



The habitual diet in rural and urban Cameroon

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Objective: To evaluate the habitual diet of a rural and urban population in Cameroon, Central Africa.

Setting: An urban area—Cité Verte Housing District, Yaoundé (1058 subjects); and a rural area—three villages in Evodoula, Cameroon (746 subjects).

Subjects: Cameroonian men and women of African origin (1058 urban, and 746 rural), aged 24–74 y.

Methods: The habitual diet was estimated with an interviewer-administered food frequency questionnaire.

Main outcome measures: Macro- and micronutrient intake.

Results: The intake of energy, fat and alcohol was higher in rural men and women than in urban subjects. In rural women, the intake of carbohydrates and protein was also higher. The intakes of fibre, iron, carotene, zinc, potassium, and of the vitamins C, D and E were all higher in rural men and women than in their urban counterparts. The intake of retinol was lower in rural subjects than in urban subjects. Eight of the 10 foods eaten in the highest amount and contributing most to energy intake differed between the rural and urban population.

Conclusion: The habitual diet in rural Cameroon contains more fat and alcohol than the diet in urban Cameroon. The high physical activity in the rural area may explain the lower levels of the cardiovascular risk factors in this area compared to those of the urban dwellers.

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Introduction

From many epidemiological studies it is clear that the habitual diet is an important contributor to the burden of chronic diseases such as cardiovascular disease, diabetes and cancer, in Western society. Although in developing countries, diseases related to under-nourishment are still a major problem, morbidity and mortality from cardiovascular diseases and diabetes are increasing (Poulter *et al*, 1984; King *et al*, 1991). In most urban populations there is adoption of a Western lifestyle, and Western foods, which have been criticized for their unhealthy effects, are being incorporated in the habitual diet of the African population (Dressler, 1984). In view of this trend, attention to primary prevention of these chronic diseases is clearly needed, along with information concerning the prevalence of the determinants of these diseases (Watkins, 1984). The information on the actual habitual food intake in African

countries is scarce. In Cameroon, there may be a large difference between the rural and urban diet and this may relate to the development of cardiovascular diseases and hypertension. However, detailed individual food intakes have not been previously studied. Earlier we reported the development of a food frequency questionnaire for an international comparison of the habitual diet among four populations of West African origin (Sharma *et al*, 1996). Dietary information collected with this questionnaire is now available for a large number of people in rural and urban Cameroon. This paper described the macro- and micronutrient intake of these subjects and the differences in habitual diet between the rural and urban populations.

Methods

Cameroonian men and women of African origin, aged 24–74 y were studied in an urban area, Cité Verte Housing District, Yaoundé and in a rural area, three villages in Evodoula, Cameroon. The study was approved by the Ministry of Health’s national Ethical Committee. The Cité Verte Housing District is located in the City of Yaoundé, the capital of the Republic of Cameroon. A preliminary house census of the inhabitants of the housing estate, aged 24–74 y, was conducted before the study. In all, 1493 households with an eligible population of 1160, of whom 533 were men and 627 women, were all invited to participate in the study; 1058 (91%) consented. The main reason for non-participation was, in order of priority, not at home after several visits, lack of free time due to work

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Contributors: LIM carried out the data checking and analyses and was responsible for writing the manuscript. JCM was involved in the fund raising, design and organization of the study and in assisting with the preparation of the manuscript. JC was involved in the field work, calculation of the nutrient intake and the writing of the manuscript. BB assisted with the fund raising, the data-analyses and writing of the manuscript. SS developed the food frequency questionnaire and was involved with the field work. SC carried out a large part of the field work and JKC was responsible for the fund raising, design and protocol development of the study.

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schedule, fear of the quantity of blood drawn for the study and fear of blood being used to test for AIDS. The adult population of this housing estate are mostly middle grade civil servants and, for those in the private sector, middle income earners.

Three of the seven villages of the rural area of Evodoula, Minwoho, Nkolassa and Nloundou, situated about 60 km from Yaoundé, were selected as the rural sites. As neither a census nor a map of the villages was available, a household census and a descriptive map of each village were established by trained villagers at the onset of the study. The eligible population of the three villages was 786 with 362 inhabitants in Minwoho, 207 in Nkolassa and 217 in Nloundou. 746 (95%) consented to participate in the study. The principal reason for non-participation was lack of free time due to farm work. The occupation of the people of Evodoula is mainly farming and hunting.

All field workers and laboratory technicians were trained to administer the lifestyle and nutritional questionnaire, to take anthropometric measurements and to draw blood. Those who successfully completed the 2 week training program were certified and employed and were re-certified every fortnight. Blood was drawn after an overnight fast of at least 12 h and total cholesterol was measured. Height and weight were measured with subjects in light clothing and body mass index (BMI) was calculated (kg/m^2). Blood pressure was measured in sitting position with a standard mercury sphygmomanometer and the average of the second and third recordings was used. Physical activity was measured using a questionnaire which looked at the type of activity, duration per session and the number of sessions per week, month and year.

A food frequency questionnaire was developed for this study from 2 day food diaries and 24 h recalls which were collected on 156 subjects, men and women, from both the rural and the urban areas (Sharma *et al*, 1996). The questionnaire was designed to be interviewer administered. Interviewers used local cooking utensils, specially prepared wooden food models and cutlery to help the subjects to describe their own portion size. The questionnaire included 76 different foods, which was a complete cover of food items available in the area. Any variation in consumption of foods between the wet and dry seasons was ascertained, by adjustment of portion size based on the number of months the foods were in season (the study was carried out towards the end of the dry season and in the wet season). Nutrient content was calculated with Microdiet (Fletcher, 1994), but this database did not cover the nutrient composition of all the typical Cameroonian cooked foods eaten in this population. Details of ingredients used were collected by weighing them and the weight of the final cooked dish. This was carried out by

trained fieldworkers in as many households as possible to obtain a standard recipe. Where recipes were different for the rural and the urban sites, separate recipes were collected for each site. Cameroon food tables were used for calculating the nutrient composition of the raw ingredients (Ngo Som & Abondo, 1989). Where there was no nutrient composition data available, values were taken from the UK food tables (Holland *et al*, 1991). Although this enabled us to calculate the macronutrient content of all the foods, some data for micronutrients were missing. Of the 76 foods in the questionnaire, 8% of them did not have data on the content of starch, 4% not on iron, 18% not on retinol, 9% not on carotene, 13% not on zinc, 24% not on vitamin D, 5% not on vitamin C, 66% not on vitamin E and 17% not on dietary fibre. The data on micronutrients presented here may thus be an underestimation of the true values.

Mean intakes of total energy, macro- and micronutrients and percentage of energy delivered by the macronutrients (E%) were calculated by site for men and women separately. Total energy and nutrient intakes of the two sites were compared, adjusting for age and physical activity, using analyses of covariance.

Results

Rural men and women were, on average, 8 y older than those in the city, while BMI, total cholesterol, fasting insulin and diastolic blood pressure were higher among urban subjects (Table 1). Furthermore, the rural subjects were physically more active than those in the urban area.

Energy intake was higher in rural men and women than in urban subjects (Table 2). This was mainly due to a higher intake of fat and alcohol in the rural area. In rural women, the intake of carbohydrates and protein was also higher. In rural men, intakes of carbohydrates and protein were lower than in urban men, but this difference did not reach statistical significance. The percentage of abstainers from alcohol was higher in the urban than in the rural area for both men and women ($P < 0.05$ for difference between sites). The percentages of energy delivered by the macronutrients also differed between the two sites, although the differences were smaller than for the absolute intakes (Table 1). Compared to the urban subjects, the energy percentage of total fat and alcohol was higher in the rural subjects, compensated for by a lower percentage intake of carbohydrates and protein.

The intakes of fibre, iron, carotene, zinc, potassium, and of the vitamins C, D and E were all higher in rural men and women than in their urban counterparts (Table 3). The intake of retinol was lower in rural subjects than in urban subjects.

Table 1 General characteristics of the study population by site and gender (mean (s.d.)); the Cameroon Survey

	Rural women	Urban women	Rural men	Urban men
<i>n</i>	436	584	307	458
Age (y)	46.0 (13)	38.0 (9)*	46.0 (14)	38.0 (9)*
Body mass index (kg/m^2)	22.3 (3.3)	27.0 (5.0)*	21.9 (2.7)	25.0 (3.7)*
Total cholesterol (mmol/l)	2.67 (0.68)	3.60 (0.82)*	2.55 (0.64)	3.42 (0.89)*
Serum triglycerides (mmol/l)	0.53 (0.20)	0.50 (0.27)*	0.53 (0.26)	0.54 (0.34)
Fasting glucose (mmol/l)	4.17 (1.66)	4.23 (1.35)	4.14 (1.55)	4.24 (1.35)
Fasting insulin ($\mu\text{U}/\text{ml}$)	4.30 (7.68)	7.16 (9.08)*	3.56 (6.20)	6.75 (10.07)*
Systolic blood pressure (mmHg)	115.0 (20)	114.0 (16)	121.0 (19)	122.0 (19)
Diastolic blood pressure (mmHg)	71.0 (12)	74.0 (11)*	74.0 (12)	81.0 (14)*
Subjects with very strenuous physical activity	5.5	0*	15.0	2*

* $P < 0.05$ for difference between rural and urban subjects.

Table 2 Daily energy and macronutrient intake of men and women by region (mean (95% confidence interval)); the Cameroon Survey

	Rural women	Urban women	Rural men	Urban men
<i>n</i>	436	584	307	458
Energy (MJ)	16.3 (15.7, 16.9)	14.1 (13.7, 14.5)*	18.0 (17.1, 18.9)	16.3 (15.3, 17.3)*
Carbohydrates: g	437.9 (421.8, 454.0)	414.7 (400.0, 429.4)*	451.9 (429.1, 474.7)	468.2 (449.8, 486.6)
E%	46.6 (45.4, 47.8)	48.7 (48.1, 49.3)*	45.3 (43.9, 46.7)	48.1 (47.4, 48.8)*
Protein: g	88.8 (85.1, 92.5)	86.0 (83.5, 88.5)*	94.5 (89.5, 99.5)	100.1 (96.8, 103.4)
E%	9.0 (8.8, 9.2)	10.3 (10.2, 10.4)*	8.9 (8.7, 9.1)	10.4 (10.3, 10.5)*
Total fat: g	197.7 (187.8, 207.6)	156.2 (151.4, 161.0)*	215.8 (203.3, 228.3)	180.1 (173.9, 186.3)*
E%	43.8 (42.7, 44.9)	42.1 (41.6, 42.6)*	43.8 (42.6, 45.0)	42.0 (41.4, 42.6)*
saturated fat (g)	63.9 (60.4, 67.4)	53.4 (51.8, 55.0)*	67.3 (63.0, 71.6)	61.9 (59.7, 64.1)*
monounsaturated fat (g)	77.5 (73.2, 81.8)	59.9 (58.1, 61.7)*	82.2 (77.0, 87.4)	69.9 (67.5, 72.3)*
polyunsaturated fat (g)	27.7 (26.3, 28.9)	21.7 (21.0, 22.4)*	28.4 (26.7, 30.1)	25.0 (24.1, 25.9)*
Alcohol: g ^a	16.9 (15.0, 18.8)	6.0 (4.9, 7.1)*	41.6 (35.8, 47.4)	16.4 (14.1, 18.7)*
E%	2.6 (2.3, 2.9)	0.8 (0.7, 0.9)*	4.0 (3.5, 4.5)	1.5 (1.2, 1.8)*

* $P < 0.05$: difference between rural and urban subjects adjusted for age and physical activity. ^aNon-drinkers excluded (rural women: 79 (18%), urban women: 193 (33%), rural men: 27 (9%), urban men: 85 (19%).

Table 3 Macronutrient intake of men and women by region (mean (95% confidence interval)); the Cameroon Survey

	Rural women	Urban women	Rural men	Urban men
<i>n</i>	436	584	307	458
Fibre (g)	43 (41, 45)	35 (34, 36)*	43 (40, 46)	39 (37, 40)*
Iron (mg)	21 (20, 22)	18 (17, 19)*	21 (20, 22)	20 (19, 20)*
Retinol (μg) ²	12 (0.11, 475)	82 (1.4, 671)*	18 (0.05, 735)	85 (0.8, 544)*
β -carotene (mg)	14 (13, 15)	9 (8.6, 9.4)*	14 (13, 15)	9 (8, 10)*
Zinc (mg)	10 (9.6, 10.4)	9 (8.8, 9.2)*	11 (10.4, 11.6)	10 (9.6, 10.4)*
Potassium (g)	6 (5.7, 6.3)	4 (3.8, 4.2)*	7 (6.7, 7.3)	5 (4.8, 5.2)*
Vitamin C (mg)	365 (346, 384)	210 (200, 220)*	366 (336, 396)	211 (200, 222)*
Vitamin D (μg) ^a	30 (0.01, 148)	15 (0.04, 176)*	30 (0.03, 152)	15 (0, 110)*
Vitamin E (mg)	8 (7.6, 8.4)	4 (3.8, 4.2)*	8 (7.6, 8.4)	4 (3.8, 4.2)*

* $P < 0.05$: difference between rural and urban, adjusted for age and physical activity. ^aMedian (range) is given, since distribution was not normal.

Eight of the 10 foods with the highest frequency or the highest energy delivery differed between the rural and urban area (Tables 4 and 5). This was the case for men as well as for women. The two foods eaten with a similar frequency and similar energy delivery in both sites were plums, mango (highest frequency) and stew and bobolo/miondo (highest energy delivery) in both men and women. The difference between the two sites was less for the foods consumed in the highest amounts, especially for women, where only three foods were different. Although plums and mango were eaten in high amounts and high frequencies in both the rural and urban area, they did not contribute a lot to the energy intake. In rural subjects the top 10 foods delivered 52% of total energy, while in urban subjects they delivered 47%. Cassava, delivered on its own more than 10% of total energy intake in rural subjects. Fresh fish soup, the food which contributed most to energy in urban women,

and mean sauce, the highest energy contributor in urban men, delivered 6% of total energy intake in those subjects. In rural men the consumption of palm wine had the second highest contribution to energy intake.

Discussion

In Cameroon, the rural population has a higher intake of energy, fat and alcohol compared to the urban population. In spite of this, the levels of classic cardiovascular risk factors like BMI, blood pressure and total cholesterol were lower in the rural population. These contradicting results can probably be explained by the much higher physical activity in the rural area. Energy requirements are high for these very physically active people and bulk will be a problem if energy has to come from cassava only.

Table 4 List of 10 most consumed foods for men (in descending order); the Cameroon Survey

Highest amount		Highest frequency		Highest energy delivery	
Rural	Urban	Rural	Urban	Rural	Urban
Plums	Irish or sweet potato	Cassava	Bread	Cassava	Meat sauce
Mango	Beignets	Plums	Mango	Palm wine	Fresh fish soup
Cocoyam	Cocoyam	Mango	Plums	Cocoyam	Stew
Lemon fruits	Boiled plantain	Palm wine	Meat sauce	Cassava leaves ^a	Bobolo/miondo ^b
Cassava	Fried plantain	Groundnut soup	Lemon fruits	Stew	Beans
Maize and vegetables	Cassava	Cocoyam	Stew	Avocado	Fried plantain
Boiled plantain	Plums	Dried fish soup	Fresh fish soup	Groundnut soup	Bread
Dried fish soup	Rice	Corn grilled	Eggs	Eru ^c	Rice
Groundnut soup	Groundnut soup	Cassava leaves	Rice	Bobolo/miondo	Foo foo corn
Fresh fish soup	Yam	Avocado	Ripe banana	Dried fish soup	Beignets

^aSauce from cassava leaves and palm oil. ^bMain ingredient: cassava paste. ^cMain ingredient: green vegetable leaves with meat or fish.

Table 5 List of 10 most consumed foods for women (in descending order); the Cameroon Survey

<i>Highest amount</i>		<i>Highest frequency</i>		<i>Highest energy delivery</i>	
<i>Rural</i>	<i>Urban</i>	<i>Rural</i>	<i>Urban</i>	<i>Rural</i>	<i>Urban</i>
Plums	Irish or sweet potato	Cassava	Bread	Cassava	Fresh fish soup
Mango	Beignets	Plums	Mango	Cocoyam	Stew
Lemon fruits	Cocoyam	Mango	Lemon fruits	Cassava leaves ^a	Bobolo/miondo ^b
Cocoyam	Mango	Groundnut soup	Plums	Stew	Fried plantain
Maize and vegetables	Boiled plantain	Cocoyam	Fresh fish soup	Groundnut soup	Meat sauce
Cassava	Cassava	Dried fish soup	Boiled plantain	Eru ^c	Beignets
Boiled plantain	Fried plantain	Cassava leaves	Meat sauce	Bobolo/miondo	Beans
Beignets	Plums	Corn grilled	Rice	Dried fish soup	Rice
Fried plantain	Yam	Maize and vegetables	Eggs	Okro	Foo foo corn
Dried fish soup	Groundnut soup	Avocado	Fried plantain	Ndolé/keleng keleng	Foo foo cassava

^aSauce from cassava leaves and palm oil. ^bMain ingredient: cassava paste. ^cMain ingredient: green vegetable leaves with meat or fish.

Although we adjusted the analyses for physical activity, the difference in the level of physical activity between the rural and urban population was probably too large to be completely adjusted for by covariance analyses. There were, for example, no urban women who participated in very strenuous physical activity, while more than 5% of the rural women were engaged in this kind of activity. The reason for the high fat intake may be due to the high energy requirement of the rural group and be caused by the frequent use of palm oil. Many of the traditional sauces and dishes contain large amounts of palm oil, the basic fat used in the Cameroonian kitchen. On the other hand we may have overestimated the amount of palm oil since calculation of nutrient composition from the recipes is extremely difficult. Often whole palm nuts are used in preparation, the fibrous pulp is left in the dish for a while during boiling, but then skimmed off and partly discarded and the quantity of oil that has been extracted is unknown. The data presented here are our best estimates taking into account the fact that a wild variety of palm nut is used which may be different from commercially available palm oil.

The study was carried out towards the end of the dry season and in the wet season. Dietary habits differ between seasons, but we have taken that into account by using a correction factor for those foods who were only available in a certain season. Mangos, for example, are eaten in huge amounts when in season, since they are cheap and available to everyone. Even when the intake was corrected for the months they are in season, they were still eaten with a high frequency and a high amount, but since energy content is low, they did not contribute much to energy delivery.

The intake of most of the micronutrients, which were measured, was also higher in the rural population than in the urban one. Although recommendations coming from western society may not be applicable to Cameroon for a 100%, it is interesting to note that in the urban subjects, the intake of vitamin E and fibre was somewhat lower than the recommended daily intake (Passmore *et al*, 1974; Committee on Dietary Allowances, Food and Nutrition Board, 1980). The intake of iron and vitamins C and D, however, did match the recommendations in both populations (Passmore *et al*, 1974; Committee on Dietary Allowances, Food and Nutrition Board, 1980). The low intake of vitamin E corresponds with the low concentrations of vitamin E found in men and women in North Cameroon (Gouado *et al*, 1998). The study by Gouado *et al* showed that 6% had very low values of vitamin E. Thirty-two percent of the subjects had very low values of vitamin A. Since in North Cameroon the staple food consists mainly of cereals, the foods

rich in vitamin A or β -carotene are scarce, vitamin E and A deficiency constitute one of the major public health problems in this area. The population of our study, however, has ready access to palm oil, which is a daily source of β -carotene. We had no data on vitamin A intake, but a low intake of vitamin A will probably in part be compensated for by the extremely high intake of β -carotene, thus avoiding vitamin A deficiency-related diseases. It has to be borne in mind though that the micronutrient intake may be underestimated as we did not have information on micronutrients of all foods and dishes. Furthermore, in rural Cameroon fibre intake was high, which may interfere with the bioavailability of minerals such as iron and zinc.

The dietary habits also differed between the two sites. Although 76 different foods were included in the questionnaire, they were not all eaten in similar amounts in the urban and rural district. The rural diet is more or less based on the traditional staple foods, while the urban subjects incorporate more modern foods into their diet. For example, beignets (deep-fried cassava balls), popular now as snacks on the streets of Yaoundé, take a prominent place in the urban diet, while they are hardly consumed by the rural dwellers. These differences are partly caused by the fact that in African cities a lot of food is consumed outdoors, while this rarely occurs in the rural areas (Ag Bendeche *et al*, 1996).

compared with a typical Western diet, the intake of energy and the absolute intakes of fat and carbohydrates are much higher in rural as well as urban Cameroon (Ocké *et al*, 1997; Bohlscheid-Thomas *et al*, 1997; Bingham *et al*, 1997; Riboli *et al*, 1997; Norris *et al*, 1997). Also the energy percentage of fat is higher than that in a Western diet, while that of protein is lower (Bohlscheid-Thomas *et al*, 1997; Bingham *et al*, 1997; Riboli *et al*, 1997; Norris *et al*, 1997). However, several decades ago, when nutrition campaigns had not yet focused on lowering the total fat intake, the energy percentage of fat was similar to that seen in Cameroon nowadays (Stephen & Wald, 1990). Especially in urban Cameroon, the Western diet seems to influence lifestyle, as more bread and fried products are eaten than in rural Cameroon.

In conclusion, the habitual diet in rural Cameroon contains more fat and alcohol than the diet in urban Cameroon. The high energy requirements due to a high physical activity level in the rural area may explain the high fat intake.

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