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Dietary Educational Program and Its Effect on the Knowledge of Patients with Diabetes Mellitus in Rivers State Nigeria

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ABSTRACT
Background: Diet is one of the key risk factors of T2DM because many nations have experienced dietary changes favoring increased calorie consumption due of urbanization and economic expansion. However, many diabetic patients still suffer the complications of diabetes mellitus because of their poor knowledge of the dietary management of diabetes mellitus. The purpose of this study was to ascertain the effects of a dietary educational program on the knowledge of diabetic patients. This study was carried out among patients with Type 2 diabetes mellitus in Rivers State University Teaching Hospital (RSUTH) and University of Port Harcourt Teaching Hospital (UPTH), Rivers State, Nigeria. This study used a quasi-experimental design. Multistage sampling techniques was used to enroll a total of 162 participants, with 81 in the Control Group (CG) and 81 in the Experimental Group (EG), while Rivers State University Teaching Hospital (RSUTH) and University of Port Harcourt Teaching Hospital (UPTH) served as EG and CG respectively. Both groups received equal intervention of personalized meal timetables and 2 weekly phone call follow-ups. Additionally, EG received Dietary education, using cooked and raw food demonstrations. Data was collected using a Semi-structured interviewer-administered questionnaire was used to collect data while the statistics analysis was conducted using SPSS version 22 statistical software with a p-value of <0.05 regarded as significant. Patients' QoL, knowledge were assessed at baseline and six months (P1 & P3). The knowledge was classified into "good" fair and "poor," At P1, EG had poor knowledge (EG: 17.3%) while CG had 18.5%. Knowledge at P3, 0% of patients in EG had poor knowledge while 17.3 % was seen in CG there was an improvement in both groups with p=0.001. Because of the educational program, the patients' knowledge was affected positively at the end of the program. However, EG had better knowledge because of the demonstration of food. Thus, dietary intervention programs improved the knowledge of the patients.

KEYWORDS: Diabetes, Knowledge, Experimental. Control, Group

INTRODUCTION

Nigeria is largely an agrarian country [1], in the early nineties, not much was known about DM in Nigeria, and traditionally, people connected DM to “curses” or “hexes” [2]. In addition, as far back as the beginning of the twentieth century, DM was characterized by Dr. Cook as being a rare condition in Africa. It is commonly established that DM, as a metabolic, endocrine disorder, is closely tied to carbohydrate, lipid, and protein metabolism. As a result, nutrition treatment forms a vital aspect of diabetes management and diabetes self-management education. Furthermore, more knowledgeable persons with diabetes have better attitudes toward the management of their conditions [3].

Knowledge is the familiarity, understanding, or comprehension of someone or something, including details, facts, descriptions, or talents that are picked up by education or experience, through seeing, finding, or learning. According to Medina-Ramirez [4], knowledge is information that has been contextualized in a given topic and may be used or applied. As a result, every piece of knowledge has a unique relationship with extra knowledge for each individual. To put it plainly, it is a need for all health-related behaviors, acts, and practices. Knowledge of dietary diabetes management of diabetics can be enhanced through different forms of dietary educational programs[5]

More than 5 million Nigerians suffer from diabetes, which is associated with high rates of morbidity and death in the country[2]. The prevalence rate of T2DM varies annually and regionally, despite a rise in the adult population in Nigeria [6]. According to the federation, Nigeria has 1.7 million cases of diabetes, making it the country with the greatest number of cases overall in West Africa [7].

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Nigeria has the largest number and burden of diabetes in Sub-Saharan Africa; hence, treating diabetes is of paramount importance to every Nigerian [8] The value of foods and natural antioxidants in preventing disease cannot be overemphasized. When individuals lack sufficient knowledge about diabetes; their health deteriorates, as many complications can be avoided through proper self-care management. Furthermore, lack of knowledge is widespread, particularly in Africa. This project identified four primary areas related to diabetes education: understanding what diabetes is; its physiopathology, signs and symptoms, and etiology; disease control including diabetic diets; and the dietary values of various indigenous foods.

A significant gap exists in both awareness and accurate information about type 2 diabetes causes and effects—largely influenced by cultural factors as well as educational attainment and socioeconomic conditions. Knowing what a disease entails helps individuals recognize morbidity risks, understand how behaviors influence these risks, respond appropriately to emerging symptoms, and seek timely healthcare interventions. In Africa specifically, there is a strikingly low level of basic awareness regarding the definition of diabetes.

Various specialized educational Research indicates significant unawareness about T2DM and its repercussions among many Africans. Dietary practices are influenced by several factors such as cultural beliefs, urbanization, lack of awareness, and the adoption of Western lifestyle pattern[9]. The American Diabetes Association recommends dietary management which has proven benefits; however adherence can often be challenging for patients. Studies highlight that structured education plays a crucial role in helping patients achieve glycemic control and sustain necessary lifestyle changes [10]. Early comprehensive education significantly reduces diabetic complications. To summarize: comprehending type-2 diabetes along with its proper management strategies is vital for achieving optimal glycemic control amongst individuals facing this condition and enhances empowerment while improving overall health outcomes through collaborative educational efforts involving clinicians and nutritional experts alongside patient-centric care models.

However, studies from various regions including Nigeria and Zimbabwe indicate that diabetic patients often have inadequate or poor knowledge about their condition [11, 12, 13]. For instance, in Umuahia, Nigeria over 70% percent of Diabetic patients believed poisoning was responsible for the development of symptoms [14]. Recognized worldwide as essential markers for managing DM effectively glycosylated hemoglobin level tests unfortunately remain poorly understood.

Despite the essential role, the dietary educational program plays in the nutritional management of T2DM, little is known about its practices in Rivers State Nigeria. Meanwhile, Nigerians living with T2DM are likely to have insufficient information about diabetes, poor dietary management, and higher morbidity/mortality[15, 16]. For example, up to two-thirds of patients with diabetes in Nigeria have uncontrolled blood glucose [17, 18] and there is a significant incidence of stroke, limb amputations, blindness, and premature mortality [19, 20] Hence this study is aimed at assessing the effectiveness of dietary educational programs on the knowledge of patients with Type 2 diabetes mellitus.

Study Design

This research employed a robust quasi-experimental study design featuring pre-intervention and post-intervention assessments among two distinct cohorts of patients diagnosed with Type 2 diabetes mellitus (DM). A carefully selected group of 162 individuals living with Type 2 DM participated in the study, drawn from two leading tertiary health institutions in Port Harcourt, Nigeria. We secured ethical approval for this significant research from both the University of Port Harcourt (UNIPORT) and the University of Port Harcourt Teaching Hospital (UPTH), along with the Rivers State University Teaching Hospital (RSUTH). In this vital investigation, RSUTH acted as the control group, while UPTH was designated as the experimental group, ensuring a comprehensive and thoughtful examination of the intervention's effectiveness. Participants in the experimental group received personalized meal plans along with a dietary education program that included physical food demonstrations. They also had two weekly phone call follow-ups to monitor adherence to their meal plans. In contrast, individuals in the control group were provided with personalized meal planning and the same two weekly phone calls, but their dietary education program did not include physical food demonstrations. The primary outcomes assessed in the study included knowledge, practice behaviors, glycosylated hemoglobin levels (HbA1c), and quality of life.

Study Area

The Port Harcourt metropolitan area in Rivers State served as the research area. It is located in the southern region of Nigeria.

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Study Duration
The study took place between September 2023 to May 2024.

Study Population
All patients aged 18 years and older with Type 2 Diabetes mellitus who were enrolled in tertiary hospitals in Rivers State, Nigeria, were included in the target population, provided they met the specified inclusion and exclusion criteria. The study's findings were applied to diabetes patients in Rivers State due to the cultural and linguistic similarities within the region.

Inclusion Criteria
- Participants had to be verified T2DM patients with a HbA1c that was higher than normal (7%) for a minimum of one year. When the patient's file was obtained for this project, the HbA1c levels were ascertained.
-Attending certain hospitals' endocrinology clinics
-Willing to take part in the research

Exclusion Criteria:
-Patients who did not follow through on the instruction;
- Patients who were involved in other initiatives.
-Additionally, critically sick patients were not included because, as stated by Slater [21], illness can affect blood glucose levels by affecting metabolism.

Sample Size Determination
The sample size was determined using a formula specifically designed for comparing outcomes between two independent proportions. The study aimed for a statistical power of 85%, with the goal of achieving a 25% reduction in the prevalence of suboptimal glycosylated hemoglobin (HbA1c) levels. Research conducted by Adebisi and colleagues indicated that 64% of patients with type 2 diabetes mellitus in Ilorin, Nigeria—a city situated in the southwest—had HbA1c values exceeding the normal threshold set at >7.2% for this study.

$$n = \frac{2(Z_{\infty}+Z_{\beta})^2 pq}{(p_1-p_2)^2}$$

was used in calculating the sample size with n=required sample size, Z∞ = standard normal deviate corresponding to a level of significance of 95% = 1.96 [9], Zβ = standard normal deviate corresponding to a power of 85% = 1.03 [9], P1= prevalence of HbA1c greater than 7.2. (= 64% in the control group; the present prevalence of suboptimal HbA1c) It was hypothesized that the intervention would reduce the proportion by 25%, And, P2= reduction in the proportion of HbA1c greater than 7.2 = 64% – 25% = 39% (i.e. prevalence/proportion expected in the experimental group)
An allowance of 15% was made for drop out, 15 % of 72 = 10.8. Final sample size = 72 + 10.8= 83 per group. Hence, at least 83 participants for control and 83 participants for experimental groups each were recruited to participate in the study.

Sampling Technique
A two-stage sampling technique was employed in the execution of this study.

Stage One
Determining the Experimental (Intervention) and Comparison (Control) Groups.
Rivers State has two tertiary health institutions. The participating health institutions were designated as either experimental or control groups through random assignment, utilizing a simple randomization method. Specifically, a coin-tossing technique was implemented, resulting in the University of Port Harcourt Teaching Hospital (UPTH) being assigned as the intervention hospital, while the Rivers State University Teaching Hospital (RSUTH) served as the control hospital.

Stage Two
In this phase, a purposive sampling technique was utilized to recruit participants for the study. The researcher engaged with diabetic individuals at the diabetic clinics within both selected health institutions (the experimental and control groups) on various occasions. After clearly explaining the purpose of the study and the procedures involved, those who expressed interest and met the inclusion

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criteria were recruited. The researcher collected the names, phone numbers, or contact details of support persons. The baseline recruitment process unfolded over approximately two consecutive months in both hospitals.

Data Collection Process

The data collection occurred in three distinct phases: the before-intervention/recruitment phase (P1), the intervention phase (P2), and the after-intervention phase (P3).

Before-intervention/recruitment phase (P1)

Research Assistants

In the before-intervention/recruitment phase (P1), six final-year nursing students, trained by the researchers, assisted with data collection across the selected health institutions. Each research assistant received comprehensive training on the specific aspects they were tasked with during the study. The questionnaire items were thoroughly explained, and the importance of maintaining objectivity was strongly emphasized.

Pre-intervention data were gathered from study participants in both the experimental and control groups who met the inclusion criteria.

Dietary Intervention Phase

At the diabetes clinics where the intervention took place, four registered dietitians worked together to create personalized one-week meal plans tailored to the food preferences of each patient. Patients were also informed about alternative food options in case they could not obtain the items specified in the meal plan. Nutrition health talks were conducted using both cooked and raw food items for demonstration purposes. Additionally, bi-monthly follow-up calls were carried out to assess adherence to the meal plans, allowing adjustments if any issues or concerns regarding compliance arose.

Intervention Bundle

Experimental Group Bundle

In this study, the intervention provided was a personalized meal schedule utilizing foods from the Diabetic exchange list (Exchange diet). This system, originally designed to assist diabetic patients in monitoring their carbohydrate intake, facilitates meal planning by estimating key macronutrients that influence post-meal blood sugar levels. The most significant revision of these lists was published in 1976, to enhance accuracy regarding caloric content, encouraging fat modification, and enabling individualized meal plans within the exchange framework.

The caloric intake for patients was carefully regulated, varying from 1200 to 2500 kcal daily depending on their specific nutritional needs. After calculating BMI, obese patients were restricted to approximately 1000-1200 kcal per day. Overweight individuals received approximately 1200-1500 kcal each day, those with a normal weight consumed around 1600-2000 kcal daily, while underweight patients were allocated roughly 2000-2500 kcal per day.

Bi-Monthly phone call follow-up

Participants received phone calls every two weeks to monitor their adherence to the meal plans. In cases where the participants were unreachable by phone, we contacted them through the phone numbers of their caregivers or spouses, or WhatsApp. The primary objective of these calls was to assess how well the participants were following the meal plans and to address any issues or complaints they might have had. Adjustments were made to the meal plans for some patients, while others who were struggling to comply were encouraged to adhere more closely to the guidelines.

Food Demonstration

During the dietary education phase, dietitians and research assistants utilized both cooked and raw food items to demonstrate appropriate serving sizes to the diabetic patients. The purpose of displaying the cooked foods was to help them visualize the portion sizes that would be suitable for their dietary needs.

Control Group Bundle

The control group received the same treatment as the interventional group, excluding the food demonstration.

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RESULT

Table 1: Social and Lifestyle History of the patients in the intervention and control groups.

Variable	Experimental n=81	Control n=81	X^2(P-value)
Exercise daily			
Yes	39(48.1)	28(34.6)	3.080(0.079)
No	42(51.9)	53(65.4)	
The pattern of fruit consumption			
Everyday	41(50.6)	44(54.3)	0.223(0.637)
Not everyday	40(49.4)	37(45.7)	
Smoke			
Yes	6(7.4)	0(0.0)	6.231(0.013)
No	75(92.6)	81(100.0)	
Family history of diabetes			
Yes	44(54.3)	32(39.5)	3.569(0.059)
No	37(45.7)	49(60.5)	

Table 1 shows a significant difference in the smoking habits of the respondents p=0.013, 6(7.4%) of the respondents in the intervention group smoked compared to 0(0.0%) of the respondents in the control group. The result showed no significant difference in the pattern of exercise p=0.079, pattern of fruit consumption p=0.637 and family history of diabetes p=0.059

Table 2: Pre-intervention (Baseline) Knowledge of Diabetes mellitus

Variable	Experimental n=81	Control n=81	X^2(P-value)
Can diabetes be cured?			
Yes	81(100.0)	81(100.0)	
Diet is important in control			
Yes	81(100.0)	81(100.0)	
Diabetes is caused by eating too much sugar and sweet food			
Yes	69(85.2)	81(100.0)	12.960(<0.001)
No	12(14.8)	0(0.0)	
Medication is more important than diet and exercise			
Yes	11(13.6)	15(18.5)	0.735(0.692)
No	14(17.3)	13(16.0)	
Don't know	56(69.1)	53(65.4)	
DM patients may develop a reduced blood flow rate to their feet			
Yes	81(100.0)	81(100.0)	
Don't know	9(11.1)	0(0.0)	
DM patients may develop foot ulcers			
Yes	81(100.0)	81(100.0)	

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Table 2 showed a significant difference in the knowledge of the cause of diabetes, 69(85.2%) of the respondents in the intervention group reported that diabetes is caused by eating too much sugar compared to 81(100.0%) of the respondents in the control group p<0.001. The respondents showed a significant difference in the question about the most important between medication and treatment p<0.0001, while 30(37.0%) of the respondents in the intervention group reported that DM patients may develop gangrene, 81(100.0%) of the respondents in the control group reported that DM patients may develop a reduced flow rate to their feet. All the respondents 81(100.0%) reported that DM patients may develop foot ulcers.

Table 3: Pre-Intervention Level of Knowledge of Diabetes

Variable	Experimental n=81	Control n=81	X^2(P-value)
Poor	14(17.3)	15(18.5)	0.042(0.979)
Fair	64(79.0)	63(77.8)	
Good	3(3.7)	3(3.7)	

Result from table 3 shows that 14(17.3%) of the respondents in the experimental group had poor level of knowledge at the beginning of the study. However, 15(18.5%) of the patients in the control group had poor knowledge. The difference was statistically significant at p=0.042

Table 4: Post-Intervention Knowledge of Diabetes Mellitus among the respondents

Variable	Experimental	Control n=81	X^2(P-value)
Can diabetes be cured			
Yes	81(100.0)	81(100.0)	
Diet important in control			
Yes	81(100.0)	81(100.0)	
Diabetes cause by eating too much sugar and sweet god			
Yes	5(6.2)	15(18.5)	62.137(<0.001)
No	63(77.8)	13(16.0)	
Don't know	13(16.0)	53(65.4)	
Medication more important than diet and exercise			
Yes	81(100.0)	81(100.0)	
Dm patients may develop reduce blood flow rate to their feet			
Yes	81(100.0)	81(100.0)	

Table 4 showed a significant difference on the knowledge of the cause of diabetes, 63(77.8%) of the respondents in the experimental group reported that diabetes is not caused by eating too much sugar and sweet food compared to 13(16.0%) of the respondents in the control group p<0.001. 81(100.0%) of the respondents in the control group reported that DM patients may develop a reduced flow rate to their feet. All the respondents 81(100.0%) reported that DM patients may develop foot ulcers.

Table 5: Post-Intervention Level of Knowledge of Diabetes

Variable	Experimental n=81	Control n=81	X^2(P-value)
Poor	0(0.0)	14(17.3)	76.481(<0.001)
Fair	23(28.4)	62(76.5)	
Good	58(71.6)	5(6.2)	

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The result from table 5 showed a significant difference in the post-intervention knowledge between both groups p<0.001, 58(71.6%) of the respondents in the experimental group had good knowledge compared to 5(6.2%) of the respondents in the control group.

DISCUSSION

The results of the study showed that the way people respond to diabetes is significantly shaped by their insufficient knowledge about the disease and how to plan their diets. For instance, Abdulrehman [22], pointed out that inadequate knowledge combined with cultural customs, financial constraints, and low educational attainment led participants in his study to adopt poor dietary habits detrimental to managing T2DM.

Dropkin [23], identified a notable knowledge gap in understanding diabetes mellitus (DM), which hinders people from comprehending how diet and exercise can alleviate the financial constraints associated with DM. From a comorbidity perspective, this lack of awareness also affects perceptions of related conditions like obesity.

In a quasi-experimental study conducted by Anyichie [24], using a pre-test and post-test non-control group design, data was obtained from 276 adults (64 male and 212 female). The University of Michigan Diabetes-Knowledge Test (UMDKT) was utilized to gather this information. After employing mean, standard deviation, and analysis of covariance for analyses, it was determined that Community Diabetes Assistants (CDAs) who received Health Education Intervention (HEI) demonstrated superior diabetes knowledge compared to those not exposed to HEI. Furthermore, there was no significant association between HEI with age, gender or level of education on the average diabetes knowledge scores among CDAs following the intervention.

whole grains, fruits, and vegetables; managing weight effectively; and limiting sugar and salt intake. Additionally, a study by Chawla [25] , showed that diabetes knowledge scores were significantly influenced by the age of CDAs. There is a significant difference in individuals aged 50 and above following HEI, with middle-aged and older adults remaining at the highest risk for developing T2D (Centers for Disease).

In their 2020 study, Chen [26] explored the effect of nutritional education interventions on patients with T2DM in rural areas of China. They found that knowledge scores significantly improved post-intervention among the rural population and suggested that such educational programs could enhance cooperation between hospitals and communities. Similarly, Odili and Oparah [27] noted increased respondent knowledge following an educational intervention. Conversely, research by Kassahun [28] and Pellulo [29] observed low knowledge scores after nutrition education programs were implemented. In contrast, Chukwuma's study[30] highlighted one key benefit of structured diabetes education equipping adults with an enhanced understanding of diabetes and its complications. The findings from Chen 's work[26] reiterated these conclusions regarding health interventions improving patient outcomes across similar demographics—underscoring their utility not just for lifestyle changes but also for fostering systemic cooperation within healthcare services. Studies conducted by Sainsbury [31] , along with Korsmo-Haugen [32].

CONCLUSION

The post-intervention knowledge of the participants in the experimental showed better improvement compared to the participants in the control group. This study showed that the intervention had a positive effect on the knowledge of the patients. It is crucial to educate patients on viewing the diabetes diet as an inclusive, healthy eating plan for the entire family rather than seeing it as overly restrictive. It is also important to encourage the use of food demonstrations during health talk sessions with diabetic patients because it will increase their understanding of dietary management of diabetes mellitus.

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