

Food exchange lists of local foods in Nigeria

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Abstract

The aim of this study was to develop exchange lists for meal planning and for the assessment of food and nutrient intake of people with diabetes and other people requiring nutritional management in Nigeria. The carbohydrate (CHO) content of 100 g of each raw food sample was obtained from The Food and Agriculture Organisation (FAO) of the United States publication *Food Composition Table for Use in Africa*.¹ Each raw food sample weighing 100 g was cooked using the standardised recipe to obtain the cooked weights. By using a kitchen scale and appropriate household food measures (evaporated milk tin, dessertspoons, and teaspoons), we quantified the cooked food sample that would yield 15 g carbohydrate, 7 g protein, or 5 g of fat. In the case of fruits, biscuits, milk, and fat, the quantities of foods, were obtained directly from the FAO Food Composition Table. The result of the 15 g CHO of the staple foods ranged from a minimum of 30.0 g (1.5 thin slices) of bread to a maximum of 112.0 g (18 dessertspoons of cooked *Ogi*) within the cereal group; 38.0 g (1.5 medium size) of Irish potatoes (fried) to 81.0 g (2 dessertspoons) of cooked yam flour (*amala*) within the roots and tubers; 1 dessertspoon of powdered milk to 128.0 g of unsweetened evaporated milk; 45.0 g of cowpea (*akara seke*) to 98.0 g of cowpea pudding (*moinmoin*) in Legumes; 0.75 g (medium size) of grapefruit to three large tangerines in fruits. The weight of the protein foods ranged from 28.0 g in beef or chicken to 112.0 g in cowpea pudding. These evaluated food values could serve as an aid for planning of meals and counselling diabetic patients on their diets in Nigeria.

Introduction

Diabetes mellitus is increasing at an alarming rate world-wide and poses an immeasurable threat to global health, healthcare, and national economies.¹ Diet is a corner-stone in the management plan for diabetes.² 'Food exchange lists for meal planning' was developed, based on the establishment of principles of good nutrition, by the American Diabetes Association (ADA) and the American Dietetic Association in 1950, as a guiding tool for people with diabetes for quantifying their diets

correctly.³⁻⁵ However, it is also useful for calculating and planning any diet in which control of the energy-yielding nutrients, as well as the total calorie obtained per day is the goal.⁶ Food exchange lists aim to help meal planning and match carbohydrate intake to medication.⁷ Food Exchange lists are arranged in a way that each item of food, within a particular food group, is approximately the same in terms of energy, carbohydrate, or protein or fat content when eaten in the quantity specified. The quantity of each item of food can freely be exchanged or substituted, or traded off with other quantities of food within the same exchange list. This helps to maintain consistent food intake and also allows a greater variety of food combinations to be used in planning meals and snacks.⁸ Foods are listed in their serving sizes after cooking. This helps individual learn to 'eye ball' the correct serving sizes and to monitor early his/her calorie intake.⁹ Food exchange lists, provide a system in which a more flexible selection as well as a wide combination of foods can be made and also allows for more accurate calculation of nutrients from information on food label¹⁰

Food exchange lists are widely used by healthcare professionals and efforts have been made to update the tool to better manage nutrition-related chronic diseases.¹¹ Food exchange lists are usually arranged according to each macronutrient for easy use. By compiling foods of similar composition an extensive databases of food exchanges can be made for each locality, revised periodically.²

In Nigeria, food measuring scales and standard measuring cups for quantifying foods are scarce in most homes.¹² To date, food exchange lists of local foods are almost non-existent in Nigeria, except for the few published by Fadupin et al.¹³ This has resulted in the use of more complicated methods for assessing food intake during clinical studies, community surveys and in the estimation of standard local food measures. Thus, the standardisation of Nigerian local foods to produce exchange lists becomes necessary.

Methodology

The commonly eaten food items in Nigeria were listed according to their food groups. The number of grams of carbohydrate (x) in 100 g of each food item was obtained from the FAO Food Composition Table for Use in Africa (1968).³ Each of the raw food samples weighing 100 g (except for fruits, biscuit, milk, and fat) was cooked in a pot which had been weighed. The weight of the cooked food was obtained by subtracting the weight of the empty pot from the weight of pot and food. Thus the weight of cooked food from 100 g of raw food = y. The weight of

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cooked food (y) also contains x carbohydrates because the weight of carbohydrates in foods does not change with cooking. Thus the weight of cooked food in 10g or 15g carbohydrate

$$= \frac{(10\text{g or } 15\text{g})y}{x}$$

The conversion factor of 1gm of raw food to cooked food was also calculated as the weight of cooked food divided by 100 = $\frac{y}{100}$

In the case of fruits and biscuits, the quantities that contained 10g or 15g CHO were calculated directly from the values of CHO listed for an 100g edible portion, for fruits and biscuits in the FAO food composition table.³ Also the weight of cooked food per selected calories was determined based on the American recommendation for daily energy distribution between the energy-yielding nutrients (carbohydrate = 50%, fat = 30%, and protein = 20% of the total daily energy requirement).¹⁴

Thus, the total daily energy required from carbohydrate foods was based on 50% of the daily calorie required. The daily energy required from carbohydrate was distributed evenly between the three main meals (breakfast, lunch, and dinner) to obtain the weight of the different cooked food for each meal. The values for each meal could be adjusted to provide snacks for individuals as required.

The weight of each cooked protein food that will yield 7 grams protein and the quantities of varieties of fat that will provide 5 grams of fat were also evaluated.

Results

Table 1 shows the weight of the cooked foods obtained from 100g of raw edible foods and the conversion factors of the raw edible food to cooked food of the selected staples foods commonly eaten in Nigeria. Among the cereals, milled sieved cooked maize (*pap*) had the highest cooked weight (552 g) followed by maize mold (*agidi*) (537 g) and millet (*amala*) (517 g). Boiled rice produced the lowest cooked weight among the cereal group. Within the roots and tuber group, yam flour (*amala*) produced the highest weight (341 g) while Irish potatoes, (boiled and fried) produced the lowest cooked weights (95 g and 47 g respectively). Within the fruit group, unripe plantain mold (*amala*) had the highest cooked weight (428 g) while unripe fried plantain had the lowest weight (41 g) after cooking. Cowpea pudding (*moinmoin*) had the highest weight (393 g) while cowpea (*akara*) had the lowest cooked weight (254 g) among the legumes.

Table 2 shows the 10g and 15g carbohydrate exchange list of selected Nigerian local foods in weight and household measures, *Pap* had the

highest (75 g and 112 g) while bread had the lowest (20 g and 30 g) weight, as 10 g or 15 g CHO among the cereals book, respectively. Unripe plantain (*amala*) and Irish potato (boiled) had the highest while cassava (*eba*) and unripe plantain had the least weights among the roots and tuber group. This indicates that a lesser quantities of cassava *eba* and unripe fried plantain would yield 10g and 15g carbohydrate among the roots and tuber group. The exchange list for protein foods and fats commonly eaten in Nigeria are also presented in Tables 3 and 4 respectively. The weights of the foods ranged from 28g in beef/mutton/chicken to 112g in cowpea pudding. One teaspoon (or 5 ml) of each variety of fat commonly eaten in Nigeria would yield 5gm of fat.

Table 1 Conversion factors of 100g raw foods to cooked foods

| 100 g Raw foods to cooked foods | Weight of cooked foods (g) | Conversion factor |
|---|----------------------------|-------------------|
| Boiled Rice | 223 | 2.23 |
| Jollof rice | 264 | 2.64 |
| Rice | 271 | 2.71 |
| Millet | 517 | 5.17 |
| Maize corn | | |
| Yellow maize (tuwo) | 515 | 5.15 |
| Yellow maize (Egbo) | 228 | 2.28 |
| Cooked milled sieved maize | 539 | 5.39 |
| Raw fermented milled sieve maize paste (<i>pap</i>) | 213 | 2.13 |
| Maize mold (<i>agidi</i>) | 537 | 5.37 |
| Roots and tubers | | |
| Yam (boiled) | 102 | 1.02 |
| Cocoyam | 172 | 1.72 |
| Pounded yam | 125 | 1.25 |
| Yam flour (<i>amala</i>) | 341 | 3.41 |
| Cassava flour (<i>amala</i>) | 284 | 2.84 |
| Cassava (<i>eba</i>) | 280 | 2.80 |
| Irish Potato (boiled) | 95 | 0.95 |
| Irish Potato (fried) | 47 | 0.47 |
| Fruits | | |
| Unripe plantain (boiled) | 116 | 1.16 |
| Unripe plantain (fried) | 41 | 0.41 |
| Unripe plantain roasted | 72 | 0.72 |
| Unripe plantain flour | | |
| Legumes | | |
| Brown cowpea (small) | 428 | 4.28 |
| Brown cowpea (large) | 283 | 2.83 |
| White Cowpea (small) | 288 | 2.88 |
| Bean cake (<i>akara</i>) | 255 | 2.55 |
| Steamed cowpea pudding (<i>moinmoin</i>) | 254 | 2.54 |
| | 393 | 3.93 |

Table 2 10g and 15g carbohydrate exchange lists of some common selected Nigerian local foods in weight with household measures (dsp = level dessertspoon; tsp = level tablespoon)

| | 10g carbohydrate | | 15g carbohydrate | |
|-----------------------------|----------------------------|-----------------------|----------------------------|--------------------------|
| | Weight of cooked foods (g) | Household measures | Weight of cooked foods (g) | Household measures |
| Cereals | | | | |
| Rice long grain (boiled) | 30 | 2dsp | 45 | 3dsps |
| Jollof rice | 33 | 2dsp | 50 | 3dsps |
| Rice-Tuwo | 34 | 2dsp | 58 | 3 dsps |
| Millet amala | 70 | 2dsp | 105 | 3dsps |
| Maize com amala | 65 | 2dsp | 98 | 3dsps |
| Maize corn-Egbo | 35 | 1dsp | 53 | 1.5dsps |
| Milled sieved maize paste | 75 | 12dsp | 112 | 18dsps |
| Maize mould agidi | 72 | - | 108 | - |
| Bead | 20 | 1 thin slice | 30 | 1.5 thin slices |
| Roots and tubers | | | | |
| Cocoyam boiled | 40 | 1.5 large thin slices | 60 | 3 large thin slices |
| Yam (boiled) | 35 | 1thin medium slice | 53 | 1.5 medium thin slices |
| Pounded yam | 45 | 1dsp | 68 | 1 1.5 dsps |
| Yam flour-amala | 54 | 1.25dsp | 81 | 2dsps |
| Cassava flou-amala | 50 | 1dsp | 75 | 1.5 dsps |
| Foo foo | 40 | 1dsp | 60 | 1.5 dsps |
| Cassava gari-eba | 33 | 1dsp | 50 | 1.5 dsps |
| Irish potato (boiled) | 53 | 1 large/2 egg size | 80 | 1.5 big /3 egg size |
| Irish potato (fried) | 25 | 1 big/2 small | 38 | 1.5 big/3 small egg size |
| Unripe plantain (amala) | 63 | Egg size 0.5dsp | 95 | Egg size 5dsp |
| Unripe plantain (cooked) | 40 | 0.25 medium size | 60 | 0.5 large/3small |
| Unripped plantain (fried) | 20 | 0.25 medium size | 30 | 0.5 medium size |
| Unripped plantain roasted | 25 | 0.25 medium size | 38 | 0.5 medium size |
| Legumes | | | | |
| Cowpeas | 50 | 1.5dsp | 75 | 2dsp |
| Cowpeas pudding (moinmoin) | 65 | 0.25 milk tin | 98.0 | 0.5 milk tin |
| Cow peas (ekuru) | 35 | - | 53.0 | - |
| Cow peas-akara (seke) | 30 | - | 45.0 | - |
| Fruits | | | | |
| Orange | - | 1medium size | - | 1.5 medium size |
| Tangerine | - | 2 large size | - | large size |
| Paw paw (fairly ripe) | - | 1 thin slice | - | 1.3 thin slices |
| Mango (fresh) | - | 0.5 medium size | - | 1 medium slices |
| Banana | - | 1 large size | - | Large size |
| Grape fruit | - | 0.5 medium size | - | 0.75 medium slices |
| Melon | - | 1 thin slice | - | 1.5 thin slices |
| Carrot | - | 2 small size | - | 3 small size |
| Milk | | | | |
| Powdered | - | 2dsp | - | 3dsp |
| Evaporated unsweetened milk | 85 | 6tbls | 128.0 | 3dsp |
| Biscuit | | | | |
| Plain cracker biscuit | 15 | 2 pieces | 23.0 | 3 pieces |

Table 3 Exchange list for common Nigerian protein foods (each serving contain approximately 7g protein, 6g fat and 90 calories)

| Food | Quantity |
|-----------------|-------------------------|
| Beef | 28 g |
| Mutton | 28 g |
| Chicken | 28 g |
| Fish | 55 g |
| Evaporated milk | ½ medium tin |
| Powdered milk | 2 dessertspoons |
| Cowpea cooked | ½ cup (3 dessertspoons) |
| Cowpea pudding | 112 g |
| Peanut | 58 g |

Table 4 Fat exchange list (each serving contain 5g fat and 45 calories)

| Food | Quantity |
|---------------------|--------------|
| Red palm oil | 1tsp (5 mls) |
| Peanut oil | 1tsp (5 mls) |
| Soyabean oil | 1tsp (5 mls) |
| Corn oil | 1tsp (5 mls) |
| Note tsp = teaspoon | |

Discussion

The primary goal of nutrition therapy for individuals with diabetes is to maintain their glycaemic control through dietary means. Nutrition therapy is often ignored due to the lack of training in nutrition of health care providers, and to lack of adapted tools for the assessment of dietary and nutrient intake and lack of proper counselling of patients.¹ The lists shown in this paper were determined to also serve as a uniform food guide to assist nutritionists and dietitians to plan and estimate meals, counsel patients and also monitor diets using cooked foods. This is important because food composition tables of cooked foods are rare in Nigeria. The list is expected to make dietary counselling easier, and patient dietary compliance hopefully enhanced.

The conversion factors of raw foods to cooked foods determined in this study could be used by anyone to quantify the amount of cooked foods that would be obtained from raw foods. This will be useful during food surveys to interpret people's intake when an individual reports his or her food intake in the raw form. Different types of food preparations affect the quantity of cooked food obtained from certain quantities of raw foods, depending on the moisture content of the end product. For example, the quantity of *tuwo rice* was more than the quantity of boiled rice or *jollof rice* obtained from 100 g of raw rice.

Smith and Ojofeitimi¹² point out that kitchen scales are

inaccessible in most Nigerian homes; thus household measures (teaspoons, dessertspoons, milk tins, cups, etc) serve as alternative device for estimating meals.¹⁵ Using these common household measures will help to educate the people who have no access to food measuring scales to quantify food portions and become acquainted with food portion sizes.¹⁶

The food exchange list is also useful in weight control to sustain an ideal body weight in individuals and also uphold the control of blood glucose.¹⁷⁻¹⁸ The list if developed in any country could provide a useful and efficient tool for recommending diets, evaluating food records and for assessing individual nutrition.

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