

Lifestyle modification adherence among patients attending diabetes clinics in selected hospitals in Remo zone, Ogun State, Nigeria

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Abstract

Objective: Lifestyle modification is an essential component of self-management of diabetes mellitus. This study assessed adherence to diet and exercise recommendations and elucidated the factors that influence adherence in patients living with diabetes.

Method: A cross-sectional study involving 300 patients attending diabetes clinics in some selected hospitals in Ogun State, Nigeria. Structured questionnaires were used to obtain information on the socio-demographic characteristics, and PRECEDE factors of lifestyle-modification adherence in the study participants. Pearson's correlation and Chi-square test were used to assess the association between the variables, while binary logistic regression was used to determine the predictors of adherence to dietary recommendations.

Results: The mean age of the study respondents was 62.7 years. The proportion of respondents who adhered to dietary and exercise recommendations were 87.8% and 45.6% respectively. There were no statistically significant linear relationships between scores for each PRECEDE factor and scores for adherence to diet and exercise. Respondents' age, body mass index, and duration of illness had a statistically significant association with adherence to diet ($P < 0.001$, $P = 0.021$, and $P = 0.041$ respectively). On logistic regression analysis, participants 60 years and older had a higher likelihood of adhering to dietary modification than younger participants [AOR=2.6, $P < 0.001$].

Conclusion: The adherence of patients living with diabetes to dietary recommendations was satisfactory while adherence to exercise recommendations was very poor. There is a need for health care workers, especially at the primary and secondary levels to implement strategies that will enhance reinforcing and enabling factors for exercise adherence.

Keywords: Adherence, Diabetes Mellitus, Diet, Exercise, Lifestyle-modification

Plain English Summary

Diabetes mellitus is a chronic medical condition that often results in long-term complications and poor quality of life if poorly managed. In addition to the use of medications, lifestyle modification including physical exercise, weight reduction, and dietary control are essential strategies for managing people living with diabetes mellitus. This study assessed the self-reported adherence to diet and exercise recommendations and the factors that influence them among patients living with diabetes in Ogun State, Nigeria. Findings suggest that adherence to dietary recommendations was satisfactory. Respondents' age, body mass index, and duration of illness had a significant association with adherence to a diet. Patients living with diabetes who were older than 60 years were more likely than younger patients to adhere to dietary recommendations.

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The adherence to exercise recommendations was very poor and had no association with any of the factors studied. There is a need for health care workers, especially at the primary and secondary levels to implement strategies that will assist in improving exercise adherence among patients living with diabetes.

Background

Diabetes mellitus (DM) is a metabolic disorder of chronic hyperglycemia characterized by disturbances to carbohydrate, protein, and fat metabolism resulting from absolute or relative insulin deficiency with dysfunction in organ systems (1). Poorly managed DM often results in long-term complications of multiple organ systems leading to poor quality of life and reduced productivity (2).

DM affects about 425 million persons worldwide and prevalence has been increasing, the greatest increase being in low- and middle-income countries where more than 80% of diabetes-related deaths occur (3, 4). In Nigeria, a recent systematic review puts the prevalence of diabetes at 5.77% (5). The increase in rates of DM in developing countries is presumably due to the trends of urbanization and lifestyle changes. These include increased sedentary lifestyles, low physical activity, and the global nutrition transition marked by a high intake of refined carbohydrates and saturated fats (6). A lack of physical activity is believed to be a predisposing factor to 7% of cases of diabetes (7).

Management of DM involves the use of appropriate medications, maintaining a healthy diet, regular physical exercise, maintaining normal body weight, avoiding the use of tobacco, control of blood pressure, and maintaining proper foot care (2). Although there appears to be good knowledge and awareness of patients regarding the complications of diabetes, many patients living with diabetes have very poor knowledge of the different components of non-pharmacological management of diabetes (8).

Lifestyle modification is an essential component of the self-management of type 2 diabetes. It starts with educating the people about the disease and available treatment options. It also involves encouraging good nutrition and physical exercise to achieve an optimal body weight (9). Evidence suggests that lifestyle interventions are as effective as drugs in managing diabetic patients (10).

Adherence to lifestyle modification is determined by various factors which include demographic factors (age, sex, marital status, level of education, occupation, residence, and duration of illness), socio-economic factors (e.g. lack of money, lack of satiety, tempting foods, lack of time, fatigue, accessibility) and behavioral factors

(level of knowledge, attitude, and practice) (11). Reports from Nigeria and Iran indicate that the overall adherence to lifestyle modifications among people living with type 2 diabetes was low (12, 13). Factors such as poor knowledge and attitude to the disease and belief in the use of complementary and alternative medicine have been postulated to be responsible for this (14, 15). There is a possibility that these factors may vary based on geographical location and ethnicity. There is no recent study on this topic in Remo Zone, Ogun State Nigeria. This study will contribute to the literature on the topic and the knowledge gained may lead to the formulation of strategies that may assist in improving lifestyle modification adherence in this environment. Hence, this study was designed to determine the proportion of respondents who adhered to the diet and exercise recommendations and elucidate the factors that may influence these in patients attending diabetes clinics in selected hospitals in Remo Zone, Ogun State, Nigeria.

Methodology

The study was carried out in five selected hospitals in Remo Zone, Ogun state, Southwest Nigeria. The hospitals are Olabisi Onabanjo Teaching Hospital Sagamu (OOUTH), Babcock University Teaching Ilishan (BUTH), State Hospital Ishara, Talabi Diabetes Centre Ishara, and General Hospital Iperu. OOUTH is a state government-owned tertiary hospital while BUTH is a private tertiary hospital. State Hospital Ishara and General Hospital (GH) Iperu are government secondary health facilities while Talabi Diabetes Centre is a private research center involved in care for patients living with diabetes. These hospitals were selected because they all have clinics where care and support are provided for patients with diabetes.

This study adopted a cross-sectional study design and the study population was patients attending diabetes clinics in the selected hospitals during the period of data collection. The sample size for the study was calculated using the Cochran formula $n = pq (z^2)/e^2$ (16); where Z= Standard normal deviate (1.96), e = margin of error (0.05), p is the prevalence of adherence taken as 0.225 from a previous study (12) and q =1-p. The calculated sample size was thus 268. The addition of 10% to accommodate for incomplete responses by participants gave a final

calculated sample size of 294. However, a sample size of 300 was used for the study. A convenience sampling technique was used. All eligible and willing patients present at the diabetes clinic of the selected hospitals were invited to participate in the study. The conceptual framework for the study was adapted from the PRECEDE (Predisposing, Reinforcing, and Enabling Constructs in Educational Diagnosis) model proposed by Green et al (17). This framework was used to investigate the relationship between the PRECEDE factors and lifestyle modification adherence in diabetic patients.

A semi-structured questionnaire designed by the research team was used for data collection. The questionnaires were administered by trained research assistants during diabetes clinics in the selected hospitals. The questionnaire had five sections. Section A asked for information regarding the socio-demographic data of study respondents, while section B sought information on predisposing factors involved in lifestyle modification i.e. knowledge and perception. Knowledge was assessed with questions related to respondents' knowledge of diabetes and the role (if any) of diet and exercise in the management of diabetes. To assess perception, respondents were asked questions about the perceived seriousness, benefit, self-efficacy, and attitudinal disposition to lifestyle modification in diabetes. Reinforcing factors were assessed in section C with questions such as whether family and friends encouraged adherence to dietary advice and exercise, the availability of support programs in the community, and whether these encouraged compliances with dietary and exercise recommendations. Enabling factors were assessed in section D, where respondents were asked questions relating to the availability of recommended food items and access to facilities that promote exercise. Respondents' adherence to diet and exercise recommendations were assessed in section E. Questions relating to their dietary and exercise habits were asked. Knowledge was assessed by asking 6 questions with Yes or No answers i.e. a maximum score of 6. Perception, reinforcing, and enabling factors were assessed using a 4-point Likert scale: strongly agree, agree, disagree, and strongly disagree, with maximum scores of 24, 15, and 15 respectively. Adherence was assessed using a 4-point Likert scale: Not at all, sometimes, often, and always, giving a maximum score of 18. Scores that were equal to or more than 80% of

the maximum score were adjudged to be good, those between 60% and 80% were adjudged to be fair and those lower than the 60% of the maximum score were adjudged to be poor. The content validity of the questionnaire was done by an Endocrinologist, a dietician, a physiotherapist, and a patient living with diabetes. The questionnaire was pretested at General hospital Iperu on 30 patients with diabetes who did not participate in the study. The items on the questionnaire were evaluated for internal reliability using Cronbach's alpha; the calculated value was 0.76, indicating a good degree of internal consistency.

Data collected in questionnaires were checked for completeness and accuracy and entered into a computer for analysis using the IBM-SPSS version 23. Continuous variables were summarized using descriptive statistics such as mean and standard deviation at 95% confidence interval, median and interquartile range. Categorical variables were summarized by frequencies and percentages. The Chi-square test was used to assess the association between the predictor variables and the level of adherence to lifestyle modification. Pearson correlation was used to assess the degree of the linear relationship between the PRECEDE factors and the level of adherence. Binary logistic regression was used to determine the predictors of adherence to dietary recommendations. $P < 0.05$ was deemed statistically significant.

Results

The mean age of the study participants was 62.7 ± 11.9 years, with a range of 17 - 90 years. The median age was 64 years with an interquartile range of 55-70 years. There were more females (194; 64.7%) compared to the males (106; 35.3%). The majority of the respondents (274; 91.3%) were of Yoruba ethnicity. Fifty-four participants (18%) had no formal education. More than half of the participants were traders (167; 55.7%). Most of the respondents were married (208; 69.3%). Forty-two participants (14%) were diagnosed with diabetes less than six months before the study, while (54; 18%) had been diagnosed for over ten years. One hundred and ten respondents (36.7%) had a normal body mass index ($18.5-24.9 \text{Kg/m}^2$) while 111 (37%) had a body mass index of $25.0-29.9 \text{Kg/m}^2$ (Table 1). The mean body mass index (BMI) was $27.1 \text{Kg/m}^2 \pm 5.7$ and range of $16.0-48.9 \text{Kg/m}^2$.

Table 1: Sociodemographic characteristics of study participants

Characteristics	Frequency	Percentage (%)
Age (years)		
≤ 20	2	0.7
21-40	10	3.3
41-60	107	35.7
61-80	165	55.0
≥ 80	16	5.3
Gender		
Male	106	35.3
Female	194	64.7
Ethnicity		
Yoruba	274	91.3
Igbo	16	5.3
Others	10	3.3
Level of Education		
No formal education	54	18.0
Primary	97	32.3
Secondary	92	30.7
Tertiary	57	19.0
Occupation		
Trader	167	55.7
Artisan	35	11.7
Civil servant/Professional	29	9.7
Farmer	13	4.3
Unemployed	15	5.0
Retiree	41	13.7
Marital Status		
Single	12	4.0
Married	208	69.3
Divorced	11	3.7
Widow/widower	69	23.0
Body Mass Index (Kg/m²)		
<18.5	6	2.0
18.5-24.9	110	36.7
25.0-29.9	111	37.0
30-39.9	64	21.3
≥40	9	3.0
Duration of diabetes		
< 6 months	42	14.0
6 months- 1 year	36	12.0
1-2 years	34	11.3
2-5 years	72	24.0
5-10 years	62	20.7
>10 years	54	18.0

Table 2 shows the study respondents' scores for all the PRECEDE factors. The mean scores for knowledge, perception, reinforcing, and enabling factors were 4.4 ± 0.7 , 20.1 ± 3.1 , 9.6 ± 3.1 , and 11.1 ± 2.3 respectively corresponding to 73.3%, 83.8%, 63.9%, and 74.0% of the maximum

possible scores. The mean score for adherence to the diet was 7.9 ± 1.2 while the mean score for adherence to exercise was 4.1 ± 1.7 , these represented 87.8% and 45.6% of maximum possible scores for diet and exercise adherence respectively.

Table 2: Study respondents' scores for PRECEDE factors and adherence to lifestyle modification

Factor	Rating Scale	Minimum value	Maximum value	Mean	S.D	95% CI	Score (%)
Predisposing factors							
Knowledge	6	2	6	4.4	0.7	4.3-4.5	73.3
Perception	24	10	24	20.1	3.1	19.8-20.5	83.8
Reinforcing factors							
Enabling factors	15	0	15	9.6	3.1	9.2-9.9	63.9
Total PRECEDE Score	60	25	59	45.2	6.1	44.5-45.9	75.3
Adherence							
Diet	9	0	9	7.9	1.2	7.8-8.0	87.8
Exercise	9	1	9	4.1	1.7	3.9-4.3	45.6
Total Adherence score	18	4	17	12.0	1.8	11.8-12.2	66.7

The respondents' scores for factors associated with lifestyle modification adherence are depicted in table 3. One hundred and twenty respondents (40.0%) had good knowledge, 190 (63.3%) had good perception, 85(28.3%) had good reinforcing factors and 136(45.3%) had good enabling

factors for lifestyle modification adherence. However, 206 respondents (68.7%) had good adherence to dietary modification while only eight respondents (2.7%) had good adherence to exercise recommendations.

Table 3: Respondents scores for factors associated with lifestyle modification adherence

	Good Scores n(%)	Fair Scores n(%)	Poor Scores n(%)
Knowledge	120(40.0)	159(53.0)	21(7.0)
Perception	190(63.3)	95(31.7)	15(5.0)
Reinforcing	85(28.3)	108(36.0)	107(35.7)
Enabling	136(45.3)	132(44.0)	32(10.7)
Adherence - Diet	206(68.7)	80(26.7)	14(4.7)
Adherence -Exercise	8(2.7)	50(16.7)	242(80.7)

Table 4 shows the Pearson correlation of PRECEDE factors to adherence scores. There was no statistically significant linear relationship between scores for each PRECEDE factor and scores for adherence to diet and exercise.

However, the aggregate PRECEDE score had a weak positive correlation with exercise adherence scores, and this was statistically significant ($r=0.150$; $P=0.009$).

Table 4: Correlation of PRECEDE factors scores to adherence scores

PRECEDE factors	Adherence to diet		Adherence to exercise	
	Pearson correlation	P-value	Pearson correlation	P-value
Predisposing factors	0.092	0.112	0.102	0.079
Knowledge	-0.031	0.595	0.079	0.170
Perception	0.102	0.078	0.087	0.133
Reinforcing factors	-0.056	0.338	0.111	0.055
Enabling factors	0.053	0.363	0.110	0.057
Total PRECEDE factors	0.040	0.491	0.150	0.009*

* $P<0.05$ statistically significant

The association between some predictor variables and adherence to diet is shown in table 5. Respondents' age ≥ 60 years, BMI $< 30\text{Kg/m}^2$, and duration of illness ≥ 5 years were associated with a significant increase in adherence to diet ($P<0.001$, $P=0.021$, and $P=0.041$ respectively). A logistic regression model was created including

variables such as age, gender, level of education, BMI, and duration of diabetes, to determine the predictors of adherence to dietary modification. The model shows that participants who were 60 years and older had a higher likelihood of adhering to dietary modifications than those younger than 60 years [AOR=2.6, $P < 0.001$]. No

other variable in the model had a significant odds ratio.

Table 6 shows the association between some predictor variables and adherence to exercise.

None of the variables analyzed had a statistically significant association with adherence to exercise.

Table 5: Association between predictor variables and adherence to dietary modification

Variable	Optimal adherence n(%)	Suboptimal adherence n(%)	Chi square	P value
Age (years)				
<60	56(53.3)	49(46.7)	17.652	< 0.001*
≥ 60	150(76.9)	45(23.1)		
Gender				
Male	76(71.7)	30(28.3)	0.700	0.436
Female	130(67.0)	64(33.0)		
Level of education				
No formal education	45(83.3)	9(16.7)	7.684	0.053
Primary	67(69.1)	30(30.9)		
Secondary	59(64.1)	33(35.9)		
Tertiary	35(61.4)	22(38.6)		
Body Mass Index				
< 30	164(72.3)	63(27.7)	5.557	0.021*
≥ 30	42(57.5)	31(42.5)		
Duration of Diabetes				
< 5 years	118(64.1)	66(35.9)	4.551	0.041*
≥ 5 years	88(75.9)	28(24.1)		

* P<0.05 statistically significant

Table 6 Association between predictor variables and adherence to exercise instructions

Variable	Optimal adherence n(%)	Suboptimal adherence n(%)	Chi square	P value
Age (years)				
<60	5(4.8)	100(95.2)	2.732	0.133
≥ 60	3(1.5)	192(98.5)		
Gender				
Male	4(3.8)	102(96.2)	0.774	0.459
Female	4(2.0)	190(98.0)		
Level of education				
No formal education	0(0.0)	54(100.0)	4.062	0.255
Primary	5(5.2)	92(94.8)		
Secondary	2(2.2)	90(97.8)		
Tertiary	1(1.8)	56(98.2)		
Body Mass Index				
< 30	4(1.8)	223(98.2)	2.941	0.102
≥ 30	4(5.5)	69(94.5)		
Duration of Diabetes				
< 5 years	5(2.7)	179(97.3)	0.005	1.000
≥ 5 years	3(2.6)	113(97.4)		

Discussion

Lifestyle modification including physical exercise, weight reduction, and dietary control are essential strategies for managing people living with diabetes mellitus (18, 19). This study assessed the self-reported adherence to diet and exercise recommendations among patients living with diabetes and the factors that influence them.

Findings suggest that while adherence to dietary recommendations was satisfactory, adherence to exercise recommendations was very poor. This study also showed that although the PRECEDE factors may influence lifestyle modification adherence in people living with diabetes, other factors such as age, BMI, and duration of the

illness also play important roles or act as modifiers of adherence.

The mean age of the study participants was 62.7 years. This is similar to the mean of 62.5 years reported in Ibadan, southwest Nigeria (20). Type 2 DM is the commoner class of DM in Nigeria, and this disease is known to be adult-onset (21, 22). The complications associated with diabetes may likely start to manifest after middle age, and this explains why most patients attending diabetes clinics were in their sixth decade of life, as seen in this study. There were more female than male persons with diabetes in this study, the female to male ratio of 1.8 reported in this study was similar to reports from similar studies in southwest Nigeria (20, 21).

The majority of the study participants in this study were either overweight or obese, with a few being morbidly obese. Also, the mean BMI of 27.1 Kg/m² recorded in this study confirms the assertion that obesity is often associated with diabetes mellitus (5). It appears that an unhealthy diet and lifestyle contribute to the development of both obesity and DM (5).

Regarding the PRECEDE factors, the respondents had the best scores in perception. This suggests that they had a good perception of the seriousness, benefits, self-efficacy, and attitudinal disposition to lifestyle modification in diabetes. This might be a result of frequent health education received during the attendance at diabetes clinics. The respondents' mean score for enabling factors was also relatively high. This may indicate the availability of healthy foods and accessibility to diabetes centers where patients living with diabetes could be adequately managed. Some of these diabetes centers organize periodic enlightenment programs which complement the health education they receive at their clinics. However, other potential enablers to lifestyle modification such as gymnasium and exercise centers were often inadequate. The study respondents had the worst scores in reinforcing factors, suggesting a lack of social support that encourages compliance with dietary and exercise recommendations in the community. Most individuals living with DM only received support and encouragement from their family members without any governmental or external assistance.

The overall proportion of respondents who adhered to lifestyle modification in Diabetes Mellitus in the Remo zone observed in this study was 66.7%. This value is far higher than what was reported in a study done by Iloh *et al* in Abia State, Nigeria (12), where the proportion of

adherence was 22.5%. The reason for this disparity is likely due to the use of a different scale for measuring adherence. In addition to diet and exercise, Iloh *et al* also assessed alcohol use and smoking which were not assessed in this study (12).

An interesting finding in this study is the fact that there was a wide disparity between the proportion of respondents who adhered to dietary modification (87.8%) and exercise (45.6%). The study also showed that more than two-thirds of the study respondents had good adherence to diet, while only about three percent had good adherence to exercise recommendations. A similar trend was also reported by other researchers (12, 13, 23). The majority of the study participants in this study were older than 60 years of age. The increased likelihood of comorbidities in this age group may be partly responsible for the low level of exercise adherence seen in this study (23). Other factors such as lack of time, fatigue, hot tropical weather, and misperceptions that exercise worsens symptoms of DM, have been reported to be associated with low adherence to exercise recommendations (18, 22, 23).

Over 90% of the study participants had either good or fair knowledge about lifestyle modification in the management of diabetes mellitus. However, this level of knowledge did not correlate significantly to adherence to lifestyle modification. This is similar to findings by Iloh *et al*, (12) where a low adherence level (22.5%) was reported despite a high awareness level of 88.3%. Although the individual PRECEDE scores had no significant correlation with adherence to diet and exercise, the total PRECEDE score had a weak positive correlation with adherence to exercise. This may suggest that the individual PRECEDE factors, acting alone was possibly not enough to translate to behavioral change or determine adherence to diet and exercise recommendations in patients living with diabetes. It appears that a combination of all the PRECEDE factors is necessary for there to be any positive influence on adherence to exercise recommendations. It is however unclear why this was not the case with adherence to dietary recommendations.

Some biological factors may also influence lifestyle modification adherence in patients living with diabetes. In this study, age, BMI, and duration of illness had a statistically significant association with adherence to dietary recommendations. Study participants with a longer duration of illness reported better

adherence to dietary modification. We can extrapolate this finding to indicate that participants with a longer duration of illness would have had more exposure to adherence counseling from health care workers. The BMI of study participants also had a significant association with the level of adherence to dietary modification. Obese participants ($BMI \geq 30 \text{Kg/m}^2$) had poorer adherence to dietary modification when compared to those with $BMI < 30 \text{Kg/m}^2$. This finding is particularly worrying and may reflect the poor attitudinal disposition of this group of people to dietary modification as an important modality for managing people living with diabetes. There is a need for concerted efforts to address this, to halt the vicious cycle of obesity and poor glycaemic control.

On multivariate analysis, however, the only variable found to be a significant predictor of adherence to dietary modification was the age of study participants. Specifically, study participants who were aged 60 years and above were about three times more likely than younger participants to adhere to dietary recommendations. This may indicate that older people were more likely to follow instructions than younger ones. Moreover, other researchers have reported that older diabetics (aged 60 years and above) had a greater likelihood of perceiving the quality of diabetic care as good compared to younger patients. This may also be a motivating factor for adherence to dietary recommendations (20). In this study, only eight respondents (2.7%) had good scores for adherence to exercise recommendations. Moreover, none of the variables analyzed in the prediction model had a statistically significant association with adherence to exercise recommendations. Further studies are required to identify the predictors of exercise adherence in patients living with diabetes in Remo Zone, Ogun State, Nigeria. This study has some limitations: one is the possibility of recall bias in some of the responses given by the study participants. However, to minimize this, the questions were structured in a manner that will enable the researchers to obtain relevant information and avoid inaccurate and inconsistent responses. Another limitation is that some aspects of lifestyle modification such as alcohol and tobacco use were not assessed in the study. The combination of purposive and convenience sampling in the study also limits its generalizability.

Conclusion

The adherence of patients living with diabetes to dietary recommendations was satisfactory while adherence to exercise recommendations was very poor in Remo zone, Ogun State, southwest Nigeria. There is a need for continued health education of patients living with diabetes on the importance of lifestyle modification adherence. Health care workers, especially at the primary and secondary levels should implement strategies that will enhance reinforcing and enabling factors for exercise adherence.

List of abbreviations

BMI	Body Mass Index
DM	Diabetes Mellitus
PRECEDE	Predisposing, Reinforcing, and Enabling Constructs in Educational Diagnosis

Declarations

Ethics approval and consent to participate

Ethical approval for the study was obtained from the Babcock University Health Research Ethics Committee (BUHREC757/18) and Olabisi Onabanjo University Teaching Hospital-Research and Ethics Committee (OOUTH/HREC/247/2019AP). The eligible study participants were given adequate information about the study and were requested to sign an informed consent form.

Consent for publication

The authors hereby give consent for the publication of our work under the creative commons CC Attribution-Non-commercial 4.0 license.

Availability of data and materials

All data generated or analyzed in this study are available upon reasonable request to the corresponding author.

Competing interests

The authors have no competing interests to declare.

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Authors Contributions

AOM conceptualized the study and was responsible for data collection while AAA did the data analysis. AOM wrote the first draft while AAA

wrote the final manuscript. All authors read and approved the final manuscript.

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