

## Review

# Dietary Recommendation in Diabetes Care: Carbohydrate Counting and Caloric Content of Nigerian Foods

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## ABSTRACT

The prevalence of diabetes mellitus is rising globally and even more in low and middle-income countries such as Nigeria. Optimal management of the disease is important to improve survival and prevent or delay its complications. Lifestyle management is a standard universal approach in optimizing the care given to diabetic patients. Dietary management is the central link in lifestyle modifications of individuals living with diabetes. Medical nutrition therapy (MNT) is a systematic therapeutic approach of assessing the nutritional needs of an individual, determining nutritional goals, counselling the clients on how to achieve the goals, prescribing and monitoring meal plans to achieve the goals. It is evidence-based, effective and highly recommended. All carers of the diabetes patient, including the health workers and the family members of the patients, need to have basic understanding of medical nutrition therapy but the efforts should be coordinated by licensed dietitians. There are evidences that adherence to prescribed calories is effective in the control of cardiovascular risk factors such as blood glucose, weight, lipid profile and blood pressure. However, prescription of calories should be based on thoughtful consideration of the nutritional needs, weight goal, personal preferences and tastes and cultural practices of individuals living with diabetes mellitus. Food pyramids give a graphical illustration on the recommended classes and servings of food. Six to eleven servings per day of carbohydrates, 3-5 servings per day of vegetables, 2-4 servings per day of fruit, 2-3 servings per day of dairy products and 2-3 servings per day of fish are the recommended proportions of the different classes of foods for an adult on an average of 2000 calories. Carbohydrate counting, taken with appropriate insulin dosing and physical activity, has been demonstrated to be effective in optimizing the glycaemic control of patients on multiple daily insulin injections. There are challenges in doing this in Nigeria due to lack of food labels. The caloric contents of common Nigerian foods are highlighted so as to help in achieving dietary goals.

### Keywords

Diabetes care; Dietary approach; Carbohydrate counting; Caloric content of Nigerian foods.

## BACKGROUND

Lifestyle management is the pedestal of optimal care in individuals with diabetes and dietary approach is the central theme of lifestyle modification. Healthy eating is the cornerstone of glycaemic control in diabetes mellitus.<sup>1</sup> Glycaemic control refers to the methodical approach to achieving the glucose targets (Fasting blood glucose, postprandial glucose and glycated haemoglobin) of patients with diabetes mellitus depending on the adopted guide-

lines. However, recommendation about dietary management may be difficult in Nigeria, where the number of registered dietitians under employment is limited. Also, there is lack of knowledge of the caloric contents of Nigerian foods. The notion of 'diabetic diet' which involves a lot of dietary restriction is being replaced with 'healthy diet' which is having a dietary plan adequate in nutrients and moderate caloric and fat contents. So, the 'healthy diet' is the recommended diet for everyone. This makes the individuals living with diabetes mellitus feel socially acceptable while also en-

couraging them to comply with their recommendation.

Patients with diabetes are expected to see the dietitians, at least, at diagnosis. However, in low resource settings, availability of professional dietitians under employment is limited so, it is important for all carers of patients with diabetes, including their family members, to understand the dietary approach to their care. Nigeria is a multicultural society with various kinds of foods and food preparations.<sup>2</sup> Dietary management in patients with diabetes and prediabetes is aimed not only at optimizing glycaemic control but also at control of other cardiovascular risk parameters such as weight, lipids and blood pressure.<sup>3</sup> Consumption of excess calories, even without causing hyperglycaemia, is an independent cardiovascular risk.<sup>3</sup> Dietary prescription involves a collaboration among the patient and his family, the dietitian and the physician based on health targets (such as weight and blood glucose readings), cultural values, lifestyle, dietary preference and taste.<sup>4</sup>

Healthy sources of carbohydrates available in Nigeria include whole grains (such as rice, maize and millet) and legumes (such as beans and groundnut). Low fat dairy foods such as milk or cheese are also recommended. As healthy as they are, studies have demonstrated that the knowledge of the health benefits as well as the consumption of fruits and vegetables is very low among Nigerians despite the extensive availability of varieties of fruits and vegetables.<sup>5</sup> Consumption of sugary beverages with extra calories is often discouraged but a study documented a high-level of consumption of sweetened beverages among Nigerians.<sup>6</sup> Saturated fats are discouraged but food sources such as organ meat (kidney, intestine and liver) rich in saturated fats are commonly consumed in Nigeria.<sup>7</sup> High salt intake (more than 5 grams of salt per day) which is unhealthy is prevalent in Nigeria and many other sub-Saharan countries, as reported by a meta-analysis.<sup>8</sup> The plate method of meal planning recommended by the American Diabetes Association (ADA) involves filling half of the serving plate with vegetables, a quarter of the plate with carbohydrates and the remaining quarter with proteins.<sup>9</sup> A serving of dairy and a cup of water can accompany the plate. This is not practiced among Nigerians with or without diabetes mellitus.<sup>7</sup>

Carbohydrate counting has beneficial effects on glycaemic control.<sup>10</sup> It helps in determining the appropriate insulin doses to prevent fluctuating glycaemic patterns. It adds flexibility to the management and engenders compliance. In Nigeria, more efforts are tailored towards controlling glucose excursions by appropriately adjusting insulin doses rather than teaching and practicing carbohydrate counting.<sup>1</sup> This is partly due to the fact that there are insufficient data on the carbohydrate and caloric contents of Nigerian foods and the methods of food preparation for consumption vary remarkably from one region to the other.<sup>11</sup>

It is a common dietary advice to tell patients to lower their caloric intake. In the developed world, appropriate food packaging and compulsory food labelling make it relatively easy for patients to achieve their calorie targets.<sup>12</sup> In Nigeria, foods are often prepared in households or at restaurants without any form of food labelling.<sup>13</sup> Even among the elites who sometimes consume pack-

aged meals, a study reported that they rarely check the labels and the few who check find them confusing.<sup>13</sup> Variation in species and variants of the crops, food processing and food preparation also tend to make estimation of food caloric content inaccurate, hence why it is rarely focused on.<sup>12</sup>

## MEDICAL NUTRITION THERAPY

Medical nutrition therapy (MNT), also known as therapeutic nutrition is an evidence-based and systematic process of assessing the nutritional status and requirements of an individual, setting nutritional goals, counselling on how to achieve the goals, prescribing and monitoring meal plans to achieve the goals.<sup>14</sup> The terminology 'medical nutrition therapy' was first used by the ADA in 1994 but the concept of recommending diets for patients with diabetes dates back to antiquity.<sup>14</sup> Several researchers have documented the clinical benefits of MNT in the management of diabetes.<sup>14</sup> Evidences from observational studies, cohort studies, randomized clinical trial and meta-analyses are in support of this assertion. Apart from the clinical benefits, economic studies have also found MNT to be cost-effective.<sup>15</sup>

While it is essential that every member of the diabetes care team knows about nutrition and is able to offer valuable nutritional advice, it is recommended that the dietitian should spearhead medical nutrition therapy.<sup>16</sup> In fact, a meta-analysis documented that diabetic patients who received MNT from a registered dietitian had more reduction in glycated haemoglobin (HbA1c) compared with those who received dietary advice from nurses or physicians.<sup>17</sup> In Nigeria, there are insufficient numbers of dietitians to provide MNT for all the diabetic patients as most of the registered ones cluster in urban centres, mostly at the secondary and tertiary levels of care.

Medical nutrition therapy emphasizes individualized care because fixed ratios of carbohydrates, proteins and fats cannot be applied to everyone with diabetes due to differences in their nutritional requirements.<sup>18</sup> Mediterranean diet has been found to be the most effective diet type in terms of lowering of HbA1c.<sup>19</sup> Mediterranean diet refers to the meal plans commonly consumed among countries bordering the Mediterranean Sea. There is no universal definition of Mediterranean diet, but it is essentially based on whole grains, fruits and vegetables, dairy products, use of healthy fats such as olive oil and minimization of red meat consumption.<sup>20</sup> The pattern of eating among patients with diabetes in Nigeria is different from the Mediterranean diet as it is based on calorie-dense high carbohydrate diet.<sup>21</sup> Also, in a developing nation like Nigeria, where there is paucity of dietitians under employment, fixed ratios of food classes is still being practiced. About 45-65% of the total daily calorie is allotted to carbohydrates, fats constitute about 25-35% and proteins constitute about 15-20%.<sup>1</sup> It is also a common misconception among the diabetic population that consuming carbohydrates is tantamount to hyperglycaemia so, they tend to avoid carbohydrates or minimize its consumption.<sup>1</sup>

Prior to the landmark discovery of insulin and its com-

mercialization, a very low caloric diet, known as Allen diet, was used in treating diabetes.<sup>1</sup> The advent of insulin therapy means carbohydrate content of the meal could be increased to as much as 50%. However, in Nigeria, the composition of dishes consumed by diabetic individuals is still dependent on the socioeconomic status of the patient, cultural food beliefs, seasonality and availability of food.<sup>22</sup> In addition, most of the meals are composite diets so, it is difficult to synthesize data on the caloric content of the meals.

### PRESCRIPTION OF DIETS FOR PATIENTS WITH DIABETES

It is recommended that prescription of diet for people living with diabetes should not be fixed but should depend on nutritional assessment, requirement, goals, individual preferences and the cultural milieu.<sup>23</sup> The goals of dietary prescription are to improve cardiometabolic parameters (blood glucose, weight, abdominal circumference and blood pressure) and prevent, delay the onset or prevent the progression of diabetes complications.<sup>24</sup> These are not to be achieved at the expense of pleasurable enjoyment of meals and disregard of cultural values and beliefs. Attention should be placed on the unique needs of special people such as the growing child or adolescent with type 1 diabetes, pregnant or lactating women and patients on meal-related medications such as insulins or insulin secretagogues to avert both hyperglycemia and more importantly, hypoglycaemia.<sup>24</sup>

Studies have shown that with good adherence, prescribed diet can lower HbA1c by 1-2% within 3-6-months.<sup>25</sup> In obese or overweight patients, the prescription should be aimed at moderate weight loss (5-10% of present body weight).<sup>24</sup> This is achievable with a low carbohydrate and low fat diet. Carbohydrates with low glycemic index should be prioritized. Glycaemic index of food is defined as the extent of rise of blood glucose

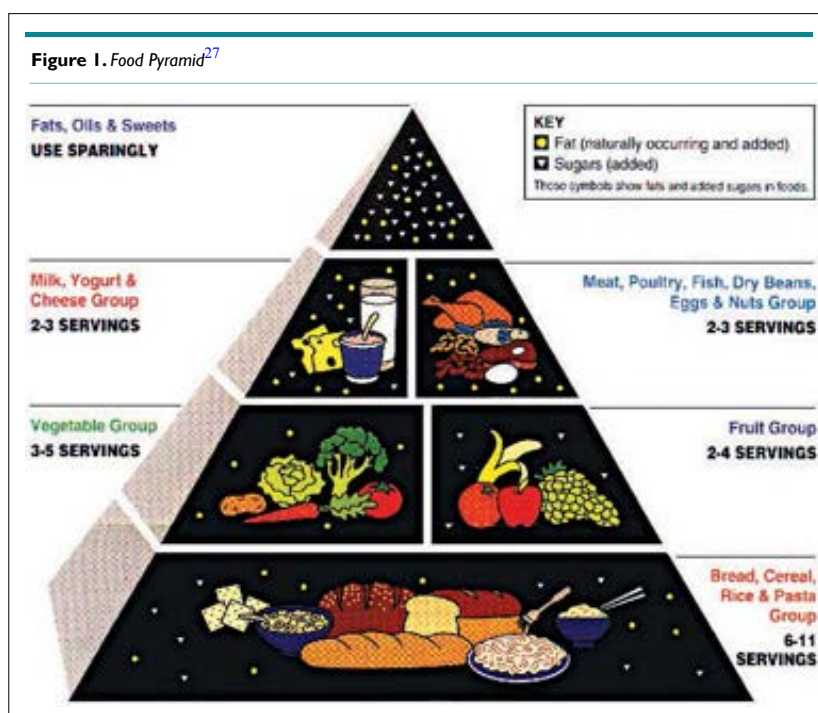
after taking the food compared with a rise in glucose after ingesting a reference food (usually glucose or white bread).<sup>24</sup> The glycemic index of a food multiplied by the amount of carbohydrate in the food gives the glycaemic load.<sup>24</sup> Whole grains and legumes are good sources of carbohydrates because they have low glycaemic indices.

Considering prescription for fats, saturated fats should be limited to <7%, trans-fat is better avoided altogether while cholesterol should be limited to <200 mg per day.<sup>24</sup> Monounsaturated fat is highly recommended. High protein diets are not recommended. Good quality proteins provide the 9 essential amino acids. Examples of quality protein that are available in Nigeria are fish, eggs, milk and poultry. Mineral or vitamin supplementation to the diets of people living with diabetes is not recommended.<sup>24</sup> However, special groups such as elderly, pregnant or lactating women and individuals on very low calorie diet may benefit from supplementation.<sup>24</sup>

### FOOD PYRAMID

Adequate diet is the diet that provides needed nutrients in a proportion that meets the physiological needs of an individual. Food pyramid is the scheme used to depict food classes and the appropriate proportion of each class.<sup>26</sup> The pyramid is divided into layers and each layer corresponds to the relative amount and class of food. It is triangular and graphically represents food proportions designed in a way to support healthy eating. The base is represented by carbohydrates, and progressing upwards, this is followed by vegetables, followed by proteins and lastly fats and sweets.<sup>26</sup> The progression from the base to the tip represents the relative quantity of each class to be consumed with the base representing the largest quantity and the tip representing the smallest quantity.

Generally, it is recommended to have 6-11 servings per



day of carbohydrates (rice, bread, cereals), 3-5 servings per day of vegetables, 2-4 servings per day of fruit, 2-3 servings per day of dairy products and 2-3 servings per day of fish.<sup>26</sup> The concept here is that no single food has all the needed nutrients in adequate doses and appropriate variety is the key. This is illustrated in Figure 1 below.<sup>27</sup>

### CARBOHYDRATE COUNTING

This is a technique used by patients with diabetes to estimate the amount of carbohydrate in their meals. The carbohydrate quantity is determined in grams and a serving of carbohydrate is about 15 grams.<sup>28</sup> The health care giver and the patient agree on how much carbohydrate to aim at so as to reach the nutritional goal. Appropriate combination of carbohydrate counting, physical activity and insulin dosing is important for optimal glycaemic control. Carbohydrate counting entails keeping track of the carbohydrate in the diets. It helps to stay healthy and prevent or delay the onset of complications of diabetes. The amount of carbohydrates is often inscribed on the food label.

Carbohydrate counting is illustrated as follows. Assuming the daily calorie recommendation for a man is 1800 Kcal per day, it is recommended that carbohydrate should constitute about 50% of this total calorie level, thereby making total calories from carbohydrate, in this instance, 900 Kcal.<sup>1</sup> Four kilocalories (Kcal) is derived from 1g of carbohydrate, therefore 900 Kcal will be derived from 225 g of carbohydrate. This can be divided into 3 meals and 1 to 2 snacks.

In Nigeria, carbohydrate counting is not usually advised during a dietary counseling session. Instead the recommendation used is to restrict one or more forms of carbohydrate.<sup>1</sup> Most foods consumed are prepared at home or bought unpackaged or without a food label. However, it is now known that the amount of carbohydrate eaten is more important than the type because any carbohydrate consumed in sufficient quantity is capable of raising the blood glucose dramatically.<sup>1</sup>

Carbohydrate counting adds flexibility to the meal plans,

diet choices and timing of meals. It enables the patients with diabetes to take charge of their health and also to estimate amount of insulin required per certain amount of carbohydrates.<sup>28</sup> Carbohydrate counting also assists the patient to observe how the blood glucose responds to different types of carbohydrate and how to respond to it appropriately by adjusting the insulin dose. It is however cumbersome for some people. Moreover, in low resource settings, such as Nigeria, where food labels are the exceptions and there are wide variations in food preparations, it is very difficult to practice food counting without the aid of a registered dietitian.<sup>13</sup>

### CALORIE CONTENTS OF COMMON NIGERIAN FOODS AND DRINKS

Foods are often culturally determined and Nigeria is a multicultural nation but there are certain foods that are commonly consumed in most households in Nigeria. There is a need to pay attention to calories so as to meet the dietary goals. Normally, a physically active man requires about 2000 calories per day and an average physically active woman requires 1800 calories per day.<sup>24</sup> The main challenge of estimating calories in Nigeria foods is the varied methods of food preparations. Another challenge is the standard of measurement, which tends to vary also. Nutrition education is scarcely available to the populace, especially the rural area dwellers.<sup>29</sup> The tables below show the estimated calories in various Nigerian foods and drink (Tables 1, 2, 3 and 4)<sup>30-33</sup>

**Table 1. Estimated Calories of Foods Consumed as Morsels ('swallows') in Nigeria**

Swallow	1 Milk Tin of Flower or Flakes
Amala	1 milk tin of yam flour=350 calories
Foofoo (fufu/akpu)	1 milk tin of cassava flour=330 calories
Garri (Eba)	1 milk tin of cassava flakes=360 calories
Pounded yam	Slices of yam equivalent to 1 milk tin of yam flour=400 calories
Semovita	1 milk tin of wheat flour=600 calories
Tuwo (white corn meal)	1 milk tin of corn flour=450 calories

**Table 2. Estimated Calories in Beverages ('Drinks') in Nigeria**

Alcoholic Beverage	Estimated Calorie Content per 100 ml of Beverage	Caloric Contents in the Bottles Commonly Sold
Gulder	55 calories	1 bottle (600ml)=330 calories
Guinness	45 calories	1 bottle (440 ml)=200 calories
Heineken	35 calories	1 bottle (440 ml)=155 calories
Red wine (13% alcohol)	70 calories	1 bottle (750 ml)=525 calories
Champagne	75 calories	1 bottle (750 ml)=560 calories
<b>Non-Alcoholic Beverage</b>		
Coca-cola coke	42 calories	1 bottle (600ml)=250 calories
Fanta	36 calories	1 bottle (600ml)=220 calories
Pepsi	40 calories	1 bottle (600ml)=240 calories
7 up	42 calories	1 bottle (600ml)=250 calories
Hollandia yoghurt	66 calories	1 bottle (1000ml)=660 calories
Maltina	56 calories	1 bottle (330 ml)=190 calories
Chi exotic	52 calories	1 bottle (1000ml)=520 calories

**Table 3. Estimated Calories in Other Staple Foods in Nigeria**

Food	Estimated Calorie Content per 100 g of Food	Caloric Contents in Specific Measures
Rice	150 calories	1 tablespoon=15 calories
Beans	140 calories	1 tablespoon=15 calories
Yam	120 calories	1 tuber=highly variable
Bread	300 calories	1 slice=120 calories
Egg	150 calories	1 egg=70 calories
Granulated sugar	-	1 tablespoon=30 calories
Sugar cube	-	1 cube=10 calories
Honey	-	1 tablespoon=60 calories
Powdered milk	-	1 tablespoon=40 calories
Snail	100 calories	-
Palm oil/coconut oil	-	1 tablespoon=40 calories
Akara (beans cake)	-	1 roll=70 calories
Pap (akamu)	-	1 tablespoon=90 calories
Roasted corn		1 medium size=100 calories
Goat meat	100 calories	-
Margarine/butter	-	1 tablespoon=100 calories
Egusi soup		1 serving=500 calories
Ewedu soup		1 serving=100 calories
Okra soup		1 serving=150 calories
Bitter leaf soup		1 serving=150 calories
Oha soup		1 serving=180 calories
Stew		1 serving=200 calories

**Table 4. Estimated Calories in Beverages ('Drinks') in Nigeria**

Fruits	Estimated Calorie Content per 100 g of Fruit	Approximate Calories per Average-sized Fruit
Apple	55 calories	95 calories
Banana	85 calories	105 calories
Orange	50 calories	65 calories
Pineapple	50 calories	450 calories
Watermelon	30 calories	450 calories
Mango	60 calories	200calories
Garden egg	25 calories	140calories
Pawpaw	80 calories	180 calories

## CONCLUSION

Diabetes mellitus is a common chronic disease globally and specifically in Nigeria. A central approach in its management is lifestyle modification. Dietary management is an integral part of the lifestyle modifications. Medical nutrition therapy involves assessing nutritional needs, setting nutritional goals and embarking upon dietary actions to achieve these goals. It also includes monitoring of the patients to ensure the dietary goals are achieved but not at the detriment of the health of the individuals. Dietitians are the primary professionals recommended to lead this effort but the registered dietitians in Nigeria are scanty and mostly distributed in the urban areas.

Food pyramids is a graphical representation of the balanced nutritious diets. Prescription of calories involves taking cognizance of factors such as food availability, weight targets, individual preferences and cultural beliefs and practices. The estimated caloric contents of the common Nigerian foods are highlighted in the tables. However, the exact caloric content is affected by species of crops, food processing and preparations and cultural practices.

## CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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