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Protein, Carbohydrate, Fat and Energy Content of "Ready-to-Eat Foods" in Cameroonian Sahel's Region

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Abstract: Eight sauces (*Adansonia digitata*, *Hibiscus sabdariffa*, *Balanites aegyptiaca*, *Solanum nigrum*, *Hibiscus esculentus*, *Ceratotheca sesamoïdes*, *Corchorus olithorus* and *Cumumis melo*) and 6 "couscous" (obtained from flour of the following cereals: *Oryza sativa*, *Panicum laetum*, *Zea mays*, *Pennicetum typoïdes*, *Sorghum bicolor* (red variety), *Sorghum bicolor* (yellow variety) widely consumed in the Cameroonian sahel's regions were analysed for their contents of proteins, fats, carbohydrates and minerals by appropriated methods. Four sauces: *Corchorus olithorus* (37.73%), *Balanites aegyptiaca* (34.54%), *Cumumis melo* (34.05%), *Hibiscus esculentus* (31.17%) and 5 couscous; *Sorghum bicolor* (yellow) (43.83%), *Pennicetum typoïdes* (37.70%), *Zea mays* (38.15%), *Panicum laetum* (35.85%), *Sorghum bicolor* (red) (30.22%), were found to be protein-rich with a content up to 30% DM basis. Fat content in all the foods was negligible depending on their preparation methods and ingredients. The nutrient database generated hitherto enables nutritionists to formulate different diets to meet the needs of the consumer while suggesting that some of these foods are nutritionally good.

Key words: Ready-to-eat food, macro-nutrients, energy, Cameroonian sahel's region

INTRODUCTION

The malnutrition and the under feeding in the Cameroon sahel's region as in many developing countries are to the first rank of public health problems (Latham, 1979). The malnutrition of the child of 6-24 months in sahel's regions is owed to the bad technique of severance and the insufficient numbers of meal (Briend, 1985). The ignorance of the nutritional value of the ready to eat foods and the quantity of food without quality are also the primordial causes of malnutrition in developing countries. To improve the nutritional state of Cameroonian sahel's population, data about the nutrient content of their ready to eat foods are necessary, because many of their foods are prepared or cooked.

The general objective of the present research was, to identify potential meals to be valorised in the respect of the nutritional equilibrium and the habits of the concerned population. Specific objective is the determination of the protein, carbohydrate and fat content of 8 sauces and 7 "couscous" complements widely consumed in the 6 departments of the Cameroon sahel's regions: Diamare, Mayo-Kani, Mayo-Tsanaga, Mayo-Sava, Mayo-Danaï, Logone and Chari.

MATERIALS AND METHODS

Apparatus: A spectronic 20D+ (Milton Roy and Co, New York, USA) was utilized for the measurement of absorbance. PH-meter consort p207 (Bioblock, Belgium) equipped with calomel glass electrode for the pH measurements. Eppendorf micropipette of 100-1000 μL (Hamburg, Germany) was used for appropriate volume of a sample solution and reagent additions. An A200s Sartorius analytic balance, accurate to 0,0001 g was used for weighing all the compounds required. Officially calibrated Pyrex glass ware was used throughout this study.

Biological materials: All vegetables samples: *Adandonia digitata*, *Hibiscus sabdariffa*, *Balanites aegyptiaca*, *Solanum nigrum*, *Hibiscus esculentus*, *Ceratotheca sesamoïdes*, *Corchorus olithorus* and *Cumumis melo* were used in the preparation of various sauces. Flours of different cereals: *Oryza sativa*, *Panicum laetum*, *Zea mays*, *Pennicetum typoïdes*, *Sorghum bicolor* (red variety), *Sorghum bicolor* (yellow variety) were used in the preparation of "couscous". Local and botanical names of all these samples are listed in Table 1. All samples were collected from various markets throughout the 6

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Table 1: Vegetable leaves and cereal flours used for sauce and couscous

Scientific names	French names	Local names	Family	Part used
Sauces				
Adansonia digitata	Baobab	Bokko (Fulfulde)	Bombacaceae	Leaves
Hibiscus sabdariffa	Oseille de guinée	Folere (Fulfulde)	Malvaceae	Leaves
Balanites aegyptiaca	Dattier du désert	Dbekame (Moundang)	Balanitaceae	Leaves
Solanum nigrum	Morelle noire	Gouozoum (Moundang)	Solanaceae	Leaves
Hibiscus esculentus	Gombo	Louri (Moundang)	Polygonaceae	Fruits
Ceratotheca sesamoïdes	Boungou	Gouboudo (Fulfulde)	Pedaliaceae	Leaves
Corchorus olithorus	Corète potagère	Lalo (Fulfulde)	Tiliaceae	Leaves
Cucumis melo	Melon	Gououkwere (Moundang)	Cucurbitaceae	Leaves
Cereals and tuber for "couscous"				
Oryza Sativa	Riz	Marori (Fulfulde)	Gramineae	Cereal
Zea mays + *Manihot esculenta*	Crêpe locale (maïs + manioc)	Kissar (Kotoko) + Mbaï (Fulfulde)	Gramineae + Euphorbiaceae	Cereal + Tuber
Penicum laetum	Fonio	Kagni (Moundang)	Gramineae	Cereal
Zea mays	Maïs	Karé (Moundang)	Gramineae	Cereal
Pennisetum typhoïdes	Mil blanc	Kajio (Moundang)	Gramineae	Cereal
Sorghum bicolor (red)	Sorgho blanc	Soukatari (Fulfulde)	Gramineae	Cereal
Sorghum bicolor (yellow)	Sorgho jaune	Safari (Fulfulde)	Gramineae	Cereal

departments of the Cameroon sahel's region. Fresh vegetable leaf samples were washed with running water to remove dust and other foreign material and thereafter spread in the sun to dry during three days prior to cut into small pieces or ground into a mortar until fine powder was obtained.

Ready to eat foods cooking methods: Sauces and complements were prepared according to the local practices. The duration of cooking was from 20-60 min according to the nature of the sauce or couscous. The cooking method of "kissar" was different: Mix 200 g of *Manihot esculenta* flour and 600 g of corn flour; dilute 40 g of this flour mixture to 400 mL of water, heat to the boiling point of water and cool it to ambient temperature. Add 600 mL of water, the remaining flour and 3 g of baker yeast. Homogenize this mixture and put it down in the sun during 2-3 h to get fermentation. Add 10 g of sugar and use frying pan to fry with 25 mL vegetable oil.

Four samples of each sauce or complement ("couscous") per month during three months have been collected and analysed. Samples obtained from the dinner have been preserved into a freezer at -10 to -5°C and brought to the laboratory the following day morning. Samples obtained on the lunch have been immediately brought to the laboratory.

All these samples were pre-treated before analysis according to the diagram of the Fig. 1.

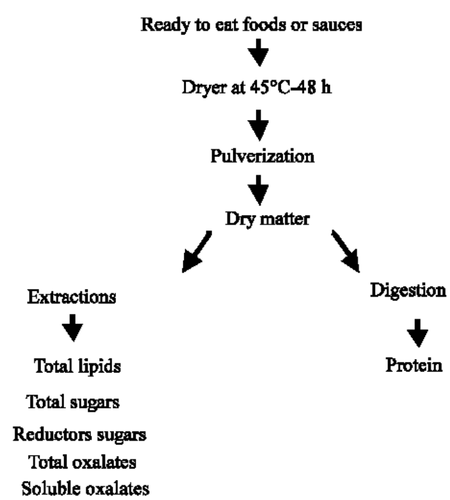

Fig. 1: Preliminary sample processing

Chemical analysis: Moisture content was determined by drying to a constant weight at 105°C in an oven. And ash content by dry-ashing in a furnace oven at 550°C. Nitrogen content was determined using the Kjeldahl method and the crude protein content calculated as 6.25×N. Crude lipid content was determined using a Soxhlet apparatus. Total sugar was determined by difference between 100 and the sum of the percentages of moisture, crude protein, lipid and ash as reported by Jeon (1995).

The energy value of sauces and couscous were estimated in kilojoules by multiplying the percentages of crude protein, crude lipid and carbohydrates by the factors 16.7, 37.7 and 16.7, respectively (Siddhuraju *et al.*, 1996). All determinations were performed in triplicate and data reported on a dry matter basis as mean values±standard deviation.

RESULTS AND DISCUSSION

The mean contents of protein, carbohydrate (total and reductors), fat and energy content in sauces and complements (couscous) analysed in the present work are given in Table 2 on a Dry Matter basis (DM).

Table 2: Contents of organic compounds (g100g-1 D.M.) and energy (Kj)

Scientific names	Dry matter (%)	Proteins	Lipids	Total sugar	Reductors sugars	Energy (Kj)
Sauces						
A. digitata	93.65±0.04	18.56±0.85	0.11±0.01	42.90±0.48	9.96±0.40	1030.53
H. sabdariffa	93.77±0.07	20.96±0.42	0.74±0.04	49.2±0.450	19.2±0.210	1199.57
B. aegyptiaca	93.51±0.28	34.54±1.07	0.50±0.04	4.50±0.240	12.11±0.45	1321.50
S. nigrum	92.23±0.23	22.40±1.10	0.01±0.00	34.08±0.55	8.54±0.300	943.59
H. esculenta	90.85±0.16	31.17±0.21	0.40±0.03	51.14±0.37	6.82±0.210	1389.66
C. sesamoïdes	93.39±0.04	15.11±0.21	0.09±0.00	75.45±0.23	8.20±0.250	1515.75
C. olithorus	93.12±0.24	37.73±1.07	0.47±0.00	49.00±0.11	9.00±0.130	1719.45
C. melo	97.34±0.41	34.05±1.44	0.81±0.02	59.56±0.50	9.56±0.350	1593.82
"Couscous"						
O. sativa	92.61±0.44	12.17±1.08	0.01±0.00	38.60±0.12	36.62±0.86	863.47
Z. mays + M. esculenta	93.43±0.43	13.90±1.50	0.23±0.00	80.74±0.25	16.75±0.28	1617.92
P. laetum	92.07±0.58	35.85±1.30	0.37±0.00	26.82±0.15	3.09±0.120	1060.53
Z. mays	92.10±0.31	38.15±1.09	0.22±0.01	65.45±0.91	3.68±0.130	1738.41
P. typhoïdes	91.78±0.21	37.67±0.21	0.37±0.02	33.50±0.17	15.25±0.52	1202.49
S. bicolor (red)	92.76±0.77	30.22±1.08	0.27±0.01	59.37±0.24	7.41±0.490	1506.33
S. bicolor (yellow)	91.52±0.48	43.83±0.87	0.35±0.04	36.82±0.31	24.27±0.37	1360.05

Dry matter contents: The sauces and couscous had dry matter levels exceeding 90%. *Cucumis melo* had the highest level (97.34±0.14 g) and *Hibiscus esculentus* had the lower level (90.85±0.16 g). The dry matter content of the other sauces and couscous ranged from 91-93%. The contents of dry matters of some ready to eat foods of Nigeria and Niger sahel's regions reported by Johnson *et al.* (2005) and Umoren *et al.* (2005) were within this limit.

Protein content: Four of the sauces *Corchorus olithorus* (37.73%), *Cumumis melo* (34.05%), *Balanites aegyptiaca* (34.54%), *Hibiscus esculentus* (31.17%) and five of the "couscous" *Sorghum bicolor* (red) (30.22%), *Panicum laetum* (35.85%), *Pennicetum typoïdes* (37.70%), *Zea mays* (38.15%), *Sorghum bicolor* (yellow) (43.83%), contained relatively large amounts of protein that ranged from 30-43% dry matter basis. Instead of the fact that in some cases, the protein content is relatively high, the quality of these protein in term of protein efficiency ratio should be determined with appropriated method mainly the Protein Digestibility Corrected Amino-Acid Score (PDCAAS) recommended by World Health Organization (WHO) and the United States Food and Drug Administration (FDA). This method give best value because it is based on the amino acid requirement for 2-5 years old children instead of using rats which have a methionine requirement about 50% higher than that of humans (Sarwar *et al.*, 1989).

Fat content: The lowest content (g % DM) of the fat depends of the traditional culinary practices of these meals. Most sauces and "couscous" are very low in fat, generally containing <1% as indicated in Table 2. The overall fat content of both sauce and "couscous" is very low and could not satisfy the dietary requirement of some of the 8 essential fatty acid such as omega 6 (α-linolenic acid) and ω-3 (linoleic acid). The deficiency of these essential fatty acids is responsible of growth retardation, neurological and dermatologic abnormalities as reported by Holman *et al.* (1982).

Carbohydrate content: The total carbohydrate content of sauces and "couscous" ranged from 34-60 and 26-80%, respectively. The content of reducing sugar in sauces and "couscous" ranged from 8-19 and 3-24%, respectively. Reducing sugars are mostly oligosaccharides. These oligosaccharides such as raffinose and stachyose are responsible for gas production as reported by Rackis *et al.* (1970). Because there is no α-galactosidase in the human intestinal mucosa to cleave the α: 1-6 galactose linkage present in galactoside containing oligosaccharides. These oligosaccharides pass into the large intestine where bacteria metabolize them and form large amounts of carbon dioxide, hydrogen and sometimes methane.

However, the beneficial effects associated with oligosaccharide consumption are their growth promoting effect on bifidobacteria and thus they have been hypothesized to promote the health of the colon, increase longevity and decrease colon cancer risk (Mitsuoka, 1982; Benno, 1989; Koo and Rao, 1991). Because of these oligosaccharide effects, Japanese researchers suggest the use of oligosaccharides as a substitute for common table sugar (Hata *et al.*, 1991). This idea indicates the necessity of analysing and regulating the content of oligosaccharides in ready to eat foods. The high-energy value observed could due to low water content of the samples.

As can be seen from Table 2, at a daily consumption rate of 100 g day^{-1}, only the values of calcium and phosphor in ready to eat foods fall within the United States recommended dietary reference intakes.

Energy content: Food energy comes from the oxidative degradation of nutrients absorbed by the body. Energy can be stored in the form of complex carbohydrates or lipids. The energy value of the studied soup (stews) varied from 93.45 Kj/ 100 g DM for *Solanum nigrum* to 1719.45 Kj/100 g DM for *Corchorus olithorus*. On the other hand, the energy given by "couscous" made with rice and corn flours varied from 843.47-1738.41 Kj/100 g DM, respectively. The high energy value of corn flour-based "couscous" might be attributed to the fact that flour was produced from the kernel-containing whole grain which is an important source of lipids. The traditional pancakes "kisser" made by hulled corn flour and dried fermented cassava roots also presented a non negligible amount of energy (1617.92 Kj/100 g DM). It is also important to notice that the red sorghum provided more energy than the yellow cultivar (1506.33 and 1360.05 Kj/100 g DM, respectively). These different energy values show that the major staple foods in northern Cameroon supply adequate amount of energy required for the maintenance of the vital body functions (temperature within permissible range, hearth beat, respiration rates, etc.) physical activity (muscular contraction) and for the normal growth and repair of tissues as well.

CONCLUSION

Considering the fact that and adult needs around 800 g of foods (soup and "couscous"), the beneficial combination of foods could be proposed to the population of northern Cameroon widely made up of farmers whose tedious daily activities require a significant energy input. Results show therefore, that the major staple foods consumed in sahel's areas of Cameroon can make up the daily energy requirement of the populations irrespective of the foods combinations. From the present study, promoting the cultivation of the studied cereals in other parts of the country where malnutrition due to energy protein deficiency constitutes and remains a serious public health problem appears to be a good alternative.

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