

## Methods of Preparation and Nutritive Value of Some Dishes Consumed in the West Region of Cameroon

Fokou Elie<sup>1</sup>, Ponka Roger<sup>1</sup>, Tchinda Dimofo Patrice Honoris<sup>1</sup>, Domguia Kenmogne Hernan Brice<sup>1</sup>, Tchouba Lisy Blonde<sup>1</sup>, Achu Mercy Bih<sup>1</sup> and Fotso Martin<sup>2</sup>

<sup>1</sup>Department of Biochemistry, Faculty of Science, Laboratory of Food Sciences and Metabolism, University of Yaoundé I, Cameroon

<sup>2</sup>Nutrition Center, IMPM, P.O. Box 6163, Yaounde, Cameroon

**Abstract:** This study deals with the description of the methods of preparation and the nutritive value of some dishes consumed in the West region of Cameroon. These dishes are prepared from potatoes, yams, cassava, unripe bananas, maize, soybeans, beans, peanuts, egusi seeds and green leafy vegetables. The contents in moisture, ash, proteins, lipids, fibres and carbohydrates were determined by standard AOAC methods. The results obtained are expressed in g/100 g fw for moisture and g/100 g dw for ash, proteins, lipids, fibres and carbohydrates. The moisture content ranges from 43 (*Tag bankun*) to 96 (*Na'm pfeu*); ash, from 2.2 (*Poumseing djap mtom*) to 17.8 (*Na'm pfeu*); proteins, from 1.5 (*Site ngali*) to 33 (*Sog sojà*); lipids from, 1 (*Na'm pfeu*) to 70 (*Na'nou'ne*); fibres, from 1.8 (*Site sembùn*) to 21.5 (*Na'm pfeu*) and carbohydrates, from 4.8 (*Ndzap njheu'*) to 69.7 (*Poumseing djap mtom*). The results show that a higher consumption of *Sog sojà* meals is to be encouraged in order to fight against malnutrition.

**Key words:** Cameroonian dishes, methods of preparation, nutritive value

### INTRODUCTION

Malnutrition is still considered as a serious public health problem in the World (Latham, 1979; FAO, 2000; De Onis, 2000; Bobby *et al.*, 2002). About 30% of the world's population suffers from one of the multiple forms of malnutrition (OMS, 1998). According to FAO (2004) estimates, 842 million persons suffer from malnutrition in the world, with 798 million found in developing countries. Protein Calorie insufficiency affects 192 million children below 5 years old and micronutrient deficiency affects more than 2 billion people (FAO, 1992). These have led to many illnesses such as kwashiorkor, marasmus, goitre, obesity, diabetes, cancer and cardiovascular illnesses (Latham, 1997; OMS, 2003).

Cameroon, despite its food diversity is not exempted from nutritional problems. Lowé *et al.* (1993) showed that the prevalence of nutritional pathology is high in Cameroon, especially in the vulnerable groups of the population in whom Protein Calorie malnutrition and micronutrient deficiencies are high, leading to high morbidity and mortality in young children. An evaluation of the chemical composition of dishes is therefore very important in public health for the fight against malnutrition.

In Cameroon, some work has been done to determine the chemical composition of dishes (Domngang *et al.*, 1989; Teugwa *et al.*, 1992; Teugwa *et al.*, 1996; Ponka *et al.*, 2005a; Ponka *et al.*, 2005b; Ponka *et al.*, 2006;

Ponka *et al.*, 2007). However, considering the ethnic diversity in Cameroon, much work has to be done before obtaining the nutritive value of all dishes consumed in Cameroon.

The aim of this study was to describe the methods of preparation and determining the contents in moisture, ash, proteins, lipids, fibres and carbohydrates in some dishes consumed in the west region of Cameroon.

### MATERIALS AND METHODS

**Study area:** This study was carried out in three communities in the West region of Cameroon: *Baham*, *Medumba* and *Nda'a* communities. The study took place in October 2006 to February 2007.

**Experimental design:** 30 families were chosen at random to watch the methods of preparation, of dishes in each community. These methods were carefully followed up and the different cooking steps, duration and ingredients of each dish were taken. From the different dishes prepared, 22 were chosen for analyses, for their nutritive value is unknown. Each of these 22 dishes chosen was collected from 6 different families (22 dishes x 6 families) at random from the 30 chosen. Each of the 6 meals was mixed together to give 6 meals from 6 families per dish. This means that each dish was a mixture of meals. Each dish was therefore analyzed 3 times to give average values per dish (Table 2).

**Chemical analysis of dishes:** The moisture content was determined by drying the fresh dish in an oven at 105°C until constant weight, ash by incineration in a muffle furnace at 550°C for 48 h, proteins by nitrogen determination using the Kjeldahl method and conversion of nitrogen to proteins by the factor 6.25, total lipids by extraction in a Soxhlet apparatus for 6 h using petroleum ether as solvent, fibers by successive digestion of the defatted sample with 0.26 N sulphuric acid and 0.23 N potassium hydroxide solutions and carbohydrates by the difference method (AOAC, 1980). All analyses were performed in triplicate. The results are presented in the form, mean±standard deviation. Statistical analyses were done using SPSS package version 10.1 at a threshold of  $p < 0.05$ . The analysis of variance (ANOVA) was used to detect difference in the values (means).

## RESULTS

**Dishes collected and the main ingredients:** Table 1 shows the list of some dishes currently consumed by the people of the three communities. The vernacular names, the main ingredients and their scientific name are found in this table for easy recognition. For the *Nda'a* community, the dishes are: *Zou'tchou'nè*, *Nkendi Ndendieu'*, *Ndzap kanné*, *Ndzap njheu'*, *Ndzap chou' mondzou'*, *Na'nou'ne*, *Na' kan se'*, *Na'm pfeu* and *Na'sessouk*. The *Baham* community dishes are: *Tchoû khedé*, *Tchoû khedé mtom*, *Tchoû goudom*, *Poumseing kodok*, *Poumseing kodok mtom*, *Poumseing djap* and *Poumseing djap mtom*. The *Medumba* community dishes are: *Site ngali*, *Site sembùn*, *Site sembùn bo kenà*, *Sog sojà*, *Tag bankun* and *Tag kenà*.

### Preparation of dishes

**Site ngali:** Depending on the number of persons present in each household, a quantity of dry gari was collected. This gari comes from the technological transformation of cassava tubers, where the tuber are ground, slightly fermented, squeezed and fried to dry powder. The gari was soaked with cool water and allowed to increase in volume by leaving it to stand for about 20 min. Into a dry pot placed on the fire, palm oil was introduced. Chopped onions were added alongside with sliced or ground tomatoes. The soaked gari was then added and the mixture was seasoned with pepper, salt, maggi cube and crayfish or smoked fish. The meal was ready after 5 min.

**Tag kenà:** Dried maize grains were ground in a grinding mill. The flour obtained was sieved to eliminate the chaff. Some roasted peanuts were ground and added to the flour. The mixture was seasoned with pepper, salt, maggi cube and crayfish or smoked fish. A small quantity of water was added to the mixture to obtain a homogenous paste. The paste was tied in banana

leaves. Some support was put in a pot containing water and the bundles of paste placed over it to prevent direct contact with the bundles and water. The pot was then cooked for 2 h under vapor.

**Tag bankun:** Bean seeds (*Phaseolus vulgaris*) were selected, washed and put in a pot containing water, salt and cooked. Flour from dried ground maize was sieved to eliminate the chaff. A small quantity of water was added to the flour to obtain a homogenous paste. The paste was tied in banana leaves and put into the pot containing the beans. After about 2 h 30 min of cooking, the pot was removed from the heater and the cooked beans were washed with cool water. The paste from maize flour was pounded in a mortar. Palm oil, salt, pepper and the beans were added to obtain the dish.

**Sog sojà:** Soybean grains were selected and roasted until a brown colour was obtained. They were allowed to get cool and ground. A dry pot was placed on the cooker and red palm oil was put inside and heated to bleach (for red colour to disappear to light yellow). Onion was sliced and added into the oil. Once fried, ground or chopped fresh tomatoes were added. Water was also added from previously soaked smoked fish and allowed to boil. Ground soy bean, salt, pepper and water were added and cooked. The dish was then ready after 30 min.

**Site sembùn:** Cassava tubers were cleaned, cut into pieces and washed. A dry pot was placed on the cooker and red palm oil was heated inside to bleach. Onion was sliced and added into the oil. Once fried, ground or chopped fresh tomatoes were added and allowed to boil. The cassava pieces were added. Salt, pepper and water were also added and the dish was ready after 20 min.

**Site sembùn bo kenà:** This dish was prepared in the same way as *Site sembùn*. The only difference is that ground peanut paste was added to the cassava pieces when they were cooked.

**Ndzap njheu':** This is a thick sauce which was prepared from egusi seeds (*Cucumeropsis manni*) and vegetable leaves (*Solanum nigrum*). Cooking was done in three stages: The vegetable was sliced, washed and put into a pot and cooked for about 1 h. This vegetable was squeezed and kept a side. Egusi seeds were ground in a paste. In the second step, a dry pot was placed on the cooker and red palm oil was heated inside to bleach. Onion was sliced and added into the oil. Once fried, ground or chopped fresh tomatoes were added. Water from soaked smoked fish was also added. The egusi paste was added when the content started boiling. This mixture was allowed to boil on the cooker for about 45

Table 1: List of dishes consumed in *Nda'a*, *Medumba* and *Baham* Communities

Dishes	Main ingredients	Scientific names of main ingredients
<i>Na' kan se'</i>	palm oil + spices + okra	<i>Elaeis guinéensis</i>
<i>Na'm pfeu</i>	<i>Triumfetta pentandra</i> + spices	<i>Triumfetta pentandra</i>
<i>Na'nou'ne</i>	palm oil + spices	<i>Elaeis guinéensis</i>
<i>Na'sessouk</i>	<i>Monodora myristica</i>	<i>Monodora myristica</i>
<i>Ndzap chou' mondzou'</i>	<i>Brassica oléacea</i> + peanut + palm oil	<i>Brassica oléacea</i> , <i>Arachis hypogea</i>
<i>Ndzap kanné</i>	vegetable + palm oil	<i>Solanum nigrum</i>
<i>Ndzap njheu'</i>	vegetable + egusi seed + palm oil	<i>Solanum nigrum</i> , <i>Cucumeropsis manni</i>
<i>Nkendi ndendieu'</i>	unripe bananas + groundnut + palm oil	<i>Musa sapientum</i>
<i>Poumseing djap</i>	maize flour + palm oil + vegetable	<i>Zea mays</i> , <i>Solanum nigrum</i>
<i>Poumseing djap mtom</i>	maize flour + palm oil + vegetable + potato	<i>Zea mays</i> , <i>Solanum nigrum</i> , <i>Solanum tuberosum</i>
<i>Poumseing kodok</i>	maize flour + palm oil + beans	<i>Zea mays</i> , <i>Phaseolus vulgaris</i>
<i>Poumseing kodok mtom</i>	maize flour + palm oil + beans + potato	<i>Zea mays</i> , <i>Phaseolus vulgaris</i> , <i>Solanum tuberosum</i>
<i>Site ngali</i>	Gari + palm oil	<i>Manihot esculenta</i>
<i>Site sembùn</i>	cassava + palm oil	<i>Manihot esculenta</i> , <i>Elaeis guinéensis</i>
<i>Site sembùn bo kenà</i>	cassava + peanut + palm oil	<i>Manihot esculenta</i> , <i>Arachis hypogea</i>
<i>Sog sojà</i>	Soybean + palm oil	<i>Glycine max</i>
<i>Tag bankun</i>	maize flour + beans + palm oil	<i>Zea mays</i> , <i>Phaseolus vulgaris</i>
<i>Tag kenà</i>	maize flour + peanut	<i>Zea mays</i> , <i>Arachis hypogea</i>
<i>Tchoù goudom</i>	Sweet potatoes + palm oil + beans	<i>Ipomea batatas</i> , <i>Phaseolus vulgaris</i>
<i>Tchoù khedé</i>	unripe bananas + palm oil + beans	<i>Musa sapientum</i> , <i>Phaseolus vulgaris</i>
<i>Tchoù khedé mtom</i>	unripe bananas + palm oil + beans + potato	<i>Musa sapientum</i> , <i>Phaseolus vulgaris</i> , <i>Solanum tuberosum</i>
<i>Zou'tchou'nè</i>	yams + beans + palm oil	<i>Discorea spp</i>

Table 2: Nutritive value of dishes

Dishes	Moisture (g/100g fw)	Ash (g/100g dw)	Proteins (g/100g dw)	Lipids (g/100g dw)	Fibres (g/100g dw)	Carbohydrates (g/100g dw)
<i>Na' kan se'</i>	86.70±0.83	7.86±0.93	5.73±0.16	63.25±1.02	6.38±1.18	16.78±0.56
<i>Na'm pfeu</i>	95.92±0.26	17.85±0.61	5.67±0.59	1.13±0.11	21.53±0.07	53.82±2.5
<i>Na'nou'ne</i>	76.66±0.57	6.48±0.05	2.36±0.03	70.29±1.21	6.48±0.50	14.39±1.27
<i>Na'sessouk</i>	75.94±1.22	12.49±0.55	7.74±0.46	4.72±0.50	15.97±0.76	59.12±0.43
<i>Ndzap chou' mondzou'</i>	76.05±1.15	6.61±0.07	22.95±0.49	49.30±1.60	8.08±0.50	13.06±0.36
<i>Ndzap kanné</i>	76.51±0.79	3.81±0.14	10.22±0.24	64.83±0.5	15.97±0.94	5.17±0.04
<i>Ndzap njheu'</i>	80.13±1.36	7.66±0.35	24.70±0.07	47.74±0.97	15.11±1.20	4.79±1.50
<i>Nkendi ndendieu'</i>	78.58±0.57	5.23±0.35	11.09±0.14	16.46±0.36	5.70±0.60	61.52±1.85
<i>Poumseing djap</i>	60.07±1.16	3.62±0.74	9.27±1.35	19.48±4.20	3.94±0.62	63.70±2.98
<i>Poumseing djap mtom</i>	64.49±1.23	2.24±0.15	8.89±0.47	16.12±1.84	3.00±0.57	69.75±1.14
<i>Poumseing kodok</i>	57.96±1.33	3.15±0.34	12.52±1.16	17.27±3.83	4.96±0.35	62.10±2.91
<i>Poumseing kodok mtom</i>	63.41±0.62	3.52±0.20	12.29±1.04	14.24±0.42	5.24±0.47	64.71±1.68
<i>Site ngali</i>	59.46±4.62	2.48±0.25	1.53±0.12	25.78±2.78	2.54±0.25	67.66±2.66
<i>Site sembùn</i>	29.84±2.98	2.98±0.59	3.03±0.42	35.56±6.53	1.85±0.53	56.58±5.07
<i>Site sembùn bo kenà</i>	69.54±2.99	3.68±0.04	8.49±1.25	22.51±0.44	2.80±0.41	62.52±2.08
<i>Sog sojà</i>	74.45±2.57	9.26±0.04	32.91±3.09	33.83±4.86	5.13±0.48	18.87±3.21
<i>Tag bankun</i>	43.26±0.09	2.52±0.07	11.92±0.19	17.61±0.62	4.23±0.08	63.72±0.63
<i>Tag kenà</i>	55.24±1.99	3.71±0.21	17.85±3.39	24.40±0.64	3.18±0.39	50.86±2.96
<i>Tchoù goudom</i>	62.87±2.1	2.97±0.81	8.64±1.07	17.23±2.51	4.36±0.75	66.80±3.69
<i>Tchoù khedé</i>	59.33±3.49	3.12±0.58	9.26±0.18	30.55±0.56	4.57±1.01	52.50±1.48
<i>Tchoù khedé mtom</i>	64.88±0.62	3.47±0.47	10.84±1.50	20.15±2.28	4.27±1.53	61.27±1.27
<i>Zou'tchou'nè</i>	59.32±0.36	3.79±0.18	13.01±0.11	21.84±0.32	7.83±0.10	53.53±0.36

There is a significant difference between the nutrients in the dishes,  $p < 0.05$

min. In the third step, the squeezed vegetable was added and the mixture homogenized after adding salt and allowing on the cooker for about 15 min and maggi cube was added at the end. The sauce obtained was eaten with cassava tubers and plantains.

**Ndzap chou' mondzou:** Its preparation was similar to that of *Ndzap njheu*. Here peanut replaced egusi and sliced *Brassica deracea* replaced *Solanum nigrum*.

**Ndzap kanné:** Its preparation was similar to that of *Ndzap chou' mondzou'* except that peanut paste was not added.

**Nkendi ndendieu':** Its preparation was similar to that of *Ndzap chou' mondzou'* except that unripe or green bananas replaced the vegetable.

**Na'nou'ne:** It is a mixture of palm oil in water stabilized by aqueous extracts of ash, into which some spices are added. Water was warmed and palm oil was added into it and mixed energetically. The ash extract are added progressively until a homogeneous and stable mixture was obtained. A mixture of ground spices was added with warmed smoked fish followed by salt and maggi cube. The soup obtained was eaten with pounded cocoyams (*Colossia esculenta*).

**Na' kan se':** Its preparation was similar to that of *Na'nou'ne* except that at the end of cooking, ground or sliced okra fruits were added.

**Na' mpfeu':** It is a mixture of *Triumfetta pentandra* and spices. *Triumfetta pentandra* was soaked in boiling water. The water was allowed to get cool. Ground spices, salt and maggi cube were added and mixed for about 20 min to obtain the sauce.

**Na'sessouk:** It is a solution of spices. Water containing smoked fish was boiled for 5 min. A mixture of smoked ground spices, salt and maggi cube was added to the warm water. The homogeneous mixture had a black color which was characteristic of the spices.

**Zou'tchou'nè:** This preparation is a mixture of beans (*Phaseolus vulgaris*) and yams tubers (*Discorea sp.*). The beans were cooked with limestone for 2 h. The yams were cleaned and cooked for 30 min. The mixture was pounded in a mortar with palm oil. Salt and pepper were added at the end.

The preparation of *Tchoû khedé*, *Tchoû khedé mtom*, *Tchoû goudom*, *Poumseing kodok*, *Poumseing kodok mtom*, *Poumseing djap* and *Poumseing djap mtom* is done in three steps: boiling of beans or vegetables, cooking of maize flour and mixing.

Boiling and preparation of the beans or vegetables: The beans were selected from bad grains, washed and cooked. Vegetables were sliced, washed, boiled with water and squeezed to remove water.

Boiling of maize paste, unripe bananas and potatoes: Cleaned bananas and potatoes were boiled. The potatoes, bananas and maize flour were pounded with beans or vegetables while adding palm oil, salt and pepper depending on each individual's preference.

Although most of the ingredients used could be rich in nutrients, the different technological processes applied could reduce their nutritive value. It is therefore preferable to analyze the foods when they are ready for consumption.

**Nutritive value of dishes:** The results of analyses are shown on Table 2. This gives the moisture, ash, proteins, lipids, crude fibres and carbohydrates contents of the dishes. These values are expressed in g/100 g dw except the moisture content which is expressed in g/100g fw. The results presented here are average values for each sample collected from 6 different families and analyzed separately.

## DISCUSSION

The moisture content ranges from 43.26 (*Tag bankun*) to 95.92 (*Na'm pfeu*) g/100g fw, with significant differences between all the dishes ( $p < 0.05$ ). The high moisture content in these dishes was due to the water

added into the dishes during cooking. The moisture content of *Tchoû khedé mtom* (64.88 g/100g fw) is compared to the value of 65 g/100g fw found by Ponka *et al.* (2005a) in *Corn chaff* from Yaounde (Centre region of Cameroon).

The ash levels ranged from 2.24 (*Poumseing djap mtom*) to 17.85/100g dw (*Na'm pfeu*) with significant differences between all the dishes ( $p < 0.05$ ). The highest ash level was found in dishes prepared with spices: *Na'm pfeu* (17.85 g/100g dw) and *Na'sessouk* (12.49g/100g dw). Theoretically, these values are proportional to the mineral salt values of the dishes. However, the findings of Domngang and Tchuinmogne (1985) showed that *Na'mpfeu* and *Na'nou'ne* have high contents of iron, calcium, phosphorus and magnesium. Tchiégang and Mbougueng (2005) showed that these minerals come from the spices used to prepare these dishes. These dishes are therefore important sources of mineral salts for the organism.

The protein values ranged from 1.53 (*Site ngali*) to 32.91 g/100g dw (*Sog sojà*) with significant differences between all the dishes ( $p < 0.05$ ). *Sog sojà* had the highest protein value. A higher consumption of this dish is to be encouraged especially in children and pregnant women in order to fight against malnutrition. The proteins values of *Sog sojà* is similar to the values (32.27 and 33.91 g/100g dw) found by Ponka *et al.* (2005b) in dishes prepared from peanut and egusi seed consumed in Ngali II (Cameroon). The protein value of *Zou'tchou'nè* (13.01 g/100g dw) is closer to that of a reference dish which is estimated at 15 g/100g dw (Hecberg *et al.*, 1985). The addition of beans in this dish helps to increase the protein content. Bell *et al.* (1996) showed that beans have a protein content of 23.7 g/100g dw. The use of maize and beans in (*Poumseing kodok*, *Poumseing kodok mtom* and *Tag bankun*) is a good nutritional practice because maize is poor in lysine but rich in methionine while beans is poor in methionine and rich in lysine. A mixture of them gives a good amino acid balance (Watier, 1982).

The lipid levels of the dishes varied 1.13 (*Na'm pfeu*) to 70.29 g/100g dw (*Na'nou'ne*) with significant differences between all the dishes ( $p < 0.05$ ). The main source of lipid in the dishes analyzed is palm oil, which increases the lipid levels of the dishes as opposed to the other ingredients used in the preparation. The lipid levels of *Tchoû goudom* (17.23 g/100g dw), *Poumseing kodok* (17.27 g/1000g dw) and *Tag bankun* (17.61 g/100g dw) are comparable to 18 g/100g dw for a reference dish (Hecberg *et al.*, 1985). The red palm oil used in preparing the dishes provides  $\beta$ -carotene which is a precursor of vitamin A (Booth *et al.*, 1992). This vitamin among several roles favours growth, protects the body from cancer, contributes in the fight against infection and plays an important role in vision (Semba and Bloem, 2001).

The fibre contents ranged from 1.85 g/100g dw (*Site sembùn*) to 21.53 g/100g dw (*Na'm pfeu*) with significant differences between all the dishes ( $p < 0.05$ ). Fibres are important because they protect the body from intestinal cancer, diabetes and cardiovascular illnesses (Mottram, 1979). They also facilitate cell hydration (Afssa, 2002). The carbohydrate contents ranged from 4.79 (*Ndzap njheu'*) to 69.75 g/100g dw (*Poumseing djap mtom*) with significant differences between all the dishes ( $p < 0.05$ ). *Tchoù goudom* (66.80 g/100g dw) and *Site ngali* (67.66 g/100g dw) have carbohydrate levels similar to 67 g/100g dw for a reference dish (Hecberg *et al.*, 1985). Dishes with high carbohydrate levels are those that were prepared from potatoes, yams, unripe (green) bananas and cassava, which are generally to be rich in carbohydrate (King and Burgess, 1993).

**Conclusion and recommendations:** It can be deduced from this work that dishes currently consumed in the *Nda'a*, *Medumba* and *Baham* clans are prepared from potatoes, yams, cassava, unripe bananas, maize, soy bean, peanuts, egusi and green leafy vegetables. *Sog sojà* has the highest protein value (33 g/100g dw). *Na'nou'ne* has the highest lipid value (70.3 g/100g dw), (*Na'm pfeu*) is richer in fibre (21.5 g/100g dw) and *Poumseing djap mtom* is richer in carbohydrate (69.7 g/100g dw).

A combination of cereals and leguminous seeds is recommended for a better protein quality for this population. Dishes from soybean, vegetables and egusi seeds can serve as substitutes for expensive animal protein sources in these communities.

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