equal). Chancel Hector Kenfack Momo: Writing – original draft (equal); writing– review and editing (equal). Wilfred Damndja Ngaha: Investigation (equal); methodology (equal); Agnes Mbaissoubo Massaba: Investigation (equal); methodology (equal); writing – origi-nal draft (equal); writing – review and editing (equal). Stephano Tene Tambo: Methodology (equal); writing – review and editing (equal). François Ngoufack Zambou: Supervision (lead); validation (equal); writing – originaldraft (equal); writing – review and editing (equal)

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Ethical approval

Participants were informed about the study, they could stop the interview at any point, written consent from all the participants to the study was obtained, and the research valued the rules of volunteer participation and confidentiality.

Consent for publication

The authors approve the publication of this manuscript.

Availability of data and materials

The manuscript has no associated data

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Conflicts of interest

The authors declare no conflicts of interest in the publication of this research.

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