Assessing Selected Local Nigerian Foods for Inclusion into the Developed Food Exchange List

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ABSTRACT

Food exchange lists were initially developed based on the establishment of principles of good nutrition, as a dietary management tool used for quantifying diets correctly for people with diabetes. This has overtime progressed to a general meal planning tool. However, the existing food exchange lists for selected local foods in Nigeria contain only a few food items. Therefore, an inclusion of more food items to the current food exchange list for Nigeria will improve its usefulness.

Objective: This aimed at developing a food exchange list with more local foods commonly consumed in Nigeria. This study addressed the need for inclusion of more commonly consumed Nigerian local foods in the food exchange list for Nigeria and the need for it in nutrition intervention.

Methods: In this study, a total of seventeen (17) food items were sampled. The food items were purposefully selected by certain criteria, which includes most importantly that they were not included in the existing food exchange list for Nigeria. The food samples were grouped according to the methods of cooking used and a procedure was used to determine the cooked weights and conversion factors.

Results and Conclusion: A Food Exchange List was developed for selected local foods commonly consumed in Nigeria. It also includes conversion factors for raw foods to cooked foods and the weight and household measures of cooked foods that are equivalent to 10g and 15g carbohydrates to be used in meal planning.

Keywords: Food Exchange Lists; Nigeria; Dietary Management; Diabetes; Meal Planning

INTRODUCTION

'Food exchange lists for meal planning' was first 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 (1). The first edition was primarily used to plan meals for Diabetic patients. It was also however used to calculate and plan any diet in which control of energy-yielding nutrients and total calorie obtained per day is the goal (2).

The word _exchange_ refers to the fact that each item on a particular list in the portion listed may be interchanged with any other food item on the same list. An exchange can be explained as a substitution, choice, or serving (3). Food exchange lists are practical meal-planning tools that groups foods according to their content of carbohydrate, protein, fat, and energy. Foods in the same exchange list provide, on average, a similar content of macronutrients and energy per serving (4). Food exchange is a user-friendly guide for dietary modification of a diseased condition. This tool may help to customize meals for people as it provides information regarding various food items in different groups (5).

Nutrition intervention is an integral part of diabetic management and self-care, which aims at achieving an optimal metabolic control. Dietary counseling for diabetic patients is aimed

at improving glycemic control and quality of life through addressing individual nutritional needs (6). In recent years, the idea of the food exchange list has risen in terms of both length and significance of its use in the dietary handling of chronic non-communicable diseases especially Diabetes Mellitus and the overall intake of calories. Due to the sheer volume and diversity of foods around the world, it is necessary to provide focus to this area (7). Exchange lists provide detailed information about nutrients in many foods and beverages. They are designed to help manage Diabetes, Cardiovascular risk reduction and Obesity. When used knowledgeably, food exchange lists help to ensure balance and moderation (8). The exchange lists concept has also been adapted for weight management education and is sometimes applied to nutrient information provided with recipes and manufactured food products (9).

The exchange system is seen as a tool that would solve adherence problems such as consistency in diet plans by providing a tremendous range of food choices. The major purpose of the exchange system is to provide a framework to group foods with similar calorie, Carbohydrate, protein and fat content, a universal system for nutritional management of Diabetes and a system that allows clients to be accountable for what they eat providing a wide variety of food choices and flexibility in planning meals and a tool to plan nutritionally adequate meals (10).

The exchange system is used for maintaining the consistency in the meal content necessary to glycemic control and well-balanced intake (11). 'Food exchange lists of local foods in Nigeria' by (2) captures several local foods in Nigeria; however, there are still so many local foods in Nigeria that are not available in the food exchange list. These foods that are not captured will either have to be substituted with other food items on the list, avoided completely or having to be quantified through a complicated means. This study is therefore aimed at assessing some local Nigerian foods for the inclusion into the developed food exchange list and the need for it in nutrition intervention.

MATERIALS AND METHODS

A total of seventeen (17) food items were selected for inclusion in the food exchange list. The food items were purchased from New Benin market and vegetable market in Benin City, Edo State. The food items included and categorized by food groups are shown below:

1. Cereals and Grain
   a. Spaghetti (boiled)
   b. Corn (Boiled) - *(Zea mays)*
   c. Macaroni
   d. Brown Rice
   e. Wheat Flour (Semolina wheat flour)
2. Legumes
   a. White Beans (*Phaseolus vulgaris*)
3. Starchy Fruits, Roots and Tubers
   a. Sweet potatoes (Boiled) – (*Ipomoea batatas*)
   b. Water yam (Boiled) - (*Dioscorea alata*)
   c. Yam (fried) - *(Dioscorea rotundata)*
   d. Yam (roasted) - *(Dioscorea rotundata)*
   e. Ripe plantain (boiled) - (*Musa paradisiaca*)
   f. Ripe plantain (roasted) *"Boli"* - (*Musa paradisiaca*)
   g. Breadfruit seed *"Ukwa"* - *(Treculia africana)*
4. Nuts and Seeds
   a. Groundnuts (Boiled) - *(Arachis hypogaea)*
   b. Dika nut soup *"Ogbono soup"* - *(Irvingia gabonensis)*
5. Fruits
   a. Pineapple - *(Ananas comosus)*
   b. Guava - *(Psidium guajava)*

Criteria for Selection of Foods

The foods were purposefully selected by the following criteria.

i. It was not included in the existing food exchange list for Nigeria.
ii. It must be available in the Nigerian food composition table.
iii. It must be commonly consumed by individuals all around Nigeria.
iv. The ingredients for the foods are readily available in any Nigerian market.
v. Some foods with high glycemic index were included so that they can be properly managed by people with Diabetes.

Apparatus and Equipment

Apparatus and equipment that were used for this study includes: Tess M17 Digital weighing scale, gas cookers, frying pans, small bowls, plates, roast pan, knives and stopwatch.
Household measures: Dessert spoons, Tablespoons, Milk Tins and Teaspoons

Preparation of Sample

The selected food samples were grouped according to the method of cooking used.

  i. Preparation of food samples by Boiling
- a. Corn
- b. Spaghetti
- c. Macaroni
- d. Brown rice
- e. White beans
- f. Water yam
- g. Ripe plantain
- h. Sweet potatoes
- i. Breadfruit seeds
- j. Groundnuts

- Each raw food sample was weighed to 100g
- The empty pot that was used to cook was weighed.
- 100g of each raw sample was cooked by boiling method in the pot with known weight in order to estimate the weight of the cooked food sample.
- The weight of the cooked food sample was determined as follows:
  Weight of raw food sample= 100g
  Weight of empty pot= p
  Weight of pot + cooked food sample= y
  Weight of cooked food= y - p= x

  ii. Preparation of food samples by Steaming and Stewing
- a. *Ogbono* soup
- b. Wheat flour

- Each raw sample was weighed to 100g
- The empty pot that was used to cook was weighed.
- 100g of each raw sample was cooked by steaming or stewing method in the pot with known weight in order to estimate the weight of the cooked food sample.
- The weight of the cooked food sample and pot waste was determined by the method of Fadupin (2009) as follows:
  Weight of raw food sample= 100g
  Weight of empty pot= p
  Weight of pot + cooked food sample= y
  Weight of cooked food= y-p=x
  Weight of pot waste = y-x=w

  iii. Preparation of the food sample by Roasting
- a. Ripe plantain
- b. Yam

- Each raw sample was weighed to 100g
- The empty roasting pan that was used to cook was weighed.
- 100g of each raw sample was cooked by roasting method in the roasting pan with known weight, in order to estimate the weight of the cooked food sample.
- The weight of the cooked food sample and pot waste was determined using the same method of the steaming and stewing samples.

  iv. Preparation of food samples by Frying
- a. Yam

- Each raw sample was weighed to 100g after they had been peeled.
- 100g of each raw sample was cooked by frying method in a frying pan with vegetable oil.
- The cooked food sample was removed from the oil, allowed to cool, and weighed.

  v. Preparation of food samples which are purchased in their edible forms
- a. Pineapple
- b. Guava

- In the case of these food samples, their outer layers were removed and only the edible portions were used. Therefore, the quantities that contain 10g or 15g carbohydrates were calculated directly from the values of carbohydrate listed for an 100g edible portion, for fruits in the Nigerian food composition table (2).

Calculation of Variables

1. Conversion factors of raw foods to cooked foods: The conversion factor (C) of 1g of raw food to cooked food was calculated as the weight of cooked food divided by 100. Thus

Conversion factor (C)= weight of cooked food (x)/ weight of raw food (100g)

$$C = \frac{x}{100g}$$

2. Calculation of the quantity of cooked food sample which provides 10grams and 15grams carbohydrates in weights and household measures: The number of grams of carbohydrate (r) in 100 g of each food sample was obtained from the Nigerian Food Composition Table.

Weight of cooked food containing 10g or 15g of carbohydrate= 10g or 15g Carbohydrate)/ Amount of Carbohydrates in 100g food sample(r) x Weight of cooked food(y).

$$\textit{Weight of cooked food containing } 10g \text{ or } 15g \textit{ of carbohydrate}$$

$$= \frac{10g \text{ or } 15g \text{ } CHO}{r} * y$$

This yielded the weight of cooked food sample containing 10g or 15g of carbohydrate. The amount of food that provides 10g or 15g carbohydrate was measured with common household measures such as Dessert spoons, Milk tins and Tablespoons as the case maybe (2).

RESULTS AND DISCUSSION
Results of Sample Preparation
The seventeen (17) selected commonly consumed food samples were evaluated and the results presented in Table 1.0. Table 1 shows the weight of cooked foods derived from 100g of raw edible food samples and the conversion factors of the raw edible food samples to cooked food for the selected local foods commonly consumed in Nigeria.

In the cereal and grain products, Wheat Flour had the highest cooked weight (295g) next to Macaroni (280g) and then Spaghetti (225g). The food sample with the lowest cooked weight amongst the cereal and grains food group was Maize (170g). In the legumes group, white beans were the only food sample analyzed (250g).

Within the starchy fruits, root and tubers group, Breadfruit seeds (*Ukwa*) produced the highest cooked weight (150g), while Yam (Fried) had the lowest (70g). Dika Nut Soup (*Ogbono Soup*) (440g) had a higher cooked weight than Groundnuts (150g) in the nuts and seeds group. For the fruit group, the weight of cooked food and conversion factor was not stated as they are foods that are consumed in their edible forms.

Table 1.0: Conversion factors of 100g raw foods to cooked foods

100g Raw Foods to Cooked Foods	Weight of Cooked Foods (g)	Conversion Factor
Cereal and Grain Products		
Spaghetti (Boiled)	225	2.25
Maize (Boiled)	170	1.70
Macaroni (Boiled)	280	2.80
Brown Rice (Boiled)	205	2.05
Wheat Flour	295	2.95
Legumes		
White Beans	250	2.50
Starchy Fruits, Roots and Tubers		
Sweet Potatoes (Boiled)	120	1.20
Water Yam (Boiled)	100	1.00
Yam (Fried)	70	0.70
Yam (Roasted)	90	0.90
Ripe Plantain (Boiled)	120	1.20
Ripe Plantain (Roasted)	90	0.90
Breadfruit Seeds (*Ukwa*)	150	1.50
Nuts and Seeds		
Groundnuts (Boiled)	135	1.35
Dika Nut Soup (*Ogbono*)	440	4.40

Table 2.0: 10g and 15g carbohydrate exchange list of the selected local foods commonly consumed in Nigerian in weight with household measures (mc = small evaporated milk can; Tbsp = level tablespoon)

Food Samples	10 Carbohydrates		15g Carbohydrates	
	Weight of cooked food (g)	Household measures	Weight of cooked food (g)	Household measures
CEREALS AND GRAIN PRODUCTS				
Spaghetti	86.54	1 mc	129.81	1½ mc
Maize	68.83	½ mc	103.24	1 mc
Macaroni	89.46	1¼ mc	134.19	2 mc
Brown rice	69.49	¾ mc	104.24	1 ¼ mc
Wheat Flour	40.69	¼ mc	61.03	½ mc
LEGUMES				
White Beans	126.90	4 Tbsp	190.36	7 Tbsp
STARCHY FRUITS, ROOTS AND TUBERS				
Sweet Potatoes	47.06	2 med. thin slices	70.59	3 med. thin slices
Water Yam	35.84	¾ large thin slice	53.76	1 large thin slice
Yam, Fried	13.01	½ large thin slice	19.52	1 large thin slice
Yam, Roasted	23.44	1 small thin slice	35.16	1 med. thin slice
Ripe Plantain, Boiled	65.22	½ small finger	97.83	1 small finger
Ripe Plantain, Roasted	20.09	¼ small finger	30.13	½ small finger
Breadfruit Seeds (*Ukwa*)	51.30	2Tbsp	76.95	3Tbsp
NUTS AND SEEDS				
Groundnuts	75.55	1 mc	113.32	1½ mc
Dika Nut Soup (*Ogbono*)	200.64	----------	300.96	--------
FRUITS				
Pineapple	83.33	4 egg size cubes	125	7 ½ egg size cubes
Guava	62.50	¼ med. Size	93.75	¾ med. Size

In Table 2.0 the 10g and 15g carbohydrate exchange list of selected local foods commonly consumed in Nigeria in weight and household measures are shown. In the cereal group, Maize had the highest weight (of 89.5g and 134.2g) 10g and 15g carbohydrate, while wheat Flour had the least weight (of 40.7g and 61g) respectively. In the legumes group, white Beans weighed (127g and 190.4g) for 10g and 15g carbohydrate respectively. For the starchy fruits, roots and tuber group, ripe Plantain (boiled) had the highest weight (of 65.2g and 97.8g) for 10g and 15g carbohydrate while the lowest weight (of 13g and 19.5g) was observed for yam (fried) respectively. For the nuts and seeds group, *Ogbono Soup* had the highest weight (of 200.6g and 301g) for 10g and 15g carbohydrate, while the lowest weight (of 76g and 113.3g) was observed for Groundnuts respectively. For the fruit group, Pineapple had the highest weight (of 83.3g and 125g) for 10g and 15g carbohydrate, while Guava had the lowest weight (of 62.5g and

93.8g) respectively.

This study shows that wheat flour, fried yam, groundnuts and guava provided the least weight that would yield 10g and 15g carbohydrate for the cereal and grains, starchy roots and tubers, nuts and seeds and fruit food groups respectively.

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