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Content and Bioavailability of Minerals in Some Cameroonian Foods from Douala: Risks of Micronutrient Deficiencies

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Abstract

Malnutrition and micronutrient deficiencies rates among preschool children and women of childbearing age as the most groups affected, are still rising in Cameroon, despite large food production, which reflected food security over the past three decades. This work aimed at evaluating the nutrient composition of the main family and transitional foods of children in the Douala town of Cameroon for food based malnutrition approach.

A food survey by interview using a structured questionnaire, including the recall of the last 24 hours food intakes, food frequency was carried out to over 500 women and caretakers in the city of Douala. Sixteen household dishes were selected from their high consumption frequencies and some traditional complementary foods were analyzed. Moisture and ash were determined by AOAC methods (1980). The following mineral contents: Fe, Zn, Ca, Mg, Mo, Mn, Cu, Cr, Al, Ni, Se, Sn, Cd, Pb, Hg, As were determined by HR-ICP-MS on the mineralized samples and Acid extracts determined to evaluate 'in vitro' bioavailability in all the samples.

The results were analyzed statistically using the software "STATGRAPHICS" Centurion. For all the foods, the dry matter and ash content (g/100 g MF) ranged from 11.07±2.58 to 42.39±0.06 and from 3.56±0.21 to 8, 88±0.02 respectively. The contents of Ca, Mg, K, P Zn, Cu, Mn, Fe (mg / 100gMS) ranged from 32.01±0.1 to 878.33±128; from 48.67±3.5 to 616.3±150.00; from 22±3 to 142±5; 197±34 to 1346.33±137; 0.49±0.06 to 12.08±0.83; 0.12±0.001 and 0.33±0.02; 0.05±0.001 and 0.8±0.001; and from 1.42±0.55 to 6.61±2.25 respectively. The phytates / zinc ratio ranged from 0.00 to 51.62, thus suspecting a high inhibition of phytates on zinc and other divalent cations.

All the foods samples had low mineral content and low bioavailability, which would explain the high prevalence of micronutrient deficiencies and the need to educate mothers and caregivers on dietary diversification in combination with micronutrient supplementation or fortification of infant foods with essential micronutrients where necessary.

Keywords: Foods; Micronutrient Intakes; Micronutrient Deficiencies; Complementary Foods; Household Dishes; Douala; Cameroon

Introduction

Health and vitality of humans depend on their diet, which must provide adequate amounts of energy and nutrients (proteins, fats, carbohydrates, vitamins and minerals) to promote effective physiological processes [1]. The World Health Organization (WHO) estimates that two out of five children are stunted in low-income countries, indicating chronic poor feeding, associated or not to ill health or poor primary health care leading to multiform malnutrition. The

vicious cycle between malnutrition and poverty sustains malnutrition and micronutrient deficiencies in Cameroon and in most of the developing countries. It has been reported that 4.5 billion of people worldwide were affected by deficiencies of iron, vitamin A and iodine; zinc is of increasing concern [2]. In Cameroon, the national prevalence of iron deficiency anemia in young children under 59 months has increased from 58% (2004) to 60 % (2014). Stunting also has risen from 24% (2004) to 32% (2014), and vitamin A, from 38% (2004) to 43% (2008) [3].

Associated to micronutrients deficiencies one consequence of inadequate intake of essential nutrients is protein-energy malnutrition, which in children and women of child-bearing age is a breeding ground for or aggravating the incidence of a series of diseases that significantly influence maternal and child mortality in developing countries [4]. Some work done in Cameroon showed the high prevalence rates of malnutrition and inappropriate feeding in all groups and of course in large cities such as Douala and Yaoundé [5]. The main objective of this work was to determine the content and bioavailability of minerals in some Cameroonian foods and the risks of micronutrient deficiencies for effective solutions.

Methodology

Food Survey

The dietary survey was conducted in the families. Through the questionnaire designed for this purpose, the methods of 24 hours recall, three days weighed food records and dietary history were used to determine dietary patterns and food habits, the type of food consumed and the usual frequency of consumption of food during a week carried out with 500 women in the city of Douala. Sixteen (16) family dishes some traditional complementary foods were selected from their high consumption frequencies and were analyzed. The meals were reproduced in triplicate according to the descriptions of the mothers with usual and local weighed ingredients. The samples complementary foods were blended and prepared in triplicate. Main ingredients were purchased in locals markets, prepared as a recipe, cooked, and then frozen at -20°C until analyses.

Chemical Analysis

The AOAC [6] method was used for the determination of moisture and ash. Content of mineral (Fe, Zn, Ca, Mg, Mo, Mn, Cu, Cr, Al, Ni, Se, Sn, Cd, Pb, Hg, As) and bioavailability of minerals were determined by the HR-ICP-MS (High Resolution Isotopic Coupe Plasma Mass Spectroscopy.

Statistical Analysis

Statistical analyses of data were done by the software «STATGRAPHICS centurion at the level of 5% level of significance.

Results

Food Survey

The surveys near woman of reproductive age and stakeholders allowed us to select the following family dishes listed in Table 1 with their frequency of consumption. It appeared that rice is the main staple food as it can be seen in three basic recipes (Rice with Tomato Sauce, Rice with Peanut Sauce, Rice Sauce).

Dishes with Scientific Names of Main Ingredients ()	Codes	Frequency	Percentage
Rice with tomato sauce (Oriza sativa, Lycopersitum sp)	RT	71	13.92
Plantain with tomato sauce (Musa sp., Lycopersitum sp)	PT	50	9.8
Rice with peanut sauce (Oriza sativa, Arachis sp)	RA	35	6.86
Banana stew (Musa sp.)	B	32	6.27
Legume meal with plantain (Vigna sp , Musa sp)	KB	31	6.08
Jallof rice (Oriza sativa)	RS	28	5.49
Cocoyam and leave vegetable	MD	19	3.73
Jallof spahetti	NS	19	3.73
Yam stew (Dioscorea sp)	IM	18	3.53
Fufu and «ERU» (*Ngetum africanum*)	«ERU»	18	3.53
Grounded cocoyam with groundnut sauce (*Arachis hypogea*)	MRA	16	3.14
Corn meal with okra Zea mays	CG	16	3.14

Pounded irish potatoes (*Solanum tuberonum*)	PP	15	3.14
Irish potato stew (*Solanum tuberonum*)	RP	14	2.94
Sweet potato with leaves (Amarenthus Hibridus, Hypomea batata)	LSP	13	2.75
Cassava tuber and leaves	KW	10	1.96

Table 1: List of mainly dishes consumed by the population.
Legend: RT: Rice with tomato sauce (Oriza sativa, Lycopersitum sp.), PT: Plantain with tomato sauce (Musa sp., Lycopersitum sp), KB: Legume meal with plantain (Vigna sp, Musa sp), RS: Jallof rice (Oriza sativa), RA: Rice with peanut sauce (Oriza sativa, Arachis sp), RS: Banana stew (Musa sp.), MD: Cocoyam and leave vegetable , NS: Jallof spaghetti, IM: Yam stew (Dioscorea sp), «ERU» Fufu and «ERU»: (Ngetum africanum); MRA: Grounded cocoyam with groundnut sauce (Arachis hypogea), CG: Corn meal with okra; LSP: Sweet potato with leaves (Amarenthushibridus, Hypomea batatas),PP: Pounded irish potatoes (Solanum tuberonum)RP Irish potato stew (Solanum tuberonum) LSP: Sweet potato with leaves (Amarenthus hibridus, Hypomea batatas), KW: Cassava tuber and leaves, DM: Dry matter.

Table 2 below revealed the frequency of daily food consumption. It shows that 44.20% and 44.8% of individuals eat respectively 2 and 3 times / day. In fact, the frequency of meal consumption and the distribution of food in the family are very important in nutritional aspect.

It was observed also that the two or three meals are from the same dish. Eating Two to three times can be acceptable in terms of number of meals, but indicate monotonous and leading to malnutrition

Frequency of meal consumption per day	Once	Two times	Three times	>three times	Total
Numbers	20	221	224	35	500
Pourcentage (%)	4	44,2	44,8	7	100

Table 2: Frequency of daily consumption of meals of the individuals surveyed.

Chemical Analysis of Family Dishes

The moisture, ashes, calcium, magnesium, potassium, phosphorus, iron, zinc, manganese and copper contents expressed per 100 g of dry matter for the sixteen analyzed Cameroonian cooked dishes are presented in Tables 3&4. For all foods, the dry matter content (g/100 g MF), ash, ranged from 11.07±2.58 to 42.39±0.06 and from 3.56±0.21 to 8, 88±0.02 respectively. The contents of Ca, Mg, K, P Zn, Cu, Mn, Fe obtained by spectrophotometry (mg/100gMS) ranged from 32.01±0.1 to 878.33±128; from 48.67±3.5 to 616.3±150.00; from 22±3 to 142±5; 197±34 to 1346.33±137; 0.49±0.06 to 12.08±0.83; 0.12±0.001 and 0.33±0.02; 0.05±0.001 and 0.8±0.001; and from 1.42±0.55 to 6.61±2.25 respectively.

Codes	Content					
	DM	Ash	Ca	Mg	P	K
	g / 100 g FM	g / 100 g DM	mg/100gMS			
B	16.99±2.4^{b}	7.78±1.03^{f}	290.67±42.44$^{bcd\ e}$	122±0.007^{hi}	288.67± 36.82^{def}	1150.33± 60.96^{ef}
CG	11.07±2.58^{a}	6.10±0.82^{de}	825.33±273.54^{hl}	125±0.007^{hi}	616.33± 159.00^{h}	547.00±40.73^{a}
ERO	25.06±0.85^{efg}	3.59±0.21^{a}	139.00±19.08^{abc}	59.66±0.005^{bc}	58.67±3.05^{a}	455.33±8.08^{bc}
IM	26.33±1.64^{gh}	7.30±0.7^{ef}	575.00±124.193^{fg}	74.33±0.000^{cde}	467.67±68.53^{g}	1146.33±258.79^{ef}
KB	24.37±1.05$^{d\ fg}$	4.44±0.0^{ab}	39.33± 6.35^{a}	117.33±0.010^{h}	199.33±34.42^{bcd}	1063.00±73.23^{ef}
KM	22.46±2.30^{cdef}	3.56±0.21^{d}	175.67± 11.55^{abcd}	95.33±0.009^{efg}	184.33±7.23^{bc}	859.00±70.77^{de}
LSP	20.67±0.29^{c}	7.56±0.23^{f}	878.33±128.77^{lj}	141.66±0.004^{i}	251.33±43.01^{cde}	793.00±65.37^{d}
MD	29.87±4.29^{h}	5.47±0.31^{bcd}	105.00±21.00^{ab}	89.33±0.010^{def}	250.67±24.70^{cde}	1092.67±87.36^{ef}
MRA	22.00±0.33^{cde}	5.70±0.11^{bcd}	284.00±105.50^{bcde}	114.66±0.044^{gh}	312.33±33.08 ^{def}	1160.00±80..52^{ef}
NS	19.89±1.78^{bc}	4.73±0.31^{abc}	335.67±60.88^{cde}	50.00±0.004^{b}	345.33±37.17^{ef}	370.33±20.00^{b}

PP	24.75±0.41^{defg}	4.69±0.22^{abc}	81.67±21.78^{ab}	82.00±0.00^{de}	266.67±7.09^{cde}	1013.67±122.4^{ef}
PT	22.10±1.59^{cde}	5.67±1.15^{bcd}	435.67±101.15^{efg}	107.66±0.003^{fgh}	339.33±61.33^{ef}	1034.00±123.31^{e}
RA	21.18±0.38^{cd}	5.91±1.28^{ef}	376.67±89.39^{def}	73.66±0.004^{cd}	392.00±31.6 ^{fg}	31.00±72.58^{ab}
RP	20.72±2.59^{c}	7.35±1.27^{ef}	61.00±391.97^{gh}	85.00±0.008^{de}	471.33±169.02 ^{g}	1216.33± 137.41^{f}
RS	25.91±2.41^{fg}	5.05±0.92^{bcd}	32.00±0.00^{a}	22.33±0.002^{a}	126.00±4.36^{ab}	197.33±16.80^{a}
RT	22.00±4.12^{cde}	7.82±1.10^{f}	172.67± 82.12^{abcd}	54.66±0.006^{bc}	270.00±57.42^{cde}	431.00±51.12^{bc}

Table 3: Average dry matter content, ash, calcium, magnesium, phosphorus and potassium.
Legend: RT: Rice with tomato sauce (Oriza sativa, Lycopersitum sp.), PT: Plantain with tomato sauce (Musa sp., Lycopersitum sp), KB: Legume meal with plantain (Vigna sp, Musa sp), RS: Jallof rice (Oriza sativa), RA: Rice with peanut sauce (Oriza sativa, Arachis sp), RS: Banana stew (Musa sp.)
MD: Cocoyam and leave vegetable , NS: Jallof spaghetti, IM: Yam stew (Dioscorea sp), «ERU» Fufu and «ERU»: (Ngetum africanum); MRA: Grounded cocoyam with groundnut sauce (Arachis hypogea), CG: Corn meal with okra; LSP: Sweet potato with leaves (Amarenthushibridus, Hypomea batatas), PP: Pounded irish potatoes (Solanum tuberonum)RP Irish potato stew (Solanum tuberonum) LSP: Sweet potato with leaves (Amarenthus hibridus, Hypomea batatas), KW: Cassava tuber and leaves, DM: Dry matter. The values are given as mean ± standard deviation (SD). The values in the same column with the same superscripts are not significantly different at p 0.05

	Mineral mg/ 100g DM			
Codes	**Zn**	**Cu**	**Mn**	**Fe**
B	12.08±0.83 ^{e}	0.28± 0.06 ^{fg}	2.61±9.08^{e}	4.62±0.88^{def}
CG	1.86±0.25^{b}	0.18±0.05 ^{bcd}	0.80±1.33^{abc}	4.91±0.24^{ef}
ERU	0.50±0.07^{a}	0.14± 0.03 ^{ad}	2.57±1.561^{e}	4.76±0.26^{def}
IM	1.16±0.09^{a}	0.24± 0.04 ^{ef}	0.67±1.24^{ab}	3.11±1.01^{bc}
KB	1.31±0.05^{a}	0.26± 0.03 ^{fg}	1.57±2.76^{d}	6.61±2.25^{g}
KM	0.49±0.06^{a}	0.21± 0.01 ^{cde}	1.16±0.90^{cd}	4.07±0.33^{cde}
LSP	1.23±0.02^{a}	0.33±0.02 ^{h}	099±1.37^{bc}	5.90±0.28^{fg}
MD	6.98±0.01^{cd}	0.29± 0.01 ^{gh}	0.97±3.38^{bc}	5.13± 0.71^{ef}
MRA	1.21±0.01^{a}	0.24± 0.02 ^{efg}	0.46±0.24^{a}	2.88± 0.17^{bc}
NS	1.27±0.01^{a}	0.20±0.02 ^{cde}	0.77±0.84^{abc}	2.74±0.30^{b}
PP	1.16±0.02^{a}	0.24± 0.02 ^{efg}	0.69±1.10^{ab}	3.54± 0.27^{bcd}
PT	0.68±0.003^{a}	0.20± 0.04 ^{cde}	0.58±2.21^{ab}	3.04± 0.03^{bc}
RA	1.61±0.01^{ab}	0.18± 0.02 ^{bcd}	0.89±025^{abc}	2.75± 0.16^{b}
RP	1.11±0.02 ^{a}	0.22±0.04^{de}	059±0.61^{ab}	5.34±0.15^{efg}
RS	1..11±0..01^{a}	0.12± 0.001^{aa}	0.83±0.63^{abc}	1.42±0.55^{a}
RT	8.46±0.15^{d}	0.17± 0.001^{abc}	0.85±0.65^{abc}	2.43±0.01^{b}

Table 4: Zn, Cu, Mn and Fe contents in family dishes.
Legend: RT: Rice with tomato sauce (Oriza sativa, Lycopersitum sp.), PT: Plantain with tomato sauce (Musa sp., Lycopersitum sp), KB: Legume meal with plantain (Vigna sp, Musa sp), RS: Jallof rice (Oriza sativa), RA: Rice with peanut sauce (Oriza sativa, Arachis sp), RS: Banana stew (Musa sp.).
MD: Cocoyam and leave vegetable , NS: Jallof spaghetti, IM: Yam stew (Dioscorea sp), «ERU» Fufu and «ERU»: (Ngetum africanum); MRA: Grounded cocoyam with groundnut sauce (Arachis hypogea), CG: Corn meal with okra; LSP: Sweet potato with leaves (Amarenthushibridus, Hypomea batatas),PP: Pounded irish potatoes (Solanum tuberonum)RP Irish potato stew (Solanum tuberonum) LSP: Sweet potato with leaves (Amarenthus hibridus, Hypomea batatas), KW :Cassava tuber and leaves, DM: Dry matter. The values are given as mean ± standard deviation (SD). The values in the same column with the same superscripts are not significantly different at p=0.05.

Phosphorus contents ranged from 58.67±3.5 mg/100 g DW in "eru", a cassava meal with vegetable (Gnetum africanum) to 616.33±150.0 mg/100 g DW in maze meal with Okra. Magnesium contents 22±3 mg/100 g DW to 142±50 mg/100 g in the sweet potato tuber meal eaten with amaranths. Potash ranging from 197.33±16.80 to 1346.33±258.79 mg/100 g were found highest in yam meal and lower in jallof rice. Zinc content ranged from 0.49±0.06 to 12.08±0.83 mg/100g in stew banana respectively. Copper levels were comprised between 0.12±0.001 mg/100 g DW (in jallof rice) and 0.33±0.02 mg/100 g DW (cocoyam with leave vegetable sauce). Manganese contents ranged from 0.05±0.002 mg/100 g DW in cocoyam paste meal with groundnut sauce to 0.80±0.001 mg/100 g DW in maize meal with okra. Iron contents ranged from 1.40±0.55 mg/100 g DW in jollof Rice to 6.61±2.25 mg/100 g DW in banana with legumes (*Vigna unguiculala*).

Discussion

At the end of the surveys on the mode of food consumption, it appears that the most consumed foods were unbalanced and constituted many more carbohydrates and lipids with a protein deficit. Essential mineral contents were very low in the Jallof Rice (RS) (ranging from 22.33±0.002 mg / 100gMS), compared with the RT, SS and RA (ranging from 54.66±0.006 mg / 100g) DM at 73.66±0.004 mg / 100g DM). They were much higher in PT, MRA, KB, B, CG and LPS where they ranged from 107.66±0.003 mg /100g DM for PT to 141.66±0.003mg / 100gMS. PP, B, KM, PT, MRA, MD, KB and LSP are the most magnesium-rich family dishes. The magnesium levels have been significantly improved by the addition of various sauces in family dishes, in particular, those with groundnut, vegetable and okra. The average levels of magnesium in the KM (95.33±0.009 mg / 100gMS) were comparable to that found by Mba'a [7] (95±5.77 mg / 100gMS) in corn chaff. The contents of PP and RP in magnesium (82.00mg and 85.00 mg / 100gMS) were close to those of the yam stew (74.33 mg) but remained lower than that of the MD (89.33±010 mg / 100g MS). It should be noted that only 35 to 40% of ingested magnesium is absorbed in the intestine [8]. Moreover, its absorption is inhibited by an excess of calcium and alcohol, a diet rich in fats, phosphates, dietary fiber and phytates [9]. Our values were much lower compared to those found by Nnorom IC, et al. [10] in mushrooms [11], who had worked on the fruit (cap) of P. tuber-regium had also found 3600±600 mg / g MS of magnesium. The fungus is therefore a good source of plant-based magnesium that can be used in infant nutrition.

Some dishes such as Jallof Rice, crushed apples, banana Koki had very low levels of calcium (32 mg, 82.67mg, 39.33 mg / 100gDM, respectively) and also a poor Ca / P ratio (0.25, 0.17 and 0.20 respectively) [12]. These calcium levels were higher compared to those reported by Utema [13] in Ethiopian dishes.

The average contents in dry matter ranged from 11.07± 2.58 g/100g FM (fresh matter) for the corn paste with the okro sauce (CG) to 29.86±4.29 g/100gFM in the yam with "Ndolé" (MD). The dry matter values of the household dishes were comparable with those reported by Kana Sop [14] in complementary and household food consumed of Cameroon. Those household dishes corroborated those found by Mba'a [7]. Bell, et al. [15] respectively of 22.3 and 22.72 g/100gMF in the "Sanga" made of corn and leafy vegetable. Ashes content (3.56 with 7.82g/100g ms) expressed in dry matter were higher than those found by Mba'a [7] in "Corn Chaff" (3.76±0.70g/100g MS) made of corn and beans, expressing the richness in minerals [10].

Potassium contents of the various dishes ranging between 197.33 and 1216.33 mg/100gMS, were higher compared to those found by Mba'a [7] which were of 687.5 gm 588, 75 mg and 376.66 mg/100gMS respectively in "Corn Chaff", the "Sanga" and the "Safon". The dishes containing tubers had high phosphorus contents (higher than 1000 Mg); this can be explained by the strong potassium content of basic food (plantain, banana, yam, manioc, potato) of these dishes. Thus a single food intake would be sufficient to meet the daily needs for them. The starchy foods are thus regarded as the best sources of potassium.

The various family dishes were rich in phosphorus, except for the "Eru" which presented a very low content of it, namely 58.67 mg/100gMS.These various phosphorus contents were comparable with those found by Mba'a [7], varying from 281.25 Mg;242.5 Mg;163.33 mg/100gMS respectively in "Corn Chaff", the "Sanga" and the "Safon" containing corn.

The average contents of Cu comprised between 0.12±0.00 for the RS to 0.33±0.02 mg/100gMS for vegetables jumped to potato (LSP) remain weak, being concentrated around 0.2 mg/100g DM. mg/100g DM. The content of copper found in (CG) (0.17± 0.04 mg/100g DM corroborated those found by Mba'a [7] in the corn chaff which (0.57± 0.08 mg/100gDM [15] Zinc contents lining up between 0.49± 0.06 mg/100g DM in the "Eru" and 23.57±4.46 mg/100g DM in corn paste with okro (CG) (1.85± 0.25) were lower than those found by Mba'a [7] which was of 3.74±1.79 mg/100g DM in in banana mixed for the family dishes). The average content Zn of the corn Paste to sauce "corn chaff" and of 2.48± 0.76 mg/100g DM the "Sanga" both also made up of corn. The Zn levels in food were high in banana stew (B) 40.39±11.12 mg/100g DM; in the yam with the 'Ndolè' sauce (20.57±0.47 mg/100g DM) and in rice with the tomato sauce (16.83±7.94 mg/100g DM).

Those zinc contents were higher compared to those reported in sauces made of leafy vegetables and the household dishes of Cameroun by Kana Sop [14] & Fokou [16] in (mg/100g DM) and in the house hold dishes from Nigeria by Adeyeye, et al. [17]. The fact that our food were poor in animal products livestock and rich in products of vegetable origin let us to believe that the minerals could have small bioavailability levels, because of the probable presence of the natural antinutritional substances present in food, responsible for the impairment of micronutrients intakes. The latter would inhibit the intestinal absorption of zinc by forming insoluble complexes as reported by Gibson & Ferguson [18] and Oberleas, et al. [19]. In all our food samples, zinc contents were lower than those founded in mushrooms, with median concentrations of varying from 19 to 26 mg/g in Nnorom, et al. [10]. The consumption of mushroom constituted a good source of Zn as indicated by Nnorom, et al. [10] as alternative to animal product, mushrooms could be used to improve zinc content in household and complementary foods.

In the family dishes, the contents of iron obtained in the ripe plantain with the tomato sauce 0.69±0.02 mg/100g DM were lower than those obtained by Teugwa [20] & Kombou [21] and in the boiled non ripe plantain (1.4 mg/100g DM). Iron intakes were high in the KB 15.97± 4.78 mg/100g DM; in DM: 15.15± 1.02 mg/100g DM; in the LSP: 12.19± 0.41; in the ERU: 11.98± 0.36 mg/100g DM and in the RP :10.89± 2.12 mg/100g DM. These high contents found their justifications in the presence of certain ingredients like dry vegetables, beans which were used the composition of these dishes rich in iron. By comparison to the iron daily requirements for a man and for a woman (respectively of 10 and 18 mg/day), the consumption of these recipes would help to meet the daily needs if the bioavailability is not too much affected by the antinutritionals substancies naturally present in this food according to Gibson, et al. [18]. The iron levels in other dishes remained weak (comprised between 3.76± 1.81 mg/100g DM for the RS and 9.12± 1.11 mg/100g DM for the KM).

The average contents of iron (comprised between 1.42± 0.55 mg/100g DM for the RS and 6.61±2.25 mg/100g DM for Koki with banana (KB)) remained weak. Those of the CG (4.90±0.25 mg/100g DM) were close to those found by Mba'a [7] in Corn chaff (6.08± 2.36 mg/100g DM) and Sanga 5.50±1.33 mg/100g DM which consisted of corn.

For all our food, iron levels were higher than that found in the "corn chaff" by Mba'a [7] has (0.35±0.61 mg/100g DM). The RS, RT, RA and SS had closer iron content each other. These contents varied from 0.77±0.84 mg/100g DM for SS to 0.89±0.25 mg/100g DM in RA. An attentive observation showed that the uses/additions of sauce improved the manganese content considerably. The contents in manganese of CG were close to those of rice (of 0.80±1.33 mg/100g DM). It is important to note that manganese is rather badly absorbed in the intestine. Moreover iron, calcium, magnesium and phosphorus in excess decrease the absorption of this mineral [22].

Conclusion

The aim of this study was to evaluate the content and bioavailability of minerals in some Cameroonian foods and to evaluate the risks of micronutrient deficiencies. Monotonous eating was observed in families (one dish for two or three meals. Analyzed dishes were mainly based on cereals, tubers, roots legumes, leaf vegetables. Minerals content and bioavailability was very low. From the comparison of mineral contents, it was possible to conclude that the leafy vegetables and legumes rich also in antinutritional substances contributed the largest part of mineral intake. However, the dishes were mostly based on cereals and legumes.. Poor consumption of animal products, fruits and vegetables was observed and may explain the poor mineral bioavailability. It is important to mention that the intakes of minerals here are just indicative. Low mineral content and low bioavailability foods may explain the high prevalence of micronutrient deficiencies and the need to educate mothers on dietary diversification in combination with micronutrient supplementation or fortification of infant foods with essential micronutrients.

Authors declare no conflict of Interest in this work.

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