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The Nigerian Diets: Distribution of Protein, Carbohydrate, Fat, Fibre and Minerals

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ABSTRACT

Nigerian diets consumed by population groups in the Calabar Metropolis were analysed for protein, carbohydrate, fat, fibre and mineral constituents. The crude protein content ranged between 5·4% and 26·3% (dry weight), 9·5% and 24·4% and 7·2% and 25·5% for breakfast, lunch and dinner diets, respectively. The ranges of values for carbohydrate, crude fat, crude fibre and total cholesterol were 32–83%, 9–39%, 1·3–3·9% and 54·8–1046 mg (per 100 g dry weight) respectively, for breakfasts; 43–75%, 12–30%, 1·8–3·4% and 452–900 mg, respectively, for lunch diets and 47–78%, 11–28%, 1·5–3·5% and 98·5–863 mg, respectively, for dinners. Typical Nigerian diets provided 25% of total food energy from fat. The mineral analysis provided data on twelve minerals and their distribution in the diets.

The results indicate that diets consumed in the Calabar Metropolis contain moderate protein, low fat and cholesterol, high carbohydrate and dietary fibre, but the diets of elite groups approximate those of western nations in composition.

INTRODUCTION

As part of efforts at assessing the nutritional status of Nigerian population groups, a few studies of food consumption in Nigeria have been made (McCulloch, 1930; Collis *et al.*, 1962; ICNND, 1967; McFie, 1967; Naismith, 1973; Abealu, 1975). Information available from these few

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reports is sketchy and inadequate, especially as the nutrient values of the diets assessed were invariably calculated from Tables of food composition.

The limitation of Tables of food composition in evaluating dietary intakes has been a subject of both discussion and investigation (Toscani, 1948; Mayer, 1960; Eagles *et al.*, 1966). In addition to wide variation in the nutrient content of foods in the raw state due to differences in cultivation, harvesting and storage and limited data on the mineral content of foods, there is a paucity of data on nutrient losses during preparation and cooking (Umoh & Bassir, 1977). This is particularly true in the case of mixed dishes and, for this reason, differences between calculated values and values obtained by laboratory analyses of meals and individual mixed dishes may be considerable. This fact confirms the suspicion that calculated values of dietary intakes and nutrient contents of dishes may not represent the actual nutrient value of food consumed (Pike & Brown, 1975). Harris (1962), for example, found that analysed values for a number of nutrients of foods prepared in the home were 5–30% lower than values calculated from food Tables.

The paucity of information on the nutrient contents of meals and cooked mixed dishes consumed by population groups in Third World countries—and in Nigeria, in particular—has hindered intelligent eating practices. There is considerable evidence to show that the enlightened public does respond to nutritional information, especially that linking diet and disease states (Mattson, 1972; Norum, 1978; Kreutler, 1980). This study was therefore undertaken to analyse some Nigerian diets in order to provide information on the nutrient contents, quantity and quality of food consumed. The accumulation of this kind of information will inform individuals about their diets and provide data for comparative analysis of consumption patterns.

MATERIALS AND METHODS

Collection and treatment of samples before analysis

Samples of breakfast, lunch and dinner diets, as prepared and actually served by individual households on seven consecutive days, were collected from randomly selected households in pre-determined localities of Calabar Metropolis. In addition, samples were obtained from selected restaurants in the area on Sundays, Wednesdays and Fridays of different weeks.

Food samples were collected on Quart canning type Mason jars, sealed with tapes and quickly brought to the laboratory in a portable vacuum-type cooler. They were weighed and then homogenized in a commercial

type Waring blender. The homogenates were spread on clean, dry metal trays and dried in a constant temperature oven (80°C). The dry samples were ground into fine powder in a mortar and stored in airtight bottles from where required quantities were taken for lipid extraction and various chemical analyses. The meals and mixed dishes collected were classified into the following ten categories of breakfast, lunch and dinner diets and identified as B1–B10, L1–L10 and D1–D10, respectively:

Breakfast ingredients

B1 —Sausage, fried eggs and bacon, cut fresh tomatoes, baked beans, toast and beverage.
B2 —Scrambled eggs, fried bacon, cut fresh tomatoes, bread, fruits and beverage.
B3 —Boiled eggs, sausage, fried bacon, stewed beef liver, toast, fruits and beverage.
B4 —Sausage, fried bacon, egg omelette, stewed beef liver, corn flakes with milk, pancake and beverage.
B5 —Fried ripe plantain, beef stew and cooked beans, fruits and beverage.
B6 —Pap made from corn starch and *akara* made from bean flour with added onions, pepper and palm oil.
B7 —*Moin-moi* made from homogenized corn with onions, pepper and eaten with Quaker Oats porridge and fruits.
B8 —Boiled yam and beans, beef stew and beverage.
B9 —Boiled rice and fish stew, fruits.
B10—*Garri* (fried cassava flour) and soup made with *okra*, vegetables, onions, pepper, palm oil, dry fish and grayfish.

Lunch ingredients

L1 —*Garri* and soup made with melon, bitter leaf, onions, pepper, beef, dry fish, grayfish and palm oil.
L2 —Jellof rice prepared with shrimps, beef and palm oil and eaten with boiled carrots and fruits.
L3 —Boiled potatoes and carrots, beef soup containing vegetables, tomato paste, onions, grayfish and pepper.
L4 —Fried chicken, boiled potatoes and carrots, vegetable soup made with beef, dry fish and crayfish, onions and pepper.
L5 —Boiled rice, shrimps and sauce, boiled eggs, onions (cut fresh), tomatoes and fruits.
L6 —Boiled yam, beans and beef stew, fruits.
L7 —Boiled plantain, rice, beans and fresh fish stew.

L8 —Cassava foofoo (pounded fermented cassava) with *afang* soup (*Gnetum africanum*) containing waterleaf, dry fish and grayfish, snails (edible portion), onions, palm oil and pepper.
L9 —Pounded yam with soup containing *okra*, vegetables, onions, pepper, palm oil, beef, dry fish and grayfish.
L10—Semovita with *edikang ikong* soup containing *ikong ubong* (*Telfaria* spp.) water leaf, onions, palm oil, pepper, dry fish and grayfish, beef and snails.

Dinner ingredients

D1 —*Edita iwa* (boiled and chopped cassava) with salted fish and groundnuts.
D2 —Ox-tail soup, coconut rice with dry fish, shrimps and coleslaw.
D3 —Fried fish with onions, boiled potatoes and carrots, fruit juice.
D4 —Cooked beef, boiled potatoes, cabbage and soup containing onions, grayfish, pepper and palm oil.
D5 —Broiled chicken, boiled potatoes and carrots, sauce and dessert.
D6 —Boiled rice and ripe plantain, beef stew and fruits.
D7 —Fried ripe plantain, boiled rice and beans, beef stew and fruits.
D8 —Boiled yam, vegetable soup containing dry fish and crayfish, onions and pepper.
D9 —Jellof rice with shrimp curry and beef, buttered carrots and fruits.
D10—*Garri* and soup containing *okra*, vegetables, beef, dry fish and grayfish, onions and pepper.

Analytical procedures

Total lipids were extracted with petroleum ether, boiling point 40–60°C, using a Soxhlet apparatus. Total lipids were determined gravimetrically. Lipid extraction for total cholesterol determinations was by the method of Folch *et al.* (1957). Total cholesterol was determined by the method of Levine & Zak (1964). Iodine and saponification numbers of the dietary fats were determined by the procedures described by the AOAC (1975). Protein (N × 6·25) was determined by the macro-Kjeldahl method. The carbohydrate content was obtained by the difference method; that is, by subtracting the total crude protein and lipid from the organic matter. Crude fibre was determined by the acid and alkaline digestion method described by Joslyn (1970) and the AOAC (1975). Food energy was calculated by multiplying grams of carbohydrate and protein by 17 and grams of fat by 38 to give kilojoules.

The elementary composition was also determined using the methods of

the AOAC (1975). Sodium and potassium were determined by flame photometric methods; calcium, iron, manganese, magnesium, copper, nickel, zinc, cobalt and chromium were determined using an absorption spectrophotometer; phosphorus was determined by colorimetric methods using ammonium molybdate.

RESULTS AND DISCUSSION

Tables 1 to 3 present the basic characteristics of Nigerian diets as consumed in the Calabar Metropolis as breakfasts, lunches and dinners, respectively. The summary of the mineral constituents of the diets is shown in Table 4.

The crude protein contents, ranging from 5·4% to 26% (Table 1), 12·1% to 21·4% (Table 2), and 7·2% to 25·5% (Table 3), respectively, for breakfast, lunch and dinner diets, show the pattern of protein intake. The data show that, on average, lunch and dinner diets provide higher levels of protein than breakfast diets and that diets from well-to-do households and western styled restaurants; for example, B3, L4 and D2, contain more protein than those from low-income households; for example, B7, L6 and D8. Overall, diets of Nigerian cuisine contain lower amounts of protein than western, although the levels were not considered inadequate, with the exception of diets B6, B7, B10 and D8. The values are comparable with those reported by Umoh & Bassir (1977), Eka & Aliu (1974) and Eka & Edijala (1972), and are compatible with data indicating that, in all countries, rich or poor, protein usually provides about 10% of the dietary energy and that the proportion of protein of animal origin only rises with income (Davidson *et al.*, 1975).

The results indicate the adequacy of protein intakes except in a few cases in which the diets consisted mostly of tubers, cereals and vegetables and not enough foods of animal origin. The data also show that, in comparison with western dietary patterns, the Nigerian protein consumption is relatively low, although the level of consumption among the high income classes is comparable with western standards.

The carbohydrate content of the diets, ranging between 32% and 83% for breakfasts (Table 1), 43% and 75% for lunches (Table 2), and between 47% and 78% for dinners (Table 3), shows that, on average, carbohydrate constitutes 60% of the diets, although some breakfasts (B3 and B4) from high-class restaurants were low in carbohydrates. The data also indicate that, overall, carbohydrates provide about 51% of the total food energy from the diets. The value of 51% is lower than 56% which was the pattern in the United States in 1913, but is higher than the present pattern of about 46% (Page & Friend, 1978).

TABLE 1

The Distribution of Protein, Carbohydrate, Fat, Fibre, Food Energy and the Iodine and Saponification Numbers of Fats in the Nigerian Diet: Breakfast

	Crude protein (g/100 g dry weight)	*Carbohydrate (excluding fibre; g/100 g dry weight)*	*Crude fat % dry weight*	*Food energy from carbohydrate (%)*	*Food energy from fats (%)*	*Food energy from protein (%)*	*Crude fibre (%)*	*Total cholesterol (mg/100 g dry weight)*	*Iodine number of fat*	*Saponification number of fat*
B1	13·1	59	25	46·1	43·6	10·2	2·6	914	70	131
B2	20·1	47	30	35·0	49·9	14·9	2·0	879	69	130
B3	26·3	33	38	22·8	58·8	18·2	1·5	1 046	67	138
B4	25·2	32	39	22·2	60·3	17·4	1·3	1 032	68	136
B5	11·3	60	24	48·0	42·9	9·0	2·6	541	57	161
B6	6·5	78	12	70·0	24·1	5·8	3·5	62	78	125
B7	5·4	83	9	76·4	18·5	4·9	3·9	55	75	130
B8	10·3	72	14	63·4	27·5	9·1	3·3	369	61	160
B9	9·1	74	13	64·7	25·9	8·1	3·5	359	56	163
B10	7·3	69	17	60·4	33·2	6·4	2·8	304	53	166
	13·5 ± 7·3	60·7 ± 17	22·1 ± 10	50·9 ± 18	38·5 ± 14	10·4 ± 4·5	2·7 ± 0·8	556 ± 0·4	64·4 ± 7·9	143·9 ± 6

TABLE 2

The Distribution of Protein, Carbohydrate, Fat, Fibre, Food Energy and the Iodine and Saponification Numbers of Fats in the Nigerian Diet: Lunch

	Crude protein (g/100 g dry weight)	*Carbohydrate (excluding fibre; g/100 g dry weight)*	*Crude fat % dry weight*	*Food energy from carbohydrate (%)*	*Food energy from fats (%)*	*Food energy from protein (%)*	*Crude fibre (%)*	*Total cholesterol (mg/100 g dry weight)*	*Iodine number of fat*	*Saponification number of fat*
L1	13·1	61	19	52·3	36·4	11·2	2·6	615	65	140
L2	13·6	70	15	61·8	29·6	11·6	3·4	452	67	135
L3	20·5	57	18	48·4	34·2	17·4	2·3	624	73	128
L4	21·4	43	30	32·7	51·0	16·3	1·8	727	58	160
L5	13·3	54	28	41·5	48·2	10·2	2·1	900	63	150
L6	9·5	75	12	67·3	24·1	8·5	3·4	580	57	155
L7	13·1	61	18	51·5	34·0	11·5	2·3	534	55	168
L8	16·3	64	15	56·2	29·5	11·7	2·6	624	53	170
L9	12·1	67	16	58·3	31·1	10·5	2·8	532	71	130
L10	17·8	61	18	51·2	33·8	14·9	2·4	863	75	126
	15·1 ± 3·9	61·3 ± 8	18·9 ± 5	52·1 ± 9·4	35·2 ± 7·9	12·4 ± 2·7	2·6 ± 0·5	645 ± 0·1	63·7 ± 7·4	146·2 ± 16

TABLE 3

The Distribution of Protein, Carbohydrate, Fat, Fibre, Food Energy and the Iodine and Saponification Numbers of Fats in the Nigerian Diet: Dinner

	Crude protein (g/100 g dry weight)	*Carbohydrate (excluding fibre; g/100 g dry weight)*	*Crude fat % dry weight*	*Food energy from carbohydrate (%)*	*Food energy from fats (%)*	*Food energy from protein (%)*	*Crude fibre (%)*	*Total cholesterol (mg/100 g dry weight)*	*Iodine number of fat*	*Saponification number of fat*
D1	12·1	62	20	52·2	37·6	10·2	2·3	99	66	135
D2	25·5	47	23	37·9	41·5	20·6	1·5	597	43	175
D3	14·0	57	24	45·7	43·0	11·2	2·5	606	63	151
D4	15·7	53	26	41·7	45·8	12·4	1·9	534	58	163
D5	13·4	59	21	49·4	39·3	11·2	2·6	863	61	152
D6	19·8	59	16	51·5	31·2	17·3	2·3	615	55	166
D7	17·7	55	23	44·3	41·4	14·3	2·1	602	58	161
D8	7·2	78	11	71·0	22·4	6·5	3·5	406	65	135
D9	15·8	49	28	38·5	49·1	12·4	1·7	863	61	153
D10	13·5	67	16	57·6	30·8	11·6	2·9	624	59	163
	15·5 ± 4·6	58·6 ± 9	20·8 ± 5	48·9 ± 9·4	38·2 ± 7·5	12·8 ± 3·6	2·3 ± 0·6	581 ± 0·2	58·9 ± 6·1	155 ± 12

TABLE 4
Summary of the Mineral Constituents of Nigerian Diets

	Ca	*Mg*	*Na*	*K*	*P*	*Fe*	*Mn*	*Cu*	*Zn*	*Ni*	*Co*	*Cr*
Breakfast	48·3	31·7	841	594	617	12·3	1·0	1·9	3·7	0·49	1·1	0·36
	±	±	±	±	±	±	±	±	±	±	±	±
	28	16	268	123	245	2·3	0·2	0·3	1·0	0·1	0·3	0·1
Lunch	74·4	46·3	731	597	565	15·5	1·0	1·8	4·8	0·63	1·34	0·45
	±	±	±	±	±	±	±	±	±	±	±	±
	35	14	185	151	138	2·5	0·2	0·6	1·7	0·5	0·6	0·1
Dinner	48·3	48·3	766	711	610	13·6	1·1	1·8	5·0	0·62	0·88	0·86
	±	±	±	±	±	±	±	±	±	±	±	±
	20	15	120	230	90	2·3	0·2	0·3	2·2	0·4	0·3	0·6

Mean of ten different meals of each category; mg/100 g dry weight.

The crude fibre content of the diets shows that dishes of Nigerian cuisine are richer in crude fibre than diets from high-class restaurants. This seems to arise from the high carbohydrate contents of these diets and the unprocessed foodstuffs used in preparing the dishes. It contrasts with the modern tendency to process the fibre out of plant foods, with the result that most western diets have become low-fibre diets (Kreutler, 1980; Connor & Connor, 1982).

The crude fat contents of the diets range between 9% and 39% for breakfasts (Table 1), 12% and 30% for lunches (Table 2) and between 11% and 28% for dinners (Table 3); the total cholesterol content and the percentage of food energy derivable from dietary lipids (Tables 1–3) show the pattern of fat consumption by population groups in the Calabar Metropolis. The data show that diets from high-income groups and western-style restaurants contain high fat and a high concentration of cholesterol. On the other hand, diets of Nigerian cuisine, for both income groups, generally contain lower fat and cholesterol contents. Overall, breakfasts provided more fat and fat energy than lunch and dinner diets. On the other hand, lunch diets provided the highest concentration of dietary cholesterol compared with breakfast and dinner diets.

When individual meals are examined, however, certain breakfast dishes, B1, B2, B3 and B4 (Table 1), are found to contain very high concentrations of dietary cholesterol. It is interesting to note that these breakfasts are typical of those from high-class restaurants that serve western dishes. When these breakfasts are contrasted with B6, B7 and B10, which are breakfasts of Nigerian cuisine, the difference is remarkable. The same pattern is observable for lunch and dinner diets when L4 and L5 are contrasted with L7 and L9, and when D4 and D9 are compared with D1 and D8.

The data on iodine and saponification numbers (Tables 1–3) show that the fats in the diets contain considerable unsaturated fatty acids of medium-to-long chain length. This is evident from the high iodine numbers and low saponification numbers.

Overall, the data show a pattern of lipid consumption that correlates the percentage of total food energy from fat with cholesterol intakes. The data demonstrate that those diets with high animal fat content and which provide high food energy from dietary fat, also contain a high concentration of cholesterol. Typical Nigerian breakfasts (B6, B7 and B10) provided 73·9 mg of cholesterol (per 1000 kcal of food energy) compared with 413 mg of cholesterol for breakfasts of foreign cuisine (B1, B2, B3 and B4).

The same pattern is observable for lunch (L4 and L5) and dinner (D5 and D9) diets which provided 366 mg and 412 mg cholesterol compared with 269 mg (L7 and L9) and 130 mg (D1 and D8) cholesterol for diets of Nigerian cuisine. It is noteworthy, however, that the Nigerian élites who are adopting western dietary patterns are ingesting a high concentration of cholesterol. This has been documented by Fashakin (1981) who reported higher levels of serum cholesterol among upper-class children in Ife, Nigeria. He attributed this to preference for modern and convenience foods among the élites.

These results are in accord with reports indicating that the diets of most westernized peoples are rich in animal fats and provide from 600 mg to 1000 mg of cholesterol per day or 200 mg to 333 mg of cholesterol per 1000 kcal of food energy (Kreutler, 1980). The results also confirm reports in the literature that in most prosperous countries fats usually contribute 35% to 45% of the total food energy while, in some poor countries, the figure is usually 15% or less (Davidson *et al.*, 1975). However, the data from this study show a rising trend in the total food energy from fats in Nigeria. This seems to follow the pattern reported for other countries. The figures for the United States show that, in 1913, fats provided 32% of the total food energy and, in 1976, the figure was 42% (Page & Friend, 1978). In the case of Britain, the figure was 38% in 1938 and 42% in 1972 (Davidson *et al.*, 1975).

The mineral composition of breakfast, lunch and dinner diets is summarized in Table 4. It is noteworthy that some of the trace elements, which are usually not adequately evaluated by calculations using food composition Tables, are shown to be provided in the diets in this study. The data thus provide useful information on the mineral contents of the Nigerian diets. The data also show that lunches are the best sources of calcium and iron, while dinners provide a higher level of magnesium and zinc. The results also show the level of sodium consumption, which was highest for breakfasts.

In this study, emphasis was placed on identifying dietary intakes as high, medium or low in regard to specific nutrients. The gross identification of dietary intake as high, medium, or low has been noted as a reasonable approach to interpretation of data from dietary studies (Mann *et al.*, 1962). The overall results indicate that the diets consumed in the Calabar Metropolis are medium in protein content, low in fat and high in carbohydrate and dietary fibre. In comparison with the typical diet of most western populations which contains large amounts of energy-dense foods, fat, sugar and salt (Kreutler, 1980), the diets analysed in this study can be described as containing moderate amounts of protein of mixed sources, low fat, mostly of plant sources, and high carbohydrate and dietary fibre.

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