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Development of food frequency questionnaires in three population samples of African origin from Cameroon, Jamaica and Caribbean migrants to the UK

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Objectives: To develop the methods for assessment of food and nutrient intake using standardized food frequency questionnaires (FFQ) in three African origin populations from Cameroon, Jamaica and Caribbean migrants to the United Kingdom.

Design: Cross-sectional assessment of diet from a representative sample in each site, using either a 2-day food diary or a 24-h recall method to determine foods for inclusion on the food frequency questionnaire.

Setting: A rural and urban site in Cameroon, Evodoula and Cite Verte in Yaounde, respectively; a district in Kingston Jamaica; African-Caribbeans living in central Manchester, UK.

Subjects: Aged 25-79 years, 61 from the Cameroonian urban site, 62 from the village site; 102 subjects from Jamaica (additional analysis on a subsample of 20); 29 subjects from Manchester, UK.

Main outcome measures: Foods contributing to nutrients in each site to allow the development of a FFQ.

Results: A high response rate was obtained in each site. Comparison of macronutrient intakes between the sites showed that carbohydrate was the most important contributor to energy intake in Jamaica (55%) and the least in rural Cameroon. In rural Cameroon, fat (mainly palm oil) was the most important contributor to energy intake (44%). Manchester had the highest contribution of protein to energy (17%). Foods contributing to total energy, protein, fat and carbohydrate were determined. In rural Cameroon, the top 10 food items contributed 66% of the total energy intake compared to 37% for the top 10 foods in Manchester. Foods contributing to energy were similar in Jamaica and Manchester. Cassava contributed 44% of the carbohydrate intake in rural Cameroon and only 6% in urban Cameroon. One FFQ has been developed for use in both sites in Cameroon containing 76 food items. The FFQ for Jamaica contains 69 foods and for Manchester 108 food items.

Conclusion: Considerable variations exist within sites (Cameroon) and between sites in foods which are important contributors to nutrient intakes. With careful exploration of eating habits it has been possible to develop standardized, but locally appropriate FFQs for use in African populations in different countries.

Sponsorship: European Community Grant.

Descriptors: dietary survey, African, method development, food intake

Introduction

This paper presents the methodology for the development of a dietary assessment tool used to determine food and nutrient intake for an international study. The study is examining the nutritional influences on the rapid emergence of diabetes and hypertension in populations of African origin in Cameroon, West Africa, Jamaica, West Indies; and their migrants to Manchester, UK. These populations share a degree of common genetic ancestry and yet experience different but rising

prevalences of non-insulin dependent diabetes and hypertension (Cruickshank & Beevers, 1989).

Increasing efforts are being made to assess the relationship between diet and the cause and potential prevention of disease by improving the precision of available methods. Epidemiological studies of diabetes and hypertension frequently suggest that nutritional factors may be important but few have measured nutritional intakes in any detail. None have examined the populations considered here, where both chronic diseases have become leading causes of mortality and morbidity. The assessment of diet in epidemiological studies is difficult because of the complex nature of the diet, the effect of disease process on dietary intake and the lack

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of precision in current dietary assessment techniques (Margetts & Nelson, 1991). Studying the association of diet and chronic disease requires reliable and valid methods. Several methods exist which differ in the time frame that is included in the enquiry, and the type of information that is sought. The accuracy of the dietary assessment *vs* the feasibility for use in large-scale studies must be considered in order to have sufficient power to detect modest relative risks.

The aim of our international study is to test the association of nutritional factors with disease prevalence and then to follow up the subjects to determine the risk factors predictive of incident disease. A food frequency questionnaire (FFQ) was the method of choice for the collection of nutritional data because they are designed to measure long-term dietary intake (Rimm *et al*, 1992) and therefore give a better approximation to the usual intake of a population than other methods. They have been shown to categorize population nutrient intakes adequately in epidemiological surveys (Margetts, Cade & Osmond, 1989; Willet *et al*, 1985), are easy to administer, can be used by trained non nutritionists, require minimal coding and are relatively inexpensive to use in large population samples.

Individual food intakes of African origin populations have not been studied in detail previously in any of these sites, except for the traditionally vulnerable groups of children and pregnant women in Jamaica, these groups do not form part of this study population. The collection of reliable dietary intake data, portion size and recipe information therefore presented a major challenge. In this paper we present the methodology used to develop the FFQ in each country, and the efforts made to standardize these methods to allow direct cross-cultural comparisons.

Methodology

As there is virtually no information available on the diets of the three populations under investigation, an initial assessment was carried out. This determined those foods for inclusion on the FFQ, that is those which contributed to at least 90% of the intake of energy, fat, carbohydrate and protein. In Jamaica, because the food composition software was limited, knowledge of commonly consumed foods that contained appreciable amounts of the nutrients under investigation was used to add to the selection of foods to be included in the FFQ. Subjects in each site were asked to complete either a 24-h recall or a 2-day food diary.

Sampling

Cameroon. In Cameroon, subjects were selected from two locations, an urban and a rural site. These were Cite Verte, a district in the capital Yaounde and Evodoula, a village centre 70 km away comprising 15 villages from which 3 were selected (Minwoho, Nloundou and Nkolassa). Evodoula was selected for the rural sample since it was a remote yet accessible community where the population live a traditional way of life, the major occupation being subsistence farming. Cite Verte is an urban area containing people from all social classes. Ninety households were randomly selected in the city and 70 in the village (6% sample in each of

three villages) and one subject from each household was asked to complete a 2-day food diary. Twenty additional subjects were randomly selected from a sub sample of households in Cite Verte and 20 from Minwoho and asked to complete a 24-h recall. In Minwoho, every eighth household was chosen since households were located along the road, those which were closer to the small market area having better access to food than those at the far end.

Although a recent census had been carried out, this only provided information on the number and gender of adults living in each household. Dietary data were collected from only one member per household of pre-determined gender, if two eligible men or women were resident the first encountered was interviewed. Households were visited at different times of the day and evening, to reduce the potential bias of selecting only those at home at certain times.

Jamaica. In Jamaica, subjects for the method development phase were selected from a community in Kingston identified as similar in socio-economic characteristics to the main survey population in neighbouring urban Spanish Town. Every second household was systematically sampled since no census data was available as a sampling frame. When more than one person of the same age and gender in any household met the criteria, one of the two was chosen at random and the age relationship noted (younger/older). The next time that the situation occurred, the subject at the opposite end of the age range was recruited. The chosen subject was asked to provide a 24-h recall. A sample of 109 persons divided into four age-sex categories was recruited. Subjects were recruited on all days of the week.

Manchester. Subjects in Manchester were randomly selected from the first 90 African Caribbean attendees, who themselves had been randomly sampled and seen as part of the main survey data collection, for assessment of blood pressure (BP), anthropometry and glucose tolerance. The main survey data collection involved the random selection of subjects (of unknown ethnicity) from four Family Health Service Association local population registers held in four health centres where the screening survey took place. These locations had been selected since they are central to areas where most African Caribbean residents live in the inner city. Response to the screening invitations at that time was approximately 65%. Of the 90, forty subjects were randomly selected and asked to complete a 2-day food diary.

Training

The collection of the nutritional data was standardized in each site, where necessary detailed training sessions were given.

Cameroon. Field workers were trained in both sites and then tested on their understanding by a nutritionist (SS). The test comprised completing a detailed 24-h recall of themselves, including details of portion size; those who did so with adequate detail were employed (7/12 potential interviewers in the city and 11/11 in the village passed the test). Two interpreters were used for the fieldwork, their competence was also tested.

Jamaica and by trained Manchester

Dietary assessment Collection of diaries was collected in

Food diary

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24-h recalls

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Jamaica and Manchester. All dietary data were collected by trained nutritionists (MJ, Jamaica and SS, Manchester).

Dietary assessment methods

Collection of the data was either by 24-h recalls or food diaries was standardized in each site. All the data were collected in the participant's home.

Food diary data collection: Cameroon and Manchester.

Those agreeing to complete the diary were asked to record their intake for the next two days and on the following day the diary was collected from the person's home (Sharma, Cade and Cruickshank 1993). In Cameroon, after the first day's recording the fieldworker returned to the home to check that the diary was being completed as requested. The diary involved recording in detail all food and drink consumed as well as the serving size, time of consumption and as much detail as possible about the food eaten. Common measuring utensils, cups, bowls and food models were employed for quantification of foods.

Diaries were distributed to specific households on specific days and at collection any anomalies clarified and further details obtained as necessary. All days of the week and weekend were included as well as market days in Cameroon to account for variation in food availability. Where it was not possible for a participant to complete a diary due to infirmity, 24-h recall was taken. Illiteracy was not a problem in Cameroon.

On completion of the diaries the serving sizes recorded were given a weight by weighing similar portion sizes in a subsample of subjects' homes or using, in the UK, a food portion size book (Ministry of Agriculture, Fisheries & Food, 1993) for foods that come in natural units (e.g. slice of bread). The food diaries were analysed using 'Microdiet' (Fletcher, 1994) a nutritional analysis package, to obtain mean daily nutrient intake and those foods contributing at least 90% of the total energy, fat, carbohydrate and protein intake for inclusion on the FFQ.

24-h recalls: Cameroon and Jamaica. Subjects were asked by the nutritionist to recall all food and drink consumed from first awakening the previous day and for the following 24 h. Participants were prompted for details of between-meal snacks; in Cameroon consumption of palm wine and foods eaten whilst in the bush were prompted for and in Jamaica consumption of snack foods and fruits, as these may be omitted. Common measuring utensils, cups, bowls and food models were used to quantify amounts of foods. The recall was then repeated back to the participant to ensure completeness. In Cameroon, all the recalls were analysed using 'Microdiet'. In Jamaica, the recalls were analysed using the computer package 'Nutritionist II' for energy and protein intake. Analysis from the whole sample was used to develop the FFQ. A random sample of 10 men and 10 women were further analysed using 'Microdiet' to provide more detailed dietary information and to allow comparison between the nutrient composition databases.

Recipe collection. In Cameroon, Jamaica and Manchester there is only limited information available on the nutrient composition of cooked foods eaten by these populations. Before any of the dietary data could be

analysed, details of ingredients used in cooked dishes had to be collected to provide a nutritional composition of each dish. In Cameroon and Manchester, participants were asked if a fieldworker could weigh all ingredients and then the final cooked dish, so that a nutritional composition could be calculated from the raw ingredients. Each dish was weighed in as many households as possible to obtain a representative nutritional composition of that dish and a standard recipe analysis was calculated for each dish in each site (Sharma *et al*, 1994). In Cameroon, where possible, nutritional composition was obtained for the same dish prepared in the village and city as ingredients may vary substantially due to availability of ingredients. Where it was not possible to obtain separate village/city recipes, the nutrient values from the average recipe obtained from any one site were used to analyse the data recorded at both sites. Cameroon food tables were used for the nutrient composition of the raw ingredients (Ngo Som and Abondo, 1989); where there was no composition available, values were taken from the UK food tables (Holland *et al*, 1991). Recipe information needed to be collected for some foods recorded in the diaries and 24-h recalls in all sites. However, in Jamaica, data is available for some cooked dishes but mainly only the energy and protein values calculated from recipe analysis (unpublished thesis, Landman 1984). Recipe information collected on the British African-Caribbean sample (mainly of Jamaican origin) was compared with these values and found to be similar for the majority of dishes, indicating that Jamaicans living in UK are preparing cooked dishes in a similar manner to Jamaicans living in Jamaica. This recipe data was used where necessary to analyse the Jamaican records. 'Microdiet' was then updated with these additional food values.

Results

Response rates

Cameroon. In Cameroon the diary was completed by 61 urban subjects (16 were unavailable and 16 refused) and 62 rural subjects (six were unavailable and two refused). The response rate was 79% and 97%, respectively. Subjects who were unavailable, mainly due to travelling to either city or village, have been removed from the denominator. Recalls were obtained from 15 people in the city (five were excluded from the denominator due to incorrect census data for two; two had travelled away and so were not available and one subject was sick) and 18 in the village, two subjects were unavailable for interview (100% response). In the city, 42% of the respondents were male, with a mean age of 36 years and the women had a mean age of 38 years. In the village, 46% of subjects were male, the mean age of both males and females in the village was 45 years.

Jamaica. 102 (51 men) of 109 subjects, completed a 24-h recall (response rate 94%), these were analysed for protein and energy intake. A random subsample of 20 subjects was chosen and the results were further analysed for foods contributing to nutrient intakes. The mean age of this subsample was 44 years for both men and women.

Manchester. In Manchester, 29 (13 men) subjects responded, 25 completed a 2-day food diary and four a



24-h recall, two were no longer in the UK and four unavailable, achieving an 85% response rate. The mean age of the subjects was 62 year (range 44–79) for men and 48 year (range 26–69) for women.

Energy profile and food intake

Table 1 shows the percentage contribution of the macronutrients to energy for each site. The Cameroonian villagers were consuming the highest percentage of energy as fat (44%) and the Jamaicans were consuming the lowest percentage of their energy as fat (27%). Alcohol provided the highest percentage of energy in rural Cameroon (10%).

Tables 2–5 show the top ten contributing foods to total energy, protein, fat and carbohydrate intake and % contribution of each food to the nutrient for each site. The Cameroon village site had the highest percentage of all nutrients provided by the top ten foods except for protein. There were considerable differences between sites in the foods appearing on the lists or the order which they appear on the lists. For energy intake, bread and rice appear in the top ten for all except Evodoula. Palm wine is only on the list for energy intake for Evodoula (Table 2). The lists of contributors to protein include rice, bread and chicken dishes in the top ten for all except Evodoula (Table 3). Tomato soup and okra soup were the most important contributors to fat intake in urban and rural Cameroon, respectively, whereas the top contributor to fat in Jamaica were dumplings and in Manchester, curried mutton (Table 4). Vegetable oil appears in the top ten fat contributing foods for Man-

chester, this comes from a few subjects who ate dishes for which no recipe was created on the database. The food items in these dishes were entered as separate ingredients. The top source of carbohydrate in Evodoula was cassava, providing 44% of the total carbohydrate intake. White bread and rice were important contributors of carbohydrate in each site (Table 5). Comparing between the urban and rural sites in Cameroon showed an overlap of foods in the top ten for each nutrient: three foods for energy, five foods for protein, five foods for fat, six foods for carbohydrate.

Recipe collection

Cameroon. Recipe information was collected for 45 dishes, in the village and city. Up to 16 compositions of the same dish were recorded.

Manchester. In Manchester, recipe data was obtained for 18 dishes eaten by the African Caribbean community. Up to four compositions of the same dish were obtained.

Food frequency questionnaire development

A food frequency questionnaire (FFQ) was developed for each site. Each questionnaire was designed to be interviewer administered and interviewers used local cooking utensils and cutlery to help subjects to describe their own portion size. In Manchester, all the foods which contributed to 90% or more of the energy, protein, fat and carbohydrate intakes were included, a

Table 1 The percentage contribution of macronutrients to energy intake by site

Nutrient	Cameroon, city n = 61	Cameroon, village n = 62	Jamaica n = 20	Manchester n = 29
Fat	39	44	27	35
of which saturates	13	12	9	11
Carbohydrate	46	38	55	43
of which sugars	8	8	19	14
Protein	13	10	12	17
Alcohol	2	10	2	6

Table 2 Top 10 foods contributing to energy in each site

Cameroon, city	%	Cameroon, village	%	Jamaica	%	Manchester	%
White bread	10	Cassava	17	Rice boiled	10	Curried mutton	8
Tomato soup	10	Palm wine	13	Rice and peas	9	Rice boiled	5
Foofoo corn	8	Okra soup	8	Hard dough bread	7	Rice and peas	4
White rice	5	Groundnuts fresh	6	Dumplings fried and boiled	7	Fried chicken	4
Groundnut soup	5	Groundnut soup	6	Condensed milk	6	Homemade soup	3
Boiled plantain	5	Corn on the cob	4	Soursop juice	4	Roast chicken	3
Fried beans	3	Avocado	3	Fried plantain	3	Wholemeal bread	3
Beignets (gateaux)	3	Sanga (green leaves and corn)	3	Yam	3	Beer	3
Meat stew	3	Nut paté	3	Curried chicken	2	Hard dough bread	2
Cassava	3	Plantain	3	Orange juice	2	Sugar	2
Total	55		66		53		37

Table 3 Top 10

Cameroon, City
Beef
Bread white
Fish grilled
Tomato soup
Chicken Groundnut soup
Bean stew
Groundnuts fresh
Rice white
Ndole
Total

total of 10 included 69 range of food limited, alm included on the urban as tained 76 food questionnair

Table 4 Top 10

Cameroon, city
Tomato soup
Groundnut soup
Bean stew
Groundnuts fresh
Ndole
Fish grilled
Beef
Kpam
Butter
Sanga
Total

Table 5 Top 10:

Cameroon, city
Bread, white
Foofoo corn
Rice, white
Plantains
Cassava
Beignets
Bobolo
Foofoo cassava
Fresh corn
Banana
Total

Table 3 Top 10 foods contributing to protein in each site

Cameroon, City	%	Cameroon, village	%	Jamaica	%	Manchester	%
Beef	12	Groundnuts fresh	10	Rice and peas	9	Roast chicken	11
Bread white	12	Fish grilled	8	Callaloo and saltfish	8	Curried mutton	9
Fish grilled	11	Okra soup	7	Hard dough bread	7	Fried chicken	8
Tomato soup	7	Groundnut soup	7	Curried chicken	6	West Indian soup	4
Chicken	6	Snail soup	6	Rice boiled	6	Dried cod/saltfish	3
Groundnut soup	5	Groundnut pudding	5	Condensed milk	5	Rice and peas	3
Bean stew	4	Corn fresh	5	Fried chicken	5	Bread wholemeal	3
Groundnuts fresh	4	Beef	3	Roast chicken	5	Semi-skimmed milk	3
Rice white	3	Bread white	3	Oxtail stew	4	Rice boiled	2
Ndole	3	Cassava	3	Dumplings	4	Fried fish	2
Total	67		57		54		48

total of 108 items. In Jamaica, the questionnaire included 69 foods and drinks. In Cameroon, since the range of foods recorded on the diaries and recalls was limited, almost all foods and drinks recorded were included on the questionnaire. One FFQ to cover both the urban and rural site was constructed and it contained 76 foods or groups of foods. Comparing between questionnaires shows some differences due to greater

availability of foods in a particular site. For example, in the Manchester FFQ there are six categories of milk included: whole, semi-skimmed, skimmed, sterilised, evaporated and condensed. The Cameroon FFQ has only one category for milk. Jamaica has five categories: condensed, whole, evaporated, powdered skimmed and powdered whole milk. Since the Manchester question-

Table 4 Top 10 foods contributing to fat in each site

Cameroon, city	%	Cameroon, village	%	Jamaica	%	Manchester	%
Tomato soup	23	Okra soup	15	Dumplings	10	Curried mutton	19
Groundnut soup	11	Palm wine	11	Curried chicken	6	Fried chicken	6
Bean stew	5	Groundnut soup	10	Rice and peas	6	Polyunsaturated margarine	6
Groundnuts fresh	5	Groundnuts fresh	10	Condensed milk	6	Vegetable oil	4
Ndole	5	Avocado	7	Curried mutton	5	West Indian soup	4
Fish grilled	4	Nuts in a bundle	5	Ackee	4	Roast chicken	3
Beef	3	Sanga	4	Callaloo and saltfish	4	Bacon	3
Kpem	3	Kpem	4	Fried chicken	4	Scrambled eggs	3
Butter	3	Huckleberry soup	3	Hard dough bread	3	Quiche lorraine	2
Sanga	3	Tomato soup	3	Fried plantain	3	Rice and peas	2
Total	65		72		51		49

Table 5 Top 10 foods contributing to carbohydrate in each site

Cameroon, city	%	Cameroon, village	%	Jamaica	%	Manchester	%
Bread, white	17	Cassava	44	Rice, boiled	16	Rice, boiled	11
Foofoo corn	16	Fresh corn	7	Rice and peas	11	Potatoes	8
Rice, white	10	Plantains	7	White bread, WI	10	Rice and peas	7
Plantains	10	Mango	5	Condensed milk	7	Bread white	7
Cassava	6	Yams	5	Dumpling	6	Sugar white	5
Beignets	4	Rice white	5	Yam	5	Bread wholemeal	5
Bobolo	4	Bread white	4	Orange Juice	5	Hard dough bread	4
Foofoo cassava	3	Koki corn	3	Lemonade	5	West Indian soup	4
Fresh corn	2	Sanga	2	Banana	4	Coca cola, lemonade	4
Banana	2	Beignets	2	Fried plantain	3	Ribena	3
Total	74		84		72		58

naire contained the most foods the other FFQs were compared to this. The Cameroon FFQ had 37 items which were covered by foods or groups of foods on the Manchester FFQ, this is 49% of the total items on the Cameroon FFQ. The Jamaican FFQ had 56 of the 69 items (81%) included the same as foods or groups of foods on the Manchester FFQ. The lists of foods

included on the questionnaires are shown in Table 6.

Discussion

In this study we carried out an initial assessment of diet aiming to ascertain major sources of energy and macro-

nutrients to enable food frequency que would provide the between country c intake. The method were a 24-h recall, 2-day food diary in views were conduct each day of the wee lasted approximatel obtained for all sit high quality recalls any incentives to ta health care was av regularly with super protocol and intervi tributed greatly to t response) of data ob

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Prior to conduct time with local wo local food produ methods of food pr of food terminolog particularly in Can foods eaten in the v for the same dish, o dish that is made w or expense of ingro understanding of d was analysed using values. Information recipe-based dishes food composition t CFNI, 1974; Hollar collected in several a standard recipe

Table 6 Lists of foods included on each food frequency questionnaire

Common foods included on each questionnaire:

White bread
Cake
Mango
Plantain
Sweet potato
Cabbage (C = soup)
Pasta/spaghetti
Sugar
Stout/beer

Additional foods on Cameroon questionnaire:

Groundnut soup
Mushroom soup
Fresh koki corn
Eru soup
Maize and vegetables (sanga)
Mets de concombre (bundle)
Fish in bundle
Grilled fish
Snail soup
Achu cocoyam
Bobolo/miondo
Foo foo rice
Tapioca
Apple
Pineapple
Coconut
Palm wine

Additional foods on Jamaica questionnaire:

Fried dumpling
Brown bread
Breakfast cereal
Processed meats
Meats
Salted fish
Papaya
Ackee
Bun/bulla
Chips: banana, plantain, potato
Pattie, meat loaf
Soda/diet soda

Additional foods on Manchester questionnaire:

Brown/wholemeal bread
Cream crackers
Weetabix shredded wheat
Cornflakes/rice crispies
Ice cream
Fruit pie/crumble
Pear
Cucumber
Callaloo
Pumpkin
Green peas
Saltfish fritters
Fish: boil, bake, fry
Curry: beef, lamb, goat
Pork, lamb, beef: roast, chop
Beef burger
Corned beef
Fried dumpling
Quiche
Crisps
Drinking chocolate
Ordinary squash

Milk (C = 1 q, J = 5 q's, M = 6 q's)^a
Banana
Tomato (C = salad)
Green banana
Potato (M = 3 q's)
Green beans
Nuts
Fizzy drinks/diet
Spirits

Tomato soup
Cassava leaves soup (kwem)
Koki beans
Huckleberry leaves
Dry koki corn
Termites
Fresh fish soup
Chicken soup
Corn boiled/grilled
Cocoyam
Beignets
Foo foo corn
Adam fruit
Sour sop
Watermelon
Yoghurt
Malta guiness

Boiled dumpling
Hard dough bread
Chicken - with and without skin
Bacon
Canned fish
Stewed peas
Callaloo
Cheese
Pudding
Margarine
Sweets/candies
Carrot juice

Hard dough bread
Margarine: ordinary, PUFA, low fat
Porridge: oatmeal, cornmeal
Cheese
Scones
Milk puddings
Grapes
Lettuce
Cassava
Cho Cho
Sweetcorn
Ackee and saltfish
Homemade WI soup
Chicken: fry, roast, curry
Pattie
Sausages
Ham
Macaroni cheese
Soup (not homemade)
Sweets, chocolate bars
Nutriment/nourishment
Fruit punch

Eggs
Orange/grapefruit
Avocado pear
Yam
Carrots
Plain rice
Tea/coffee
Pure fruit juice
Wine

Okra soup
Bean stew
Plantain porridge
Ndole/keleng keleng
Corn Chaff
Groundnuts in bundle
Dried fish soup
Meat soup
Cassava
green peas
Pap
Foo foo cassava
Plums
Papaya
Guava
Drinking chocolate
Soda

Cornmeal porridge
Biscuit/crackers
Corned beef
Liver
Pickled mackerel
Baked beans
Pumpkin
Ice cream
Butter
Potato salad
Cocoa

Sweet bun
Butter
Mueali, etc.
Yoghurt
Biscuits
Apple
Tinned fruit
Coleslaw
Bread fruit
Brussels sprouts
Broccoli/cauliflower
Tinned fish
Oxtail WI soup
Mince dishes
Meat pie/pastie
Bacon
Rice and peas
Pizza
Baked beans
Jam, honey
Low cal squash
Water

^a C = Cameroon, J = Jamaica, M = Manchester.

Foods separated by a '/' may be asked individually on some questions and are combined on others.



Table 6.

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nutrients to enable the standardized development of a food frequency questionnaire (FFQ) in each site, which would provide the means to make both within and between country comparisons in food and nutrient intake. The methods used to develop the questionnaires were a 24-h recall, in Cameroon and Jamaica and a 2-day food diary in Manchester and Cameroon. Interviews were conducted in respondent's homes to cover each day of the week, during daytime and evening, and lasted approximately 20 min. A good response rate was obtained for all sites, diaries were well completed and high quality recalls obtained; subjects were not given any incentives to take part, although in Cameroon free health care was available if needed. Interviewers met regularly with supervisory staff to discuss the schedule, protocol and interview techniques. All these factors contributed greatly to the quality and quantity (in terms of response) of data obtained.

There is no best method that can be applied to all epidemiological studies (Riboli, 1992); survey size, comprehension and cooperation of subjects and qualifications of survey personnel all influence choice of method (Taylor *et al*, 1992). In our situation, with the aim to compare intakes across sites, the FFQ was the method of choice. Other methods such as the weighed intake would not have been appropriate. The effort of weighing has been shown to alter people's food intake, tending to lead to underreporting (Pryer *et al*, 1995). Weighed intakes also only reflect actual intake over a short period of time rather than usual intake. Some recent studies have shown a poor performance of FFQs compared to weighed intakes (Bingham *et al*, 1994) and also when validated against biological markers (Bingham *et al*, 1995; Porrini, Gentle & Fidanza, 1995). This may reflect problems with the particular questionnaire used, and is likely to occur if the FFQ was not designed specifically for use in the population concerned. For example, how foods are grouped on the questionnaire will affect the results, particularly for vitamin intakes (Porrini, Gentle & Fidanza, 1995) as will whether the questionnaire is self or interviewer administered (Leighton, Neugut & Block, 1988; Caan, Hiatt & Owen, 1991). Weighed intakes also require subjects to be familiar with scales, to be literate and for fieldworkers to have a substantial knowledge of nutrition so that they can probe for detailed responses. These requirements would not be met in the main study for all subjects and fieldworkers in each site.

Prior to conducting the surveys, nutritionists spent time with local workers to familiarize themselves with local food products, recipes, market supplies and methods of food preparation. This basic understanding of food terminology was invaluable in all settings, but particularly in Cameroon where local names used for foods eaten in the village may be different from the city for the same dish, or where the same name is used for a dish that is made up very differently (due to availability or expense of ingredients) in the rural setting. This basic understanding of diet was essential to ensure the data was analysed using the appropriate food composition values. Information on the composition of most local recipe-based dishes was not available in the published food composition tables (Ngo Som & Abondo, 1989; CFNI, 1974; Holland *et al*, 1991). Recipe data had to be collected in several representative households to create a standard recipe that could then be used to analyse the

data from published values for the raw ingredients. Nutrient intakes are usually estimated by means of food composition tables which only approximately reflect the actual composition of the food (Riboli, 1992). This will vary depending upon a range of factors including the type of soil, the season of the year, the cooking and storage processes. Recipe data collected in this study was analysed using published values of raw ingredients; it would have been preferred to have recipes analysed chemically to reduce any bias due to use of the food composition tables or problems with the collection of ingredient weights but that has not yet been possible.

Although this method development study was not designed to assess nutrient intakes in these populations, nevertheless the contribution of the macronutrients to total energy intake has been presented (Table 1). This was to allow comparison between the sites and to ensure that the lists of foods to be included on the FFQs were reflecting reasonable intake levels. The contribution to energy varied between the sites with carbohydrate providing the most energy in Jamaica (55%) and the least in rural Cameroon. This is mirrored by the fat contribution in each of the sites with rural Cameroonians having the highest energy contributor as fat (44%) and Jamaica the lowest (27%). Urban Cameroon and Manchester had intermediate values for the contribution of fat and carbohydrate to energy. Alcohol provided the highest percentage of energy in rural Cameroon (10%) and this is probably because palm wine is freely available, 5.5% of energy was provided by alcohol in Manchester, this is higher than the average UK population figure of 4%. Alcohol contributed 2% to energy intake in urban Cameroon and Jamaica. Men in each site were consuming more alcohol than women. A large study of mainly European origin adults in the UK using weighed intakes (Gregory *et al*, 1990) has shown that fat contributed approximately 38%, carbohydrate 42%, protein 15% and alcohol 4% of total energy intake.

Tables 2-5 show the top ten contributing foods to total energy, protein, fat and carbohydrate intakes. In rural Cameroon the top 10 food items contributed a total of 66% to the energy intake compared to 37% in Manchester. This illustrates the greater variety of foods available in Manchester and the need for a longer FFQ containing more food items. The foods contributing to energy intake were similar in Jamaica and Manchester, with rice, rice and peas, hard dough bread and homemade West Indian soup featuring on both lists, illustrating that Jamaicans living in Manchester are eating similar foods to Jamaicans living in Jamaica, although in smaller quantities or less frequently, as a wider variety of foods are consumed in Manchester. The rural site in Cameroon had 84% of the carbohydrate intake provided by the top ten food items. Cassava providing the most important source at 44% alone, whereas in Manchester, only 58% of the carbohydrate intake was accounted for by the top ten food items. The relative importance of various food items differed between the urban and rural sites in Cameroon. For example, beef provided 12% of the protein intake in the urban site compared to 3% in the rural site. Similar lists of foods for a European origin population in the UK found that the top three contributors to energy intake were white bread and flour, potatoes and whole milk (Cade and Margetts, 1988). It is clearly important to design food

frequency questionnaires based on knowledge of foods which are important contributors to nutrients of interest in each population studied. Use of inappropriate food lists may result in underestimation of nutrients by the FFQ due to omission of key items.

In order to develop FFQs from this record and recall data it has been necessary to obtain accurate food intake data on a representative sample of the populations of interest. This has enabled us to develop food lists of the important sources of nutrients for each population, so that these can be included on the FFQ. Those foods that contributed to at least 90% of the intake of energy and macronutrients were listed for inclusion on the FFQ. In Cameroon, one FFQ was designed for use in both settings since there is frequent movement of people between the city and village. Also most foods eaten in the village are also eaten in the city but much less frequently and in smaller quantities. The FFQ contains 76 items and any variation in consumption of foods between the wet and dry seasons is ascertained. The FFQ developed for use in Jamaica contains 69 food items. In Manchester, 108 food items were included since both Caribbean and European foods needed to be covered by the questionnaire. The FFQs have been piloted, are being calibrated and are now in use in all sites on samples between 400 and 1500 subjects per site.

Conclusion

The ability to develop an appropriate FFQ depends on certain factors. Including the ability to obtain accurate food intake data in order to develop food lists for use on the FFQ; appropriate recipe and food composition data; an understanding of the cultural context; the level of literacy in the community and the skills of the nutrition workers involved in collecting the data. This study has shown that with careful exploration of eating habits, standardized but locally appropriate FFQs can be developed for use in African origin populations in different countries. One of our goals is to improve and develop dietary assessment tools to determine nutrient intakes. It is only with these improved approaches to dietary assessment that we will be able to estimate more precisely associations, if they occur, between food, nutrients and the development of diabetes and hypertension.

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Introduction

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