

# Macronutrient Values of Local Meals of Some Cameroonian Traditional Communities Living in Yaounde

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**Abstract:** Background and objectives: This study aimed to evaluate the macronutrient values of some traditional meals consumed by some communities living in Yaounde. Methods: The study was carried out among six traditional communities living in Yaounde (Cameroon) (*Mbo*, *Bamougoum*, *Eton*, *Bafia*, *Haussa* and *Dschang*). This study was carried out in two different stages: a food survey and a food composition analysis. In the first stage: the food questionnaire was administered to 30 natives of each community to investigate local meals more and rarely consumed. After a data analysis of these questionnaires, the most consumed meals were selected for food composition analysis. A total of 41 most consumed meals were selected and prepared (*Bafia* community (06), *Haussa* community (09), *Dschang* community (06), *Eton* community (06), *Mbo* community (07) and *Bamougoum* community (07)). A portion of 100g of each was used to evaluate food composition (moisture, ash, water, proteins and lipids). Results: The results of this study show that the highest meals from *Bamougoum*, *Dschang*, *Eton* and *Bafia* communities presented the highest level of ash. The protein contents were acceptable for most dishes and were significantly ( $p < 0.05$ ) higher for meals from the *Bafia* community. Some exhibited high lipid contents with more than 70g/100gdw. Conclusion: The results of this study are essential for determining diet-disease associations and could also be extremely useful for nutrition education and dietary interventions, and are necessary for the successful dietary management of metabolic syndrome and his comorbidities in Cameroon.

**Keywords:** Macronutrient Values, Local Meals, Traditional Communities

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## 1. Introduction

Throughout the world, nutrition-related diseases are a major public health problem. These diseases are the result of a nutritional imbalance either in favour of a deficit or an overload, better known as malnutrition [1].

Strategies for managing malnutrition and its associated comorbidities are essentially based on diet and lifestyle correction. The identification and promotion of local foods with specific nutritional and therapeutic qualities for the

management of certain nutritional diseases are strongly encouraged as part of local resilience as advocated by the WHO [2].

Hence the importance of a comprehensive assessment of the nutritional value of local dishes commonly consumed in a community. Cameroon, like other developing countries, is not spared by the rapid emergence of nutrition-related diseases [3] Thus, many works have so far been carried out

to determine the nutritional value of certain traditional Cameroonian foods and meals. These include the vitamin C content of certain tubers and plantains before and after cooking [4]; the fatty acid composition of some dishes prepared in North Cameroon [5]; the composition of some dishes prepared traditionally in an urban area (Yaoundé) [6]; the chemical composition of some dishes prepared traditionally by the Bassa community [7]; the content of some important mineral salts in traditional sauces of the west province of Cameroon [8]; the nutritive value of some dishes consumed in some rural areas in the West province of Cameroon [9]; the protein and mineral contents of Cameroonian dishes [10]; the study of the nutritional potential of some traditional dishes consumed in a rural area in the far North province of Cameroon [11]; the methods of preparation and nutritional evaluation of dishes consumed in a malaria endemic zone in Cameroon (Ngali II) [12]; the Nutritional composition of commonly consumed composite dishes from the Central Province of Cameroon [13]; the methods of preparation and nutritive value of some dishes consumed in the west region of Cameroon [14] and A review of composition studies of Cameroonian traditional dishes: Macronutrients and minerals [3].

However, Cameroon is characterised by ethnic and cultural diversity, which implies a diversity of eating habits that is richness for its populations. Several studies in Cameroon highlighted a lack in knowledge of the composition of a healthy diet as a barrier to healthy dietary behaviours [15].

This study aimed to evaluate the nutritional values of some Cameroonian local meals consumed by some Cameroonian communities living in Yaounde

## 2. Methodology

The work has been carried out in 2015. The study design a mix of food survey and the determination of the food composition of selected local meals.

### 2.1. Ethno – Food Survey

Study was carried out in six halogen ethnic communities randomly chosen among the most representative living in Yaounde, the political capital of Cameroon namely: Mbo (Littoral region), Bamougoum and Dschang (from West region), Eton and Bafia (from Center region), Haussa (Adamawa Region). An ethno - food questionnaire was administered to a subset of 180 households randomly selected, i.e. 30 per community.

After a clear description of the purposes of the study to the household, and their approval to participate to the survey, a food survey questionnaire was administered to the person in charge of the family's nutrition. The frequency of consumption of traditional meals were recorded and their

occasions of consumption were also investigated. An appointment was then made with her to attend the cooking of the traditional dishes. During cooking demonstration, the different cooking steps, duration and ingredients were well recorded. After data analysis, some meals were selected for the nutritional values assessment.

### 2.2. Nutritional Value of Some Local Meals Consumed

41 meals were selected because their high frequency consumption and distributed as follows: Bamougoum ethnic group (07 local meals), Eton ethnic group (06 local meals), Mbo ethnic group (07 local meals), Haussa ethnic group (09 local meals), Dschang ethnic group (06 local meals) and Bafia ethnic group (06 local meals).

The meals selected after ethno-food survey have been prepared in the kitchen of the Department of Home Economics, Higher Teacher's Training School for Technical Education, University of Douala, using the ingredients for the traditional recipes described in visited household. Ingredients used for the preparation of the meals were purchased from five of the most popular markets of the city of Douala (Bepanda, Makepe-Missoke, and Central market) and were mixed for a representative sampling. All the ingredients were weighed and each meal was prepared three times. After cooking, the samples were packed in plastic bags of which the opening was sealed using a lighted candle, labelled and transferred to a deep freeze ( $-20^{\circ}\text{C}$ ). Water contents of meals were determined immediately after cooking.

100grams of each selected meal were taken to the CRAN/IMP/MINRESI for analysis. The different samples of meals were then lyophilized, incinerated and analyzed. All the analyses were done in triplicate.

### 2.3. Moisture Determination and Chemical Analysis [16]

Moisture content was determined by drying samples to constant weight in an electric oven at  $105-110^{\circ}\text{C}$ .

Ash content was determined by incineration in a muffle furnace at  $550^{\circ}\text{C}$  for 48h.

Proteins were determined by nitrogen determination using the Kjeldahl micro-method and conversion of nitrogen to proteins by the factor 6.25.

Total lipids by extraction in a Soxhlet apparatus for 6h using petroleum ether as solvent.

### 2.4. Statistical Analysis

The means and standard errors of the data were calculated. They were then analysed by the analysis of variance (ANOVA) and Post Hoc test (Least Significance Difference) and significance judged at  $p < 0.05$  using IBM SPSS (Statistical Package of Social Science) software version 22.0. equations.

### 3. Results

#### 3.1. Description of Some Cameroonian Local Meals

**Table 1.** Description of some traditional Cameroonian meals of Bamougoum and Dschang ethnic groups (West region).

Name of meals (common and local names)	Carbohydrates staples	Form of the foods	Coded meal	Ingredients	Scientific names of main ingredients
Bamougoumethnic group					
Yellow soup (péna'atchu)/pounded cocoyam	Pounded cocoyam	Light sauce	TSJ	Palm oil + spices + dried fish + chilli pepper + salt + cocoyam	<i>Colocosiasp</i>
Yellow soup and okra/fufu corn (messanna'atchuregan)	Fufu corn	Light sauce	CSJ	Palm oil + spices + dried fish + chilli pepper + salt + okra	<i>Hibiscus esculentus</i>
Yellow soup and elephant/Fufu corn grass (messanna'atchusisson)	Fufu corn	Light sauce	CSSL	Palm oil + spices + chilli pepper + salt + elephant grass	<i>Capsicum annum</i>
Peeled dried maize and huckleberry leaves (tchou'ouguessandjap)	Peeled dried maize	Paste	PML	Huckleberry leaves + palm oil + salt + chilli pepper	<i>Solanumnigrum</i>
Black soup and okra/Fufu corn (messanna'atchè'e)	Fufu corn	Light sauce	CSN	Okra + spices + salt + chilli pepper	<i>Hibiscus esculentus</i>
Yellow soup and eggplants/pounded cocoyam (na'atchuchèchouo)	Pounded cocoyam	Light sauce	TSJA	Palm oil + spices + eggplants + chilli pepper + salt	<i>Solanummelongena</i>
Banana stew (kentiè tam)	Unripe banana	Piece	BM	Banana + groundnut + palm oil + dried fish + chilli pepper	<i>Musa paradisiacal and Arachis hypogea</i>
Dschangethnic group					
Fresh peanut with huckleberry/banana (Mebou'oh)	Unripe banana	Paste	MALB	Huckleberry + fresh groundnut + salt	<i>Arachis hypogea, Solanumnigrum</i>
Crush irish potatoes with dried yams (Nguin)	Irish potatoes / Dried yams	Paste	PPIS	Irish potatoes + dried yams + palm oil	<i>Solanumtuberosum, Dioscoreasp</i>
Yellow soup with sissongo leaves/cocoyam (Apa'ahchouchoun)	Cocoyam	Thick soup	TSJS	Sissongo + natron + dried fish + palm oil + spices	<i>Pennisetumpurpureum</i>
Yams stew	Yams	Piece	IM	Yams + palm oil + dried fish + garlic + onion + Ricinodendron	<i>Dioscoreasp</i>
Pounded cocoyam with Roasted vegetables (Kwa – ndzap)	Pounded cocoyam	Paste	MPLS	Macabo + huckleberry + onion + tomato + salt + palm oil	<i>Xanthosomasp, Solanumnigrum</i>
Banana cake with chilli leaves (Menda'ah)		Paste	GBFP	Banana + chilli leaves + salt + palm oil	<i>Musa sapientum, Capsicum annum</i>

**Table 2.** Description of some traditional Cameroonian meals ofBafiaand Eton ethnic groups (Center region).

Name of meals (common and local names)	Carbohydrates staples	Form of foods	Coded meal	Ingredients	Scientific names of main ingredients
Bafiaethnic groups					
Young cocoa fruits sauce/Fufu corn (kakaedaeukepenkibazi)	Fufu corn	Thick sauce	CCM	Young cocoa fruits + dried fish + dried crayfish + palm oil + chilli pepper + onion + tomato + salt	<i>Theobroma cacao</i>
Melon with eggplants (mereingdaeuterée)	Melon	Thick sauce	MA	Melon + eggplants + salt + palm oil + dried fish + onion + chilli pepper + dried crayfish	<i>Cucurbitasp, solanummelongena</i>
Young palm leaves/Fufu corn (ndoongdaeukepenkibazi)	Fufu corn	Thick sauce	PCM	Young palm leaves + dried fish + chilli pepper + salt + palm oil + onion	<i>Elaeisqueensis</i>
Young sissongo leaves/Fufu corn (mechongchongdaeukepenkibazi)	Fufu corn	Thick sauce	SCM	Young sissongo leaves + dried crayfish + palm oil + dried fish + salt + chilli pepper +Egusi	<i>Pennisetumpurpureum</i>
Huckleberry leaves/Fufu corn(Bitossodaeukepenkibazi)	Fufu corn	Thick sauce	BCM	Huckleberry leaves + chilli pepper + salt + palm oil	<i>Solanumnigrum</i>
Roasted caterpillar/cassava tubers (gououdaeukidjanekibeudoun)	Cassava tubers	Piece	CTM	Caterpillar + salt + onion + chilli pepper + palm oil	<i>Embrassaioyemensis</i>
Eton ethnic groups					
Melon leaves/Cassava tubers(Midjen)	Cassava tubers	Thick sauce	FMM	Melon leaves + palm nut pulp + groundnuts	<i>Cucurbitasp</i>
Paï leaves/Cassava tubers (Paï)	Cassava tubers	Thick sauce	PM	Paï (vegetables) + salt + groundnut + palm oil	<i>Paï</i>
Termites dishes/Bundle cassava (n-kongi – sil)	Bundle cassava	Paste	MTBM	Crushed termites + salt + chilli pepper + local spices	<i>Macrotermessubhyalinus</i>
Saka'a leaves/Cassava tubers	Cassava tubers	Thick sauce	SM	Saka'a leaves + groundnuts + palm oil	<i>Hilerialatifolia</i>
Young sissongo sprouts/Cassava tubers (Misson)	Cassava tubers	Thick sauce	JPSM	Young sissongo sprouts + palm nut pulp + chilli pepper + salt + dried fish + onion + tomato + local spices	<i>Pennisetumpurpureum</i>
Eggplants puree (Ipirikzon)	Cassava tubers	Puree	PAM	Eggplants + groundnut + onion + salt + palm oil	<i>Solanummelongena</i>

**Table 3.** Description of some traditional Cameroonian meals of Mbo community (Littoral region).

Name of meals (common and local names)	Carbohydrates staples	Form of the foods	Coded meal	Ingredients	Scientific names of main ingredients
Koki cowpea beans (Ekokikeun)	Cocoyam leaves	Paste	KN	vouandzou nuts + palm oil + macabo leaves + salt + chilli pepper + water	<i>Vigna unguiculata</i>
Koki dried maize (Ekokimbè)	corn	Paste	KMS	Dried maize + macabo leaves + palm oil + salt + chilli pepper + water	<i>Zea mays</i>
Koki dried plantain (Ekokimpouh)	Plantain	Paste	KPS	Dried plantain flour + macabo leaves + palm oil + salt + chilli pepper + water	<i>Musa paradisiaca</i>
Koki fresh maize (Ekokietoumbè)	Corn	Paste	KMF	Fresh maize + macabo leaves + palm oil + salt + chilli pepper + water	<i>Zea mays</i>
Koki sweet potato (Ekokialang)	Sweet potatoes	Paste	KP	Potatoes + macabo leaves + palm oil + salt + chilli pepper + water	<i>Ipomea batatas</i>
Koki macabo (Ekokialang)	Cocoyam	Paste	KMA	Macabo + macabo leaves + palm oil + salt + piment + water + dried fish	<i>Xanthosoma sp</i>
Green soup (Essouba)/pounded cocoyam	Pounded cocoyam	Thick sauce	TPSV	Cocoyam + salt + chilli pepper + cocoyam young leaves + palm oil + water + dried fish	<i>Colocasia sp</i>

**Table 4.** Description of some traditional Cameroonian meals of Hausa community (Adamawa region).

Name of meals (common and local names)	Carbohydrates staples	Form of foods	Coded meal	Ingredients	Scientific names of main ingredients
Baobab soup -beef meat/Fufu rice (toughonchincapa/kouka)	Fufu rice	Thick soup	CRSB	Powder of baobab leaves + garlic + onion + peanut oil + salt + tomato + beef meat	<i>Adansoniadigitata</i>
Fresh okra – beef meat/Fufu cassava (toughongourka/coubewa)	Fufu cassava	Thick soup	CMGF	Okra + garlic + onion + peanut oil + salt + tomato + beefmeat	<i>Hibiscus esculentus</i>
Soye/Fufu cassava (toughongourkasoye)	Fufu cassava	Thick soup	CMSO	tomatoes + garlic + onion + tomato + peanut oil + salt + ginger + water + beefmeat	<i>Lycopersicon esculentum</i>
Folere – beef meat/Fufu rice (toughonchincapa/yakouwa)	Fufu rice	Thick soup	CRFO	Folere + garlic + onion + tomato + crushed peanut + peanut oil + salt + beefmeat	<i>Hibiscus sabdariffa</i>
Baobab soup – beef meat/Fufu corn (toughon mascara/kouka)	Fufu corn	Thick soup	CMAIBA	Powder of baobab leaves + tomato + garlic + onion + peanut oil + salt + beefmeat	<i>Adansoniadigitata</i>
Dried lalo – beef meat/Fufu corn (toughon mascara/laloboucheche)	Fufu corn	Thick soup	CMAILS	Powder of Lalo leaves + garlic + onion + tomato + peanut oil + salt + beefmeat	<i>Corchorus solitorius</i>
Fresh lalo – beef meat/Fufu rice (Toughonchincapa/lalo)	Fufu rice	Thick soup	CRLF	Fresh Lalo leaves + garlic + tomato + onion + peanut oil + salt + beefmeat	<i>Corchorus solitorius</i>
Dried lalo – beef meat/Fufu rice (toughonchincapa/laloboucheche)	Fufu rice	Thick soup	CRLS	Powder of Lalo leaves + garlic + onion + tomato + peanut oil + salt + beefmeat	<i>Corchorus solitorius</i>
Dried okra – beef meat/Fufu corn (toughon mascara/coubewaboucheche)	Fufu corn	Thick soup	CMAIGS	Powder of okra + garlic + onion + peanut oil + tomato + salt + beefmeat	<i>Hibiscus esculentus</i>

### 3.2. Nutritional Values of Local Meals

The analysis of local dishes has made it possible to highlight the contents of dry matter, ashes, proteins and lipids.

The table 5 below shows the nutritional value of the local meals of the Bamougoumand Dschang communities.

For the Bamougou local meals, it appears that the protein and ash contents are significantly higher with the yellow sauce (péna'atchu) ( $8.66 \pm 0.08\text{g}/100\text{g}$ ) and ( $3.94 \pm 0.07\text{g}/100\text{g}$ )

while the lipid contents are significantly higher with the yellow sauce and elephant grass (messanna'atchusisson) ( $93.86 \pm 0.31\text{g}/100\text{g}$ ) (table 5).

For the Dschang community, the dried matter, ashes and the lipid contents are significantly higher with the Banana cake with chilli leaves (Menda'ah) ( $35.55 \pm 0.12\text{g}/100\text{g dw}$ ;  $2.87 \pm 0.05\text{g}/100\text{g dw}$  and  $53.72 \pm 0.11\text{g}/100\text{g dw}$ ) while the proteins contents are significantly higher with the Yellow soup with sissongo leaves (Apa'ahchouchoun) ( $8.46 \pm 0.04\text{g}/100\text{gdw}$ ) (table 5).

**Table 5.** Macronutrient values of local meals of Bamougoumand Dschang communities (West region).

Name of traditional dishes (common and local names)	Dried matter (g/100g dw)	Ash (g/100g dw)	Proteins (g/100g dw)	Lipids (g/100g dw)	Moisture (g/100g fw)
Bamougou community					
Yellow soup (péna'atchu)	$27.06 \pm 0.05^a$	$3.94 \pm 0.07^a$	$8.66 \pm 0.08^a$	$83.47 \pm 0.04^a$	$72.94 \pm 0.05^a$
Yellow soup and okra (messanna'atchuregan)	$22.40 \pm 0.07^b$	$2.35 \pm 0.05^b$	$5.49 \pm 0.06^b$	$91.37 \pm 0.30^b$	$77.60 \pm 0.07^b$
Yellow soup and elephant grass (messanna'atchusisson)	$15.74 \pm 0.04^c$	$2.10 \pm 0.01^c$	$0.94 \pm 0.01^c$	$93.86 \pm 0.31^c$	$84.26 \pm 0.04^c$
Peeled dried maize and huckleberry leaves (tchou'ouguessandjap)	$45.43 \pm 0.21^d$	$2.01 \pm 0.02^c$	$3.70 \pm 0.08^d$	$89.68 \pm 0.22^d$	$54.57 \pm 0.21^d$
Black soup and okra (messanna'atchè'e)	$19.55 \pm 0.11^e$	$1.83 \pm 0.03^d$	$5.81 \pm 0.08^e$	$88.29 \pm 0.08^e$	$80.45 \pm 0.11^e$
Yellow soup and eggplants (na'atchuchèchouo)	$12.36 \pm 0.07^f$	$2.06 \pm 0.05^c$	$1.81 \pm 0.05^f$	$85.23 \pm 0.09^f$	$87.64 \pm 0.07^f$
Banana stew (kentiè tam)	$26.73 \pm 0.19^a$	$2.21 \pm 0.07^c$	$2.06 \pm 0.06^g$	$47.76 \pm 0.21^g$	$73.27 \pm 0.19^a$
Dschang community					

Name of traditional dishes (common and local names)	Dried matter (g/100g dw)	Ash (g/100g dw)	Proteins (g/100g dw)	Lipids (g/100g dw)	Moisture (g/100g fw)
Fresh peanut with huckleberry (Mebou'oh)	27.61±0.05 <sup>a</sup>	2.00±0.01 <sup>a</sup>	3.88±0.07 <sup>a</sup>	47.17±0.011 <sup>a</sup>	73.40±0.05 <sup>a</sup>
Crush irish potatoes with dried yams (Nguin)	32.00±0.03 <sup>b</sup>	2.48±0.04 <sup>b</sup>	2.41±0.02 <sup>b</sup>	46.40±0.03 <sup>b</sup>	68.00±0.03 <sup>b</sup>
Yellow soup with sissongo leaves (Apa'ahchouchoun)	28.40±0.07 <sup>c</sup>	2.44±0.06 <sup>b</sup>	8.46±0.04 <sup>c</sup>	47.90±0.01 <sup>c</sup>	71.60±0.07 <sup>c</sup>
Yams stew	26.80±0.01 <sup>d</sup>	2.38±0.04 <sup>b</sup>	1.86±0.01 <sup>d</sup>	26.90±0.03 <sup>d</sup>	73.21±0.01 <sup>d</sup>
Pounded cocoyam with Roasted vegetables (Kwa – ndzap)	30.58±0.02 <sup>e</sup>	2.72±0.02 <sup>c</sup>	1.30±0.06 <sup>e</sup>	53.51±0.12 <sup>e</sup>	69.42±0.02 <sup>e</sup>
Banana cake with chilli leaves (Menda'ah)	35.55±0.12 <sup>f</sup>	2.87±0.05 <sup>d</sup>	2.72±0.03 <sup>f</sup>	53.72±0.11 <sup>e</sup>	64.45±0.12 <sup>f</sup>

For each column, values followed by different superscripts are significantly different ( $p < 0.05$ ).

The table 6 below shows the nutritional value of the local meals of the Bafiaand Eton communities.

For Bafia community, it appears that Young cocoa fruits sauce (kakaadaeukepenkibazi), Young palm leaves (ndoongdaeukepenkibazi), Huckleberry leaves (Bitossodauekenkibazi) and Roasted caterpillar (gououdaeukidjanekibeudoun) have significantly contents in ashes (2.46±0.12g/100g dw; 1.83±0.03g/100g dw; 2.72±0.01g/100g dw and 1.93±0.01g/100g dw respectively) (table 6).

Proteins contents are significantly higher with Young palm leaves (ndoongdaeukepenkibazi) (42.52±0.53g/100g dw), Young sissongo leaves (mechongchongdaeukepenkibazi) (50.48±0.42g/100g dw) and Roasted caterpillar

(gououdaeukidjanekibeudoun) (53.53±0.42g/100g dw) respectively (table 6).

Lipids contents are significantly higher with Melon with eggplants (mereingdaeuterée) (90.85±0.11g/100g dw), Young palm leaves (ndoongdaeukepenkibazi) (87.73±0.39g/100g dw) and Huckleberry leaves (Bitossodauekenkibazi) (88.02±0.33g/100g dw) respectively (table 6).

For local meals of Eton community, ashes contents are significantly contents with Saka'a leaves (4.16±0.14g/100g dw). Proteins contents are significantly higher with Termites dishes (n-kongi – sil) (11.06±0.16g/100g dw) and Saka'a leaves (10.20±0.14g/100g dw) respectively. Lipids contents are significantly higher with all dishes but contents are significantly higher with Saka'a leaves (82.74±0.02g/100g dw) (table 6).

**Table 6.** Micronutrient values of local meals of Bafia and Eton communities (Center region).

Name of traditional dishes (common and local names)	Dried matter (g/100g dw)	Ash (g/100g dw)	Proteins (g/100g dw)	Lipids (g/100g dw)	Moisture (g/100g fw)
Bafia community					
Young cocoa fruits sauce (kakaadaeukepenkibazi)	22.40±0.02 <sup>a</sup>	2.46±0.12 <sup>a</sup>	34.26±0.47 <sup>a</sup>	84.46±0.33 <sup>a</sup>	77.60±0.02 <sup>a</sup>
Melon with eggplants (mereingdaeuterée)	15.67±0.36 <sup>b</sup>	1.36±0.07 <sup>b</sup>	24.94±0.12 <sup>b</sup>	90.85±0.11 <sup>b</sup>	84.33±0.36 <sup>b</sup>
Young palm leaves (ndoongdaeukepenkibazi)	21.13±0.05 <sup>c</sup>	1.83±0.03 <sup>c</sup>	42.52±0.53 <sup>c</sup>	87.73±0.39 <sup>c</sup>	78.87±0.05 <sup>c</sup>
Young sissongo leaves (mechongchongdaeukepenkibazi)	23.16±0.01 <sup>d</sup>	1.08±0.02 <sup>d</sup>	50.48±0.42 <sup>d</sup>	43.39±0.71 <sup>d</sup>	76.84±0.01 <sup>d</sup>
Huckleberry leaves(Bitossodauekenkibazi)	2.23±0.05 <sup>e</sup>	2.72±0.01 <sup>e</sup>	19.71±0.46 <sup>e</sup>	88.02±0.33 <sup>c</sup>	97.77±0.05 <sup>e</sup>
Roasted caterpillar (gououdaeukidjanekibeudoun)	49.49±0.07 <sup>f</sup>	1.93±0.01 <sup>c</sup>	53.53±0.42 <sup>f</sup>	63.41±0.11 <sup>e</sup>	50.51±0.07 <sup>f</sup>
Eton community					
Melon leaves(Midjen)	6.39±0.05 <sup>a</sup>	1.13±0.02 <sup>a</sup>	0.33±0.01 <sup>a</sup>	73.97±0.39 <sup>a</sup>	99.61±0.05 <sup>a</sup>
Paï leaves(Paï)	32.21±0.03 <sup>b</sup>	1.87±0.05 <sup>b</sup>	0.46±0.00 <sup>a</sup>	70.86±0.82 <sup>b</sup>	67.79±0.03 <sup>b</sup>
Termites dishes (n-kongi – sil)	45.53±0.05 <sup>c</sup>	2.89±0.02 <sup>c</sup>	11.06±0.16 <sup>b</sup>	75.60±0.12 <sup>c</sup>	54.47±0.05 <sup>c</sup>
Saka'a leaves	35.31±0.40 <sup>d</sup>	4.16±0.14 <sup>d</sup>	10.20±0.14 <sup>c</sup>	82.74±0.02 <sup>d</sup>	64.69±0.39 <sup>d</sup>
Young sissongo sprouts (Misson)	15.58±0.07 <sup>e</sup>	2.43±0.15 <sup>e</sup>	8.38±0.03 <sup>d</sup>	71.72±0.67 <sup>b</sup>	84.42±0.07 <sup>e</sup>
Eggplants puree (Ipirikzon)	30.70±0.20 <sup>f</sup>	2.71±0.01 <sup>c</sup>	9.13±0.07 <sup>c</sup>	76.41±0.03 <sup>c</sup>	69.30±0.07 <sup>f</sup>

For each column, values followed by different superscripts are significantly different ( $p < 0.05$ ).

The table 7 below shows the nutritional value of the local meals of the Mbo community that ashes contents are significantly ( $p < 0.05$ ) high with Koki dried maize (Ekokimbè) (1.49±0.10g/100g dw) and Koki sweet potato (Ekokialang) (1.37±0.12g/100g dw) respectively. Proteins contents are significantly higher ( $p < 0.05$ ) with Koki fresh

maize (Ekokietoumbè) (2.78±0.02 g/100g dw) and Koki dried maize (Ekokimbè) (2.48±0.02 g/100g dw) respectively. Lipids contents are significantly higher ( $p < 0.05$ ) with Koki fresh maize (Ekokietoumbè) (75.01±0.35g/100g dw) and Koki macabo (Ekokialang) (70.32±0.09g/100g dw) respectively.

**Table 7.** Micronutrient values of local meals of Mbo community (Littoral region).

Name of traditional dishes (common and local names)	Dried matter (g/100g dw)	Ash (g/100g dw)	Proteins (g/100g dw)	Lipids (g/100g dw)	Moisture (g/100g fw)
Koki sweet potato (Ekokialang)	32.51±0.15 <sup>a</sup>	1.37±0.12 <sup>a</sup>	1.40±0.12 <sup>a</sup>	65.43±0.02 <sup>a</sup>	67.49±0.15 <sup>a</sup>
Koki dried maize (Ekokimbè)	23.59±0.13 <sup>b</sup>	1.49±0.10 <sup>b</sup>	2.48±0.02 <sup>b</sup>	62.47±0.07 <sup>b</sup>	76.41±0.13 <sup>b</sup>
Koki dried plantain (Ekokimpouh)	33.48±0.08 <sup>c</sup>	0.94±0.01 <sup>c</sup>	0.77±0.01 <sup>c</sup>	63.77±0.06 <sup>c</sup>	66.52±0.08 <sup>c</sup>
Koki cowpea beans (Ekokikeun)	26.60±0.14 <sup>d</sup>	0.86±0.02 <sup>c</sup>	1.90±0.00 <sup>d</sup>	67.25±0.19 <sup>d</sup>	73.40±0.14 <sup>d</sup>
Koki fresh maize (Ekokietoumbè)	23.56±0.03 <sup>b</sup>	0.78±0.01 <sup>c</sup>	2.78±0.02 <sup>c</sup>	75.01±0.35 <sup>e</sup>	76.44±0.03 <sup>b</sup>
Koki macabo (Ekokialang)	27.70±0.12 <sup>c</sup>	1.25±0.04 <sup>a</sup>	0.00±0.00 <sup>f</sup>	70.32±0.09 <sup>f</sup>	72.30±0.12 <sup>c</sup>
Green soup (Essouba)	23.47±0.11 <sup>b</sup>	1.26±0.03 <sup>a</sup>	0.79±0.01 <sup>c</sup>	66.49±0.12 <sup>a</sup>	76.53±0.12 <sup>b</sup>

For each column, values followed by different superscripts are significantly different ( $p < 0.05$ ).

The table 8 below shows the nutritional value of the local meals of the Hausa community. That, ashes contents are significantly ( $p < 0.05$ ) high with Soye (toughongourkasoye) ( $0.94 \pm 0.026 \text{g}/100 \text{g dw}$ ). Proteins contents are significantly higher ( $p < 0.05$ ) with Baobab soup – beef meat (toughon mascara/kouka) ( $2.95 \pm 0.03 \text{g}/100 \text{g dw}$ ), Fresh okra – beef meat (toughongourka/coubewa) ( $2.90 \pm 0.03 \text{g}/100 \text{g dw}$ ), Dried

lalo – beef meat (toughon mascara/laloboucheche) ( $2.67 \pm 0.06 \text{g}/100 \text{g dw}$ ) and Dried okra – beef meat (toughon mascara/coubewaboucheche) ( $2.08 \pm 0.04 \text{g}/100 \text{g dw}$ ) respectively. Lipids contents are significantly higher ( $p < 0.05$ ) with Baobab soup – beef meat (toughonchincapa/kouka) ( $80.82 \pm 0.41 \text{g}/100 \text{g}$ ).

**Table 8.** Micronutrient values of local meals of Hausa community (Adamawa region).

Name of traditional dishes (common and local names)	Dried matter (g/100g dw)	Ash (g/100g dw)	Proteins (g/100g dw)	Lipids (g/100g dw)	Moisture (g/100g fw)
Baobab soup -beef meat (toughonchincapa/kouka)	$16.29 \pm 0.05^a$	$0.59 \pm 0.01^a$	$0.49 \pm 0.01^a$	$80.82 \pm 0.41^a$	$83.71 \pm 0.05^a$
Fresh okra – beef meat (toughongourka/coubewa)	$21.52 \pm 0.03^b$	$0.49 \pm 0.02^b$	$2.90 \pm 0.03^b$	$56.57 \pm 1.31^b$	$78.48 \pm 0.03^b$
Soye (toughongourkasoye)	$28.41 \pm 0.06^c$	$0.94 \pm 0.026^c$	$0.54 \pm 0.02^a$	$54.48 \pm 0.47^c$	$71.59 \pm 0.06^c$
Folere – beef meat (toughonchincapa/yakouwa)	$18.60 \pm 0.25^d$	$0.44 \pm 0.01^d$	$0.51 \pm 0.01^a$	$50.98 \pm 0.78^d$	$81.40 \pm 0.25^d$
Baobab soup – beef meat (toughon mascara/kouka)	$18.77 \pm 0.06^d$	$0.29 \pm 0.01^c$	$2.95 \pm 0.03^b$	$53.08 \pm 0.07^c$	$81.23 \pm 0.06^d$
Dried lalo – beef meat (toughon mascara/laloboucheche)	$17.61 \pm 0.03^e$	$0.48 \pm 0.00^b$	$2.67 \pm 0.06^c$	$51.49 \pm 0.01^d$	$82.39 \pm 0.03^e$
Fresh lalo – beef meat (Toughonchincapa/lalo)	$13.90 \pm 0.11^f$	$0.62 \pm 0.01^a$	$1.98 \pm 0.06^d$	$50.21 \pm 0.52^d$	$86.10 \pm 0.11^f$
Dried lalo – beef meat (toughonchincapa/laloboucheche)	$17.20 \pm 0.08^g$	$0.40 \pm 0.00^f$	$1.88 \pm 0.08^d$	$61.33 \pm 0.07^e$	$82.80 \pm 0.08^g$
Dried okra – beef meat (toughon mascara/coubewaboucheche)	$19.14 \pm 0.12^d$	$0.19 \pm 0.01^g$	$2.08 \pm 0.04^d$	$60.29 \pm 0.05^e$	$80.86 \pm 0.14^h$

For each column, values followed by different superscripts are significantly different ( $p < 0.05$ ).

## 4. Discussion

There are little composition data available for composite meals in Cameroon and we have provided, for the first time, the nutritional composition of the most commonly consumed dishes in our study areas. Cameroon is made up of many tribes whose food habits are different from each other. In the Central, West, East, South and three Northern regions, ground nuts or melon seeds (providing fat and protein) are usually added to almost all soups and green cooked vegetables, whereas this practice is not common among the coastal/high - land zones [13, 17]. The use of palm nuts pulp in the place of palm oil is common among the Central region. However, the three Northern Provinces do not use palm oil or palm nut pulps but groundnut oils in all sauces and vegetables dishes. In west region, populations consume dishes based on spices or groundnut with cereals and tubers like complements.

The nutrient composition of Cameroon local meals is influenced by ethnic belongings and dietary habits which define the nature and doses of ingredients. Hence, differences in preparation methods can have an effect on the energy and nutrient content of a dish [13]. Determining the nutritional composition of these composite dishes is of critical importance for defining average daily nutrient intakes, a step to enable studies of association between nutrient intakes and diet-related diseases [18].

The highest ash level found with meals from *Bamougoum*, *Dschang*, *Eton* and *Bafia* communities is due to the presence of spices in these meals. Theoretically, levels of ashes are proportional to the mineral salts values of the dishes [14]. Moreover, ash contents also depend on the type of spices used. Studies have shown that spices like *Dichrostachys glomerata* and *Tetrapleura trepatatera* used in the preparation of certain dishes from the western regions had preventive effects on obesity, type 2 diabetes

and metabolic syndrome [19, 20]. However, findings of Domngang and Tchuinmogne showed that spices used to prepare meals had high contents of Iron, calcium, magnesium and phosphorus [14]. This could be reduced risk of anaemia and hypertension in diabetic patients. The low ash contents observed in the meals of the *Hausa* and *Mbo* communities could be due to the non-use of spices in the preparation of the selected meals.

In our study, the protein contents are high for most meals from different communities. But these protein contents are significantly ( $p < 0.05$ ) higher for meals from the *Bafia* community. This result could be explained by the nature of the raw material used to prepare the selected meals. Young vegetable leaves are the raw material used to prepare meals of *Bafia* community. [21] have shown that in young leaves, photosynthetic activity was high during maturity process of plants; this could explain the high content of proteins of young leaves. In general, the use of fufu corn like complements is a good culinary practice because corn is rich in methionin which is essential aminoacid.

The high lipid contents of certain meals from different communities (more than  $70 \text{g} / 100 \text{g dw}$ ) could be explained by the use of palm oil during culinary preparations or the lipid composition of the raw material. Note that palm oil is rich in beta carotene which is a precursor of vitamin A [22]. This vitamin is an antioxidant that protects the body against cancer and infections [23].

Otherwise, the results of [3] also showed the high fibres content of most of the traditional dishes in our study. Fibres are important because it protects the body from colon cancer, diabetes and CVD. Fibres have been linked to lower cholesterol, improved insulin sensitivity and lower blood pressure [24].

The high water content (more than  $60 \text{g}/100 \text{g dw}$ ) of most of meals of different communities would be due to the fact that much water is used for their preparation.

## 5. Conclusion

This study broad macronutrients contents of some local meals. The results suggest that local meals of Bamougoum, Dschang, Eton and Bafia communities content high level of Ashes. Protein contents are significantly higher in local meals of Bafia community (young palm leaves, young sissongo leaves and roasted carterpillar). Certain meals of different communities content the high lipid contents (70/100g dw). This study is preliminary study. It would be important to complete this study by determination of aminoacids and fatty acid profile of these local meals.

The results of this study are essential for nutritional education and dietary interventions, and are necessary for the successful dietary management of nutritional diseases in Cameroon.

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## References

- [1] WHO (2003). Diet, nutrition and the prevention of chronic diseases. *Report of a joint WHO/FAO expert consultation*. Geneva, Switzerland.
- [2] Englberger L, Lorens A, Pretrick M, Tara MJ, Johnson E (2011). Local food policies can help promote local foods and improve health: a case study from the Federated States of Micronesia. *Hawaii Med. J.* 70 (11 Suppl 2): 31-4.
- [3] Kouebou CP, Achu M, Nzali S, Chelea M, Bonglaisin J, Kamda A, Djiele P, Yadang G, Ponka R, NgohNewilah G, Nkouam G, Teugwa C, Kana Sop MM (2013). A review of composition studies of Cameroon traditional dishes: Macronutrients and minerals. *Food chemistry* 140: 483-494.
- [4] Leberre S Gallong and Tabi B (1969). Teneur en Vitamine C dans les tubercules et le plantain du Cameroun avant et après cuisson. *Ann. Nutr. Alim.* 1: 31-45.
- [5] Chevassus-Agnès S (1972). Composition en acides gras de quelques plats cuisinés au Nord-Cameroun. *Ann. Nutr. Alim.* 26: 7-31.
- [6] Kombou MN and Joseph A (1984). Composition protéique et minérale de quelques plats traditionnels cuisinés en milieu urbain (Yaoundé). *Revue Science et Technique. Sci. Santé.* (II) 2: 31-44.
- [7] Domngang F and Tchoné M (1985). Nutrient content of some traditionally prepared diets. *Ann. Fac. Sc. Biol. Biochim.* (III) 3: 107-113.
- [8] Domngang F et Tchuinmogne J (1985). Teneur en quelques sels minéraux importants des sauces traditionnelles "Nkui" et "Naa Pow". *Ann. Fac. Sc. Biol. Biochim.* (III) 3: 97 – 106.
- [9] Domngang F, Teugwa C, Fokou E et Tchuinmogne J (1989). Etude nutritive de quelques plats alimentaires consommés dans certaines zones rurales de l'Ouest-Cameroun. *Ann. Fac. Sc. Biol. Bioch.* (II) 1: 35-45.
- [10] Bell A, Rikong H, Hagbe B et Ndanga T (1996). Teneurs en protéines et minéraux des plats cuisinés camerounais. In: Bien manger et bien vivre. *ORSTOM.* 231-236.
- [11] Teugwa C, Mbiapo F, Fokou E et Fotso M (1996). Potentiel nutritionnel de quelques plats traditionnels consommés dans une zone rurale de l'Extrême-Nord Cameroun. *Cam. J. Biol. Bioch. Sc.* (VI) 1: 61-66.
- [12] Fokou E, Leke R, Fotso M, Souopgui J, Achu M and Biapo Tchouanguep F (2005). Methods of preparation and nutritional evaluation of dishes consumed in a malaria endemic zone of Cameroon (Ngali II). *Afr J Biotech* 4(3): ISSN 1684-5315, 273-278.
- [13] Sharma S and Cade J (2007). Nutritional composition of commonly consumed composite dishes from the Central Province of Cameroon. *Intern J of food Sci and Nutr*, 475-485.
- [14] Fokou E, Kenmogne H and Achu M (2009). Methods of preparation and nutritive values of some dishes consumed in the west region of Cameroon. *Pakistan J Nutr* 8(8): ISSN 1680-5194, 1190-1195.
- [15] Kiawi EE (2006). Unwin knowledge, attitudes, and behaviour relating to diabetes and its main risks factors among urban residents in Cameroon: a qualitative survey. *Cameroon: ethnic diseases* 16, 503 – 509.
- [16] AOAC (1980). Official methods of analysis. 13<sup>th</sup> ed., William Horwitz ed., Washington, D.C.
- [17] Tchiegang C and Kitkil A (2004). Données ethnonutritionnelles et caractéristiques physico-chimiques des légumes-feuilles consommés dans la savane de l'Adamaoua (Cameroun). *Tropicultura*, 22, 1, 11-18.
- [18] Greenfield H and Southgate DAT (2003). Food composition data production, Management and use. 2<sup>nd</sup> ed. Page 88-93.
- [19] Kuate D, Etoundi BC, Manan WA, Muda BW, Oben J (2013). Anti-inflammatory, anthropometric and lipomodulatory effects of diglomera (aqueous extract of *Dichrostachys glomerata*) in obese patients with metabolic syndrome. *Functionnal foods in health and diseases.* 3 (11): 416-427.
- [20] Kuate D, Kengne Mavemsi AP, Biapa Nya CP, Azantsa Kingue BG, Manan WA, Muda BW (2015). *Tetrapleurat reptatera* spices attenuate high-carbohydrate, high fat diet induced obese and type 2 diabetic rats with metabolic syndrome features. *Lipids health Sis* 14: 50.
- [21] Gonzales-Perez and Aredlano (2009). Handbook of hydrocolloids. 2<sup>nd</sup> edition. Philips GO and Williams PA.
- [22] Booth SL, Johns T and Kuhnlein (1992). Natural sources of vitamin A and pro-vitamin A. *UNU Food and Nutr Bull* 14: 6-19.
- [23] Semba RD and Bloem MW (2001). Nutrition and health in developing countries. *Totowa: Humana Press.*
- [24] Streppel MT, Arends LR, Veer V, Grobbee DE, Geleijnse JM (2005). Dietary fiber and blood pressure: A Meta-analysis of randomized placebo-controlled trials. *Arch Intern Med* 165: 150-6.