

## Efficacy of breadfruit flour meal in the management of Diabetes Mellitus

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### Abstract

The main objective of this study was to determine the potency of meals prepared from breadfruit flour as a major source of carbohydrate in the management regime of type II diabetes mellitus. Ten (10) diabetic patients were involved in the study. After feeding the patients with cake, biscuits and puddings made from breadfruit flour as a major food ingredient, for a period of three days, the results showed that there was a significant reduction in the collective blood sugar levels of the patients. The mean blood sugar level of the patients was observed to drop from 20.19 mol/L to 18.75 mol/L. The glucose response curve revealed that diabetic patients who were fed with breadfruit flour meal showed positive post prandial effect as a result of reduced sugar level. In conclusion, the observation of the response glucose curve and glycemic index of breadfruit gives a supportive clue as to why breadfruit flour meals should be adopted in the menu list of diabetic patients as a control towards the management of diabetes mellitus conditions.

**Keywords:** Breadfruit Flour Meal; Diabetes mellitus; Diabetes management; Blood sugar

### 1. Introduction

Diabetes mellitus is a metabolic disorder that occurs when the pancreas ceases to produce sufficient insulin (the hormone that regulates blood sugar) or on the other hand when the body cannot effectively use the insulin it produces [1]. Sometimes diabetes can also occur due to abnormal production of one or more hormones, a deficiency of an enzyme or a modification of excretion [2]. Therefore, it is on the basis of the need to satisfy the nutritional needs of most patients that planned and modified diets are of paramount.

Diabetes can be classified as either type I; which is characterized by lack of insulin production, or type II; which comes as a result of the body's inability to use up the insulin produced [2, 3] In type I diabetes, physical exercise plays a fundamental role in both physical and mental development, in addition improving insulin sensitivity and plasma glucose control as well as dietary management which will involve the modification of normal diets and the use of low glycemic index foods are also important [2, 4, 5].

Symptoms and signs associated with diabetes includes, hyperglycaemia (high blood sugar), hypoglycaemia (low blood sugar), polydipsia (excessive thirst), polyuria (frequent urination), polyphagia (excessive hunger), weight loss, fatigue, skin and genital itching, dry mouth, stomatitis, visual disturbances, poor wound healing, recurrent infections, erectile dysfunction and balanitis [2]. It is of therefore of great importance that, diabetic meals be modified to develop a healthy eating plan which will help in the control of blood sugar (glucose), weight management and heart control disease factors such as high blood pressure and high blood fat [1, 7]. This is because diabetic diets require a low carbohydrate and fats

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with increased protein content. Although the carbohydrate proportion should be reduced but not totally eliminated to a level of hypoglycaemia, since carbohydrate is the main energy source in the body and fuel for the brain [8].

Several studies such as [5, 9, 10, 11] etc., have shown some carbohydrate-based foods to have low glycemic indices slowly digestible and resistance starches should be included in diabetes menu lists to create a meal diversity plan. The glycemic index (GI) therefore, classifies carbohydrate from various sources according to postprandial (happening after a meal) level of blood glucose [12]. The glycemic index (GI) therefore measures how a carbohydrate containing meal raises blood sugar level by ranking it on a scale from 0 to 100 according to the extent to which they raise blood sugar after eating. This implies that food with high GI are those that are not readily absorbed into the cells after digestion and bring about marked fluctuations in blood sugar levels [8].

The identification and application of local and underutilized food commodities with low GI could be one of the effective ways of to control hyperglycemia in diabetic patients [13]. Furthermore, according to the [14], consumption of some indigenous foods crops such as breadfruit has the potency of helping to control some metabolic abnormalities in diabetes mellitus condition by reducing the blood sugar levels due to their high soluble fibre contents [15]. It therefore, imperative due to the functional quality of breadfruit to determine the efficacy of meals prepared from it flour for management of diabetic condition in patients in developing countries specially in Nigeria where this plant is grown and the fruit, breadfruit is readily available and at very cheap cost.

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## 2. Material and methods

### 2.1. Area of study

The study was conducted in the University of Uyo Health Centre (UUHC). The University of Uyo Health Centre is a secondary Health care facility with 21 beds located along Ikpa road, in Uyo Local Government Area of Akwa Ibom State Nigeria, situated between Latitudes 4-14°N and Longitudes 2-16°E. The health care facility started in the seventies as a Clinic and was managed by the then College of Education, it was also manned by a visiting Physician who attended to the health needs of both the staff and the students. Today, the clinic is well equipped and inspected and has been given accreditation by the following bodies; National Health Insurance Scheme (NHIS) Pharmaceutical Council of Nigeria (PCN) and the National University Commission (NUC).

### 2.2. Processing of Raw Breadfruit (*A. altalis*)

Freshly harvested Breadfruits were washed in clean water to remove adhering latex and dirt and subsequently peeled, sliced into pieces of about 5mm for blanching. Blanching was done by soaking the sliced specimen into 0.02% concentration of  $\text{KHSO}_3$  at a temperature of 50°C for 5minutes after which the specimen was oven-dried at the temperature of 50°C for 12hrs.

### 2.3. Breadfruit Flour Production

After the specimen was well dried, it was subjected to milling and passed through sieving with a mesh size of 55 $\mu\text{m}$  to obtain a fine powder flour which was then packaged in an air-tight cellophane bag and stored in an air-tight plastic container at 37°C (room temperature). This method was adopted from [16].

### 2.4. Breadfruit flour Meal preparation

The breadfruit flour which served as the main source of carbohydrate was used in the preparation of dough balls and crackers flakes. The following recipe were added as ingredient for the biscuit; (Flour = 200g), (Sugar = 100g), (Butter = 25g), (Milk = 150ml), (Lemon juice = 1teaspoon). The recipe was well baked and presented as meals.

### 2.5. Sample size

In the assessment of the efficacy of breadfruit flour meal towards the management of diabetes mellitus, ten (10) diabetic patients in the UUHC were consented for participation in the study which they willingly agreed.

### 2.6. Assessment of the Efficacy of Samples

The food products were administered in morning (as breakfast) for a period of three consecutive days to the diabetic mellitus patients in the in-patient's wards. The meals were consumed after testing for the fasting glucose levels at intervals of 30mins, 60mins, 90mins and 120mins of consumption of the food products using the standard AIC test, Fasting plasma glucose test and Oral Glucose Tolerance test.

## 2.7. Data Analysis

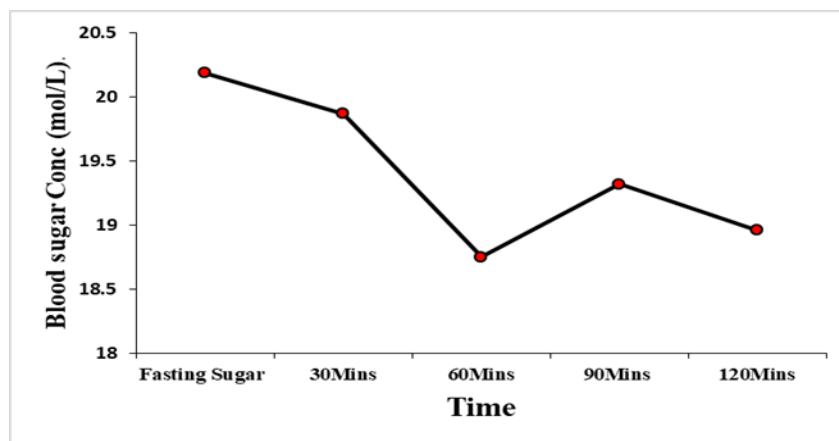
The IBM statistical software SPSS version 20 software was used to determine the Least Significant Difference (LSD) of the blood sugar fluctuations of the patient and the result was presented using graphical illustration.

## 3. Results and discussion

### 3.1. Product feed performance on Diabetic Patients

The result of the mean difference in the time-response variations in random blood sugar (RBS) level of diabetic patients as presented in fig 3. 1 shows that after being fed with breadfruit flour meal for three consecutive times, there was a marked digression in the collective blood sugar levels of the patients. The result had revealed that mean blood sugar level of the patients dropped from 20.19 mol/L to 18.96 mol/L after 120mins of feeding. This observation seems to agree with the propositions by [17, 18], who stated that breadfruit has the potency of helping to control some metabolic errors in diabetic patients, by reducing the blood sugar levels due to probably soluble their high fibre contents. The evaluation of the glycaemic index of breadfruit flour (65.30) shows that even though the values were a little higher than the glycaemic index of the control flour (wheat flour = 62.22), this food commodity was still within the tolerance feeding range of diabetic patients.

The result of this studies also gives a predictive clue that meals which help to low type II diabetes could proof effective towards the management of these health condition on the long run, as some food can also cause cancer if consume for a long period of time [18]. Although there is a dearth of literature on the use of breadfruit flour as a major source of carbohydrate for the management of diabetic patients, care should be taken when preparing this meal avoid the introduction of adulterants which advertently could affect the overall potency and performance of the functional properties of breadfruit diets. The mean differences in the responses of blood sugar levels of patients observed during the study is presented in figure1 below.



**Figure 1** Response curve of breadfruit meal consumption by diabetic patients (Duncan test at  $p < 0.05$ )

**Table 1** Glycaemic Index (GI) of from Breadfruit flour

Flour	Carbohydrate	Glycaemic Index
Breadfruit flour	65.30	Intermediate
Wheat flour (control)	62.22	Intermediate

GI key: High =  $>70$ , Intermediate =  $>55$  to  $<70$ , low =  $<55$

## 4. Conclusion

Although there are a lot of misconceptions about diabetes mellitus everywhere, the studies seek to show that diabetes mellitus (type II) can be managed with some specific indigenous food together with a fair drug administration. Thus this information can be of great help in the management of the diabetes mellitus (type II) in the society among the employers, employees, in schools, hospitals, churches and families for resultant optimum health and performance in any particular

community in the developing countries with special relevance to Nigeria where breadfruit tree grows as indigenous readily available low cost plant.

### *Recommendation*

It is therefore recommended that seminars, workshops and media enlightenments should be carried out to educate different communities on how to manage diabetes mellitus (type II) condition with specific indigenous food like breadfruit flour for optimum result.

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## **Compliance with ethical standards**

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### *Disclosure of conflict of interest*

This research was only conducted as a contribution to academic knowledge. I hereby declare that there is no conflict of interest for whatsoever reason among the co-authors and other researchers in the publication of this research article.

### *Ethical approval*

The ethical approval of these research work was granted by the ethical research committee of the University of Uyo with Ref No. UU/DHS/EC/VOL.1/003.

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