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Role of lifestyle modification in the management of diabetes: Insights from a cross-sectional study in Bayelsa state southern Nigeria

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Abstract
Lifestyle modification plays a crucial role in the effective management of diabetes. Diabetic patients oftentimes neglect this very crucial aspect of their management plan, which most times results in treatment failures. This study assesses the baseline knowledge of diabetic patients on the importance of lifestyle modification in the management of diabetes in Bayelsa State. It also assesses the lifestyle modification habits of these patients, drawing a reasonable conclusion on its role in relation to measured treatment outcomes. A continuous and total enumerative sampling was applied, involving 160 diabetic patients from 4 selected healthcare institutions in Bayelsa State, Nigeria. Ethical approval was sought from the Bayelsa Ministry of Health ethic committee. Data collection was by a self-administered structured questionnaire, analyzed with the aid of SPSS version 20. There were more females (53.8) than males (46.2) in the study with the majority of respondents (39.4) in the age group of 40-59 years. There was a statistically significant difference between lifestyle modification and education of the participants. Conclusively, knowledge of the role of lifestyle modification in diabetes management is low, with suboptimal lifestyle modification habits among diabetic patients in Bayelsa State. This study recommended education and awareness about diabetes among the patients.

Keywords: Diabetics, Bayelsa State, South, Nigeria, Ministry of Health

Introduction
Diabetes mellitus is an incurable chronic disease afflicting people of all races, sex, economic and social status, and all ages (Adeleke *et al.,* 2020) [1]. It is well known that diabetes self-care habits are critical to disease progression. Unfortunately, many patients do not follow the recommendations for diabetes self-management, even though they are important (Engler *et al.,* 2013) [5]. Making lifestyle changes can be challenging for people with diabetes. However, to achieve metabolic control in many people with diabetes, changes in diet and physical activity are essential. In the past, diet and exercise recommendations were rigid and allowed little flexibility; however, there are no longer any uniform guidelines that apply to all persons with diabetes. By personalizing treatment and focusing on metabolic outcomes, healthcare professionals can support people with diabetes to make lifestyle modifications and meet metabolic goals. The benefits of physical activity are often ignored. Current evidence suggests that a range of lifestyle strategies that individuals are more likely to adopt can help achieve metabolic goals (Franz *et al.,* 1997) [8].
Exercise can improve glucose tolerance and insulin sensitivity in several ways. In their review, (Borghouts and Keizer, 2000) [2] note that acute and chronic exercise can have a beneficial effect on blood glucose and insulin action**.** According to them, up to 2 hours after an acute exercise session**,** glucose uptake is increased in part by a non-insulin-dependent mechanism, likely related to an increase in GLUT-4 in cell membranes caused by doing exercise (Borghouts and Keizer, 2000) [2]. In addition, a course of exercise can increase insulin sensitivity for up to 16 hours afterward**.** Chronic physical exercise enhances the effect of exercise on insulin sensitivity through multiple adaptations of glucose transport and metabolism (Adeleke *et al.,* 2020) [1].

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Reducing dietary carbohydrates as a treatment for diabetes has had a checkered history. Before and largely after the discovery of insulin, which was the preferred treatment (Westman *et al*., 2006) [12]. Only a reduction in total energy intake can be compared with an effective dietary intervention. The benefits of carbohydrate restriction in diabetes are immediate and well-documented. Efficacy and safety concerns are long-term and speculative rather than data-driven. Limiting carbohydrates in the diet reliably lowers high blood sugar, doesn't require weight loss (although it's still the best way to lose weight), and leads to a reduction or elimination of medications. It has never shown side effects comparable to those seen in many drugs (Feinman *et al.,* 2015) [9].

In a recent study conducted by the University of Illinois at Chicago USA, researchers asked 45 study participants about their level of hunger before they ate a provided meal. Participants' blood sugar levels are then tested after eating. The study found that participants who ate carbohydrates when they were not hungry had significantly higher blood glucose levels than those who are hungry enough when they ate. This simply means that if a diabetic eats when not hungry, it can cause a spike in already elevated blood sugar levels, and make blood sugar control for the rest of the day more difficult (Corpeleijn *et al.,* 2016) [3].

Drinking alcohol in diabetics may worsen glycaemic control in these patients. For example, long-term alcohol consumption in well-nourished diabetics can lead to excessively high blood sugar. Conversely, long-term alcohol consumption in undernourished diabetics can lead to dangerously low blood sugar levels. Drinking too much alcohol, especially in diabetics, can also cause certain acids to build up in the blood, leading to serious health consequences. Finally, drinking alcohol can worsen the medical complications of diabetes, such as disorders of fat metabolism, nerve damage, and eye disease (Emanuele *et al*., 1998) [6].

Smoking is associated with the development and progression of diabetic nephropathy (Wingard *et al* 2002) [13]. Therefore, smoking status should be taken into account in clinical studies of the renal disease process. The association between smoking and retinopathy is less consistent. There is growing evidence that smoking affects insulin action. Several large prospective cohort studies have shown that the relative risk of all-cause mortality in smokers is twice as high as in non-smoking diabetic patients. A strong association was consistently found between years of pack use and complications. The theoretical benefit of smoking cessation has been calculated as the most effective (cost) risk factor intervention for patients with diabetes. However, the programs available to help diabetics quit smoking have not been successful (Muhlhauser *et al.,* 1994) [11].

Therefore, this study aims to investigate the role of lifestyle modification in the management of diabetes among diabetic patients in Bayelsa State.

Methods
Study Design: This study is a descriptive, cross-sectional, multi-centre, quantitative study.

Study Area: Respondents for this study were drawn from 4 healthcare institutions. They are; General Hospital Nembe, Cottage Hospital Bassambiri, General Hospital Kolo, and Cottage Hospital Akepilai. The 2 selected Cottage hospitals provide both primary and secondary healthcare services which include diabetes care, while the selected 2 General hospitals provide secondary care services including diabetes care, as well as specialist services such as surgical operations. General Hospital Kolo serves as a referral hub with linkages to five health-for-life centers and 13 ward health centers. General Hospital Nembe serves as a referral hub for other healthcare facilities in the Nembe environment. Two healthcare facilities, a general hospital, and a cottage hospital each were selected from Nembe and Ogbia local government areas of Bayelsa State. For Nembe LGA, General Hospital Nembe and Cottage Hospital Bassambiri were used as the study areas, while General Hospital Kolo and Cottage Hospital Akepilai were used as study areas for Ogbia LGA.

Study Population
The study population are patients in the 4 selected study areas, while those eligible to participate in the study are patients previously diagnosed with diabetes, who had been receiving their health and medical treatments in those healthcare institutions for at least 6 months prior to this study.

Sampling
Total enumerative and continuous sampling technique was used for this study. Four government-funded hospitals as described in the study areas were selected and used for this study. 2 hospitals each from Nembe and Ogbia LGA's of Bayelsa State, 1 General Hospital, and 1 Cottage hospital in each of the 2 LGA based on the level of activity, services rendered and availability of targeted registered diabetic patients. Cochran's (1977) formula was used to determine the sample size (Chaokromthong *et al*., 2021) [4]. This resulted in 57 diabetic patients being sampled from General Hospital Nembe, 65 from General Hospital Kolo, 17 from Cottage Hospital Akepilai, and 24 from Cottage Hospital Bassambiri, bringing the total number of sampled diabetic patients to 160.

Data Collection and Analysis
Data were collected using a structured self-administered questionnaire, which was modified to the final questionnaire after the pre-test. Data collection was done within a time frame of 6 months, which commenced on the 2nd of December 2019 and was completed on the 4th of June 2020. This was within the approved time frame of 12 months assigned by the Bayelsa State Health Research Ethics Committee (BSHREC). Each consecutive voluntary diabetic respondent that met the inclusion criteria for the study was administered the questionnaire after assenting to the informed consent form. Clinical parameter such as blood glucose concentration was determined after a finger prick sample was obtained with an automatic lancing device following an aseptic procedure. A Fine-test Auto-coding Premium glucometer and test strips were used to obtain blood glucose measurements, with values recorded on a data collection form. The collected final data was analyzed after responses were coded and entered into SPSS version 20.

Ethical Clearance: Permission to conduct the study was sought and obtained from the Bayelsa State Health Research and Ethics Committee, of which ethical approval was

granted, with approval number BSHREC/Vol.1/19/10. The nature and purpose of the study were explained to voluntary participants, and privacy and confidentiality were assured prior to seeking their consent.

Results

A total of 160 questionnaires were self-administered to diabetic respondents, all of which were filled and returned to the investigator, with clinical parameters of all 160 diabetic respondents collected, amounting to a 100% response rate.

Demographic Characteristics of Respondents: There are more females (53.8%) than males (46.2%) in this study, with the majority of respondents (39.4%) in the age group of 40-50 years. There are more Christians (75%) in this study, with the majority (56.9%) having a secondary educational qualification. Other collected vital demographics of respondents includes, employment status and proportions of respondents sampled from the various study areas. These demographics are presented in Table 1.

Table 1: Demographic Characteristics of Respondents

Variables	Frequency (%)
Gender	
Male	74 (46.2)
Female	86 (53.8)
Age	
Below 20	15 (9.4)
21-39	61 (38.1)
40-50	63 (39.4)
60 and above	21 (13.1)
Marital status	
Married	110 (68.8)
Single	37 (23.1)
Widow/Widower/Divorced	13 (8.1)
Educational qualification	
Primary	4 (2.5)
Secondary	91 (56.9)
Tertiary	51 (31.9)
Postgraduate	14 (8.7)
Employment status	
Self-employed	65 (40.6)
Civil servant	56 (35.0)
Out of work	18 (11.3)
Unable to work	5 (3.1)
Retired	16 (10.0)
Religion	
Christianity	120 (75.0)
Islam	9 (5.6)
Others	31 (19.4)
Study area	
General Hospital Nembe	57 (35.6)
General Hospital Kolo	65 (40.6)
Lottace hospital Alcepilai	14 (8.8)
Cottage Hospital Bassambir:	24 (15.0)

Knowledge of the Role of Lifestyle Modification: The majority of respondents (73.1%) have received some form of education about diabetes, which includes the role of lifestyle modification in diabetes management. More than half (50.6%) know what a normal or target blood glucose concentration should be, with as much as (83.7%) know that the effect of exercise in diabetes management is the reduction of blood glucose concentration. However, less than half (49.4%) of respondents are aware that the recommended eating style for diabetics is only when hungry. 56.9% agree that dietary changes and restrictions are crucial aspects of proper diabetes management. Summarily, more than half of respondents (51.3%) agree that lifestyle modification is as crucial as diabetic medications in the proper management of diabetes.

Table 2: Knowledge of the Role of Lifestyle Modifications

Variables	Frequency (%)
Have you been educated about diabetes?	
Yes	117 (73.1)
No	43 (26.9)
What is a normal and target blood glucose level before meal?	
3.5-5.5mmoI/L	81 (50.6)
6.5-10.5 mmoI/L	54 (33.8)
10.6-15.7 mmoI/L	16 (10.0)
What is the effect of exercise in diabetes?	
To lower blood glucose level	134 (83.7)
To increase blood glucose level	24 (15.0)
I don't know	2 (1.3)
What is the recommended eating style for a diabetic?	
Anytime	32 (20.0)
Only when hungry	79 (49.4)
Regular meal times	49 (30.6)
Dietary adjustments and restriction are crucial for proper management	
True	91 (56.9)
False	69 (43.1)
Lifestyle modification is as crucial as medications	
True	82 (51.3)
False	72 (45.0)
I don't know	6 (3.7)

Lifestyle Modification Habits: As crucial as dietary changes and restrictions are in diabetes management, less than half of respondents (46.3%) reported dietary changes and restrictions, with more than half (52.5%) eating only when hungry. Only (55%) of respondents frequently exercised, with meager (16%) reported not taking alcohol at all. The majority, (81.9%) of respondents reported not smoking cigarettes, with (7.5%) reported to have stopped smoking. There was a statistically significant difference between lifestyle modification and education of the participants.

Table 3: Lifestyle Modification Habits

Variables	Frequency (%)
Do you adjust or restrict your diet?	
Yes	74 (463)
No	86 (53.8)
Eating style	
All day or anytime	27 (16.9)
Only when hungry	84 (52.5)
Fairly regular meals	49 (30.6)
Exercise pattern	
Frequently	88 (55.0)
Rarely	72 (45.0)
Alcohol use	
All the time	19 (11.9)
Sometimes	65 (40.6)
Once a while	50 (31.3)
Not at all	26 (16.3)
Smoking	
Yes	17 (10.6)
No	131 (81.9)

Table 4: Impact of Self-Reported Habits on Blood Glucose Level

Blood glucose concentrations				
Variables	**Normal 3.5-5.5mmold. N (%)**	**High >7mmol/L N (%)**	**Low <3.9mmol/L N (%)**	**Total N (%)**
Exercise pattern				
Frequently	77 (48.2)	4 (2.5)	7 (4.3)	88 (55)
Rarely	45 (28.1)	24 (15.0)	3 (1.9)	72 (45)
Total	122 (76.3)	28 (17.5)	10 (6.2)	160 (100)
Diet changes				
Yes	63 (39.4)	6 (3.8)	5 (3.1)	74 (46.3)
No	59 (36.9)	22 (13.8)	5 (3.1)	86 (53.8)
Total	122 (763)	28 (17.5)	10 (6.2)	160 (100)
Eating styles				
Anytime	11 (6.9)	11 (6.9)	5 (3.1)	27 (16.9)
Only when hungry	72 (45.0)	10 (6.2)	2 (1.2)	84 (52.5)
Regular meals	39 (24.4)	7 (4.4)	3 (1.9)	49 (30.6)
Total	122 (76.3)	28 (17.5)	10 (6.2)	160 (100)
Alcohol use				
All the time	14 (8.8)	4 (2.5)	1 (0.6)	19 (11.9)
Sometimes	50 (31.2)	12 (.5)	3 (1.9)	65 (40.6)
Once a while	36 (22.5)	10 (6.2)	4 (2.5)	50 (31.2)
Not at all	22 (13.8)	2 (1.3)	2 (1.2)	26 (16.3)
Total	122 (76.3)	28 (17.5)	10 (6.2)	160 (100)
Smoking				
Yes	8 (5.0)	8 (5.0)	1 (0.6)	17 (10.6)
No	110 (68.8)	16 (10.0)	5 (3.1)	131 (81.9)
Stopped	4 (2.5)	4 (2.5)	4 (2.5)	12 (7.5)
Total	122 (76.3)	28 (1/.5)	10 (6.2)	160 (100)

Discussions

The aim of this study was to evaluate the baseline knowledge of diabetic patients on the role of lifestyle modification in diabetes management, as well as to assess their lifestyle modification habits. The study reveals that the majority of the respondents (39.4%) are within the age group of 40-50 years, indicating that the majority of the respondents are type 2 diabetic patients. There were more female (53.8) than male (46.2) respondents in this study indicating that the prevalence of type 2 diabetes is more in females than males, which is in line with another study conducted in southeastern Nigeria by Ekpenyong *et al.,* 2012 [7]. There are more Christians, (75%) followed by traditional worshippers (19.4%) in the study population, a true reflection of the general population of Bayelsa State.

Knowledge of the Role of Lifestyle Modifications

The results presented in Table 2 provide insights into the baseline knowledge and understanding of the significance of lifestyle modifications in diabetes management amongst sampled respondents. The majority of the respondents (73.1%) reported having received some form of education about diabetes. There was a statistically significant difference between lifestyle modification and education of the participants. However, only (50.6%) correctly identified the range of 3.5-5.5mmol/L as the normal and target blood glucose level. The normal and target blood glucose level is identified as 3.5-5.5mmol/L (Guemes *et al.,* 2016) [10]. 33.8% of the respondents gave an incorrect range, and 10% gave an even higher range as the normal and target blood glucose level. This implies that about half (43.8%) of the respondents lack an understanding regarding optimal blood glucose levels, which could impact their ability to self-monitor and control their blood glucose effectively. With regards to knowledge of the effect of physical exercise on blood glucose levels, the majority (83.7%) have good knowledge of this, with about 15% having a wrong notion

that it rather increases blood glucose levels. This indicates the need for further education to dispel this belief. With regards to knowledge of dietary adjustments and restrictions, (43.1%) of respondents do not recognize its significance, indicating a potential knowledge gap regarding the role of nutrition in diabetes management. 51.3% of respondents acknowledged that lifestyle modifications are as crucial as medications in the management of diabetes with 45% believing otherwise, highlighting the need for further education and awareness regarding the integral role of lifestyle modifications alongside medications in diabetes management. Summarily, the results presented in Table 2 reveal knowledge gaps and understanding regarding various aspects of lifestyle modifications in diabetes management. This is similar to reports presented in another study. These findings emphasize the need and significance of education and awareness programs to address these gaps, empowering diabetic patients to make informed decisions about their lifestyle habits and diabetes management plans.

Lifestyle Modification Habits

Table 3 above shows the frequency of various lifestyle modification habits among sampled respondents. Nutrition plays a crucial role in diabetes management; however, it is disappointing that more than half (53.8%) of sampled respondents don't adjust or restrict their diet. This implies that a significant proportion of sampled diabetic patients are not conscious of their dietary habits and not making significant efforts to modify them. More than half (55%) of respondents frequently exercised, with 45% rarely exercising. Diet and exercise are primary therapeutic options for diabetes management, this highlights the need for increased awareness and encouragement towards dietary adjustments and regular physical exercise for improved glycaemic control and overall quality of health. The results presented show that the alcohol consumption patterns among respondents vary. A small percentage (11.9%)

reported frequent alcohol consumption, with a significant percentage (40.6%) consuming alcohol sometimes. Only 16.3% reported not consuming alcohol at all. It is necessary to consider the potential health effects associated with excessive or frequent alcohol consumption. The majority of respondents (81.9%) reported not smoking cigarettes, which is a positive finding considering the health risks associated with smoking in diabetes. Summarily, these findings provide insights into the lifestyle modification habits of sampled diabetic patients and can be useful for understanding health habits and guiding interventions aimed at promoting healthier lifestyles in the diabetic population.

Impact of Self-Reported Habits on Blood Glucose Level
It is pertinent to state that treatment outcome in diabetes in terms of blood glucose level is a function of the effect of both adherence to medication and good lifestyle modification habits among diabetic patients. Hence, findings on respondents' blood glucose levels presented in Table 4 were achieved as a result of a combination of both factors, because respondents prior to the survey and during the survey had always been on their diabetic medications. The presented findings in Table 4 is to emphasize the effect of good lifestyle modification habits on blood glucose levels. It is vivid from the presented results, that a greater proportion of respondents in all surveyed modifiable habits, who adhered to modifying those habits had their measured blood glucose concentrations in the normal range as against those who don't adhere. For instance, among respondents who frequently exercised, 48.2% had a normal blood glucose level, with just 2.5% having a high blood glucose level. For respondents who rarely exercised, 28.1% of had a normal blood glucose level, while as much as 15% had a high blood glucose level. This pattern of results was recorded for other surveyed modifiable habits. This is a pointer to the positive impact of good lifestyle modification habits such as; frequent exercise, making dietary adjustments, maintaining controlled eating styles, limiting alcohol use and smoking cessation on blood glucose concentration. It is important to note that these conclusions are based on data presented in Table 4, and additional factors such as weight control and obesity not included in the table could also influence blood glucose levels.

Conclusion
The majority of the respondents have received some form of education about diabetes. However, analyzed results reveal a gap in knowledge and understanding regarding various aspects of lifestyle modifications in diabetes management, similar to reports from other studies. Findings also revealed that the lifestyle modification habits of sampled diabetic patients are suboptimal, necessitating the need for increased awareness programs on the role of lifestyle modification in diabetes management. The impact of good lifestyle modification habits on blood glucose levels was positive, with a greater proportion of sampled respondents who adequately modified their lifestyle having their measured blood glucose levels in the normal range of 3.5-5.5mmol/L.

Recommendations
Based on the findings from this study, there is a need for improved education and awareness about diabetes. To address the noted and existing knowledge gaps, there is a need to provide accurate information through various channels, such as healthcare professionals, educational materials, online resources, and support groups. Findings also revealed that lifestyle modification among diabetic patients is suboptimal; to address this, it is recommended that diabetic patients are advised to always consult a healthcare professional or a registered dietician for personalized guidance on specific health goals and requirements with regard to dieting and other lifestyle habits.

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