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Research Article

Impact of Knowledge and Awareness on Dietary and Physical Activity Compliance Among Type 2 Diabetes Mellitus Patients in North Central Nigeria

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Abstract

Introduction: Type 2 Diabetes Mellitus (T2DM) management relies on both diet and physical activity adherence; however, patients compliance rates are unsatisfactory. *Objective:* This study aimed to assess the knowledge and awareness about diet and physical activity among T2DM patients and the impact it has on adherence to the recommended guidelines. *Methods:* This cross-sectional study was carried out at the Jos University Teaching Hospital using a systematic random sampling. Structured questionnaire was used to assess knowledge, awareness and self-reported compliance with diabetes medication and lifestyle modification guidelines. Care practices were based on modified instruments of Summary of Diabetes Self-Care Activities. The relationship between variables was determined using correlation and regression analysis. *Results:* A response rate of 96% (N=288) was obtained. Respondents who had 'Good' in their dietary knowledge and physical activity knowledge were 41.7%, and 38.2% respectively. The mean of dietary and physical activity adherence was 4.2+/-1.8 and 2.8+/-2.1 days/week, respectively. The highest percentage rate for dietary compliance was 32.6% and physical activity compliance was 18.4%. There was positive correlation between knowledge and compliance (dietary: r=0.54, p<0.001; physical activity: r=0.49, p<0.001). The mean HbA1c was 8.42 ± 2.2%, and only 23.6% achieved target control (<7.0%). *Conclusion:* Knowledge has significant effect on compliance behaviour of the T2DM patients; however, compliance levels are still low even with a moderate level of knowledge. Greater awareness and knowledge of diet and physical activity guidelines are needed to bridge the gap concerning this in T2DM management in order to improve patient outcomes in North Central Nigeria.

Keywords

Type 2 Diabetes Mellitus, Knowledge and Awareness, Compliance Behaviours

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1. Introduction

Diabetes Mellitus (DM) is now an epidemic worldwide, as it is estimated that 589 million adults have diabetes in 2024, and this number is projected to increase to 853 million by 2050 [1]. The number of people with diabetes in sub-Saharan Africa is on the rise with Nigeria having the highest rate of people living with diabetes in the region [2]. The International Diabetes Federation (IDF) estimated that 3.6 million Nigerians are living with diabetes; with higher figures in the urban areas [1].

Self-management in diabetes is also essential, especially the adherence to dietary prescriptions and routine physical exercise to help in glycaemic control and prevention of complications [3]. Nonetheless, adherence to such lifestyle changes is not yet satisfactory in most populations including Nigeria [4]. Factors such as socio-economic issues, access to healthcare, and knowledge and awareness of the guidelines for managing diabetes are among the variables that influence compliance [5].

The North Central region of Nigeria is a culturally diverse region with varying socio-economic construction that may be relevant to diabetes management attitudes and behaviors. Previous researches across other parts of Nigeria have reported variable levels of diabetes knowledge and compliance to lifestyle modification guidelines [6, 7].

The correlation between knowledge, awareness, and compliance with lifestyle recommendations is essential for developing effective interventions to improve diabetes outcomes in this population. Therefore, this study aimed to assess the knowledge and awareness of dietary and physical activity recommendations, and their impact on compliance behaviours among T2DM patients in North Central Nigeria.

2. Methods

2.1. Study Area and Design

This cross-sectional survey was conducted at Jos University Teaching Hospital among type 2 diabetes mellitus patients. This tertiary institution serves both urban and rural communities of the region.

2.2. Participants

The study participants included consenting patients diagnosed with type 2 diabetes mellitus for a duration of not less than 6 months and are aged 18 years of age and above who accessed healthcare at the diabetic clinic of Jos University Teaching Hospital. The study excluded pregnant women, people who could not exercise due to physical disabilities, and participants with cognitive impairments that made providing consent or answering survey questions unreliable.

2.3. Sample Size and Sampling Technique

The sample size was determined using Fisher's formula based on the prevalence (3.1%) of diabetes in the study area, with a 95% confidence level and 5% margin of error. The calculated sample size was 288, which was rounded up to 300 participants to account for potential non-response. Systematic random sampling was employed to select participants from the diabetic clinic attendance list.

2.4. Data Collection

Data were collected through structured interviewer-administered questionnaires developed based on validated instruments and modified for the local context. The questionnaire had multiple sections:

Sociodemographic and Clinical Characteristics: This section recorded participant demographic information including age, gender, education level, occupation, marital status, and duration of diabetes diagnosis.

Knowledge and Awareness Assessment: This section examined participants' understanding of diabetes management through proper diet and physical activity practices using self-reported 5-point Likert scales (Very Poor, Poor, Fair, Good, Very Good).

Compliance Assessment: This section assessed adherence to dietary recommendations and physical activity guidelines using adapted items from the Summary of Diabetes Self-Care Activities (SDSCA) scale. Participants reported the number of days per week they followed their diabetic diet and engaged in at least 30 minutes of physical activity over the past two weeks.

Clinical Indicators: HbA1c levels and BMI measurements were obtained from participants' most recent medical records (within 3 months).

2.5. Ethical Considerations

Ethical approval was obtained from the Institution's ethical committee and permission was obtained from the department of Internal Medicine. Informed consent was obtained from all participants after due explanation of the research work. Participants were assured that findings from this study would be useful in developing policies and awareness concerning dietary choices and physical activity that would affect patient management and outcomes. Patient data was treated with utmost confidentiality.

2.6. Data Analysis

Data was analysed using SPSS version 26.0. Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize socio-demographic characteristics, knowledge/awareness levels, and compliance behaviours. Pearson correlation analysis was performed to examine relationships between knowledge levels and com-

pliance behaviours. Analysis of variance (ANOVA) was used to compare compliance across knowledge categories. Statistical significance was set at $p<0.05$.

3. Results

3.1. Socio-Demographic and Clinical Characteristics

The response rate of the study was 96% (N=288) as presented in Table 1. A large proportion (24.3%) of the respondents were aged 41-50 years. The respondents sampled comprised females (51.4%) and the highest category of educational qualification was secondary school education (34.7%). Employed workforce (38.2%) was the leading occupational sector whereas students was the least among the demographics (9.7%). The majority of the participants were married individuals (55.6) and majority were at a duration of diabetes mellitus diagnosis of 4-6 years (27.8%).

Table 1. *Sociodemographic Characteristics of Respondents (N=288).*

Demographic Variables	Frequency	Percentage
Age Group		
18-30	50	17.4%
31-40	60	20.8%
41-50	70	24.3%
51-60	55	19.1%
61 and above	53	18.4%
Gender		
Male	140	48.6%
Female	148	51.4%
Education Level		
No formal education	20	6.9%
Primary education	60	20.8%
Secondary education	100	34.7%
Tertiary education	80	27.8%
Postgraduate education	28	9.7%
Occupation		
Unemployed	50	17.4%
Self-employed	70	24.3%
Employed (part-time/full-time)	110	38.2%
Retired	30	10.4%
Student	28	9.7%
Marital Status		
Single	90	31.3%
Married	160	55.6%
Divorced	20	6.9%
Widowed	18	6.2%
Duration of Diagnosis		
Less than 1 year	30	10.4%
1-3 years	70	24.3%
4-6 years	80	27.8%
7-10 years	60	20.8%
More than 10 years	48	16.7%

3.2. Level of Awareness and Knowledge Regarding Physical Activity and Diet

Table 2 depicts self-reported level of knowledge and awareness of respondents about diet and physical activity on management of diabetes. Majority of participants responded their dietary knowledge as “Good” (41.7%), and “Fair” responses was reported by 27.8% of the participants. Only a total of 20.1% of the participants rated their knowledge of diet as being very good; 6.9% stated it was poor, and 3.5% said it was very poor.

A similar pattern appeared in answers to the question of what participants know about the significance of physical activity: 38.2% answered Good, and 31.3% - Fair. The participants who showed excellent skills of comprehension were only 16.6% and there was a centrally represented score where 0.8 and 5.2% of the participants responded to their level of understanding as poor and very poor, respectively.

Table 2. *Knowledge and Awareness Levels on Diet and Physical Activity among Individuals with Type 2 Diabetes (N=288).*

Question	Response Option	Frequency	Percentage
How well do you understand the importance of diet in managing type 2 diabetes (T2DM)?			
	Very poor	10	3.5%
	Poor	20	6.9%
	Fair	80	27.8%
	Good	120	41.7%
	Very good	58	20.1%
How would you grade your understanding of the importance of physical activity in managing T2DM?			

Question	Response Option	Frequency	Percentage
	Very poor	15	5.2%
	Poor	25	8.7%
	Fair	90	31.3%
	Good	110	38.2%
	Very good	48	16.6%

3.3. Compliance Behaviours and Clinical Outcomes

Table 3 shows compliance behaviours and clinical indicators of the study participants. The average habitual compliance was 4.2 +/-1.8 days per week, and only 32.6% of the participants were found to exhibit a high compliance (>=5 days per week). Compliance with physical activity was significantly lower and the subjects engaged in physical activity an average of 2.8 +/- 2.1 days in a week with only 18.4% enjoying high compliance with such activity (exercising 5 or more days in a week for an average of 30 minutes or more per day).

Clinical measures showed poor care of diabetes where the mean HbA1c was 8.4 +/- 2.2 and much surpassing the recommended levels of HbA1c levels at less than 7%. Fewer than one in every four participants had good glycemic control with HbA1c below 7 per cent. The average BMI was 28.7 kg/m^2 +/- 4.8, equivalent to overweight in most of the subjects.

Table 3. *Dietary and Physical Activity Compliance Among Type 2 Diabetes Patients (N=288).*

Compliance Measure	Mean ± SD	Median	Range	Compliance (%)
Dietary Compliance				
Days following diabetic diet (per week)	4.2 ± 1.8	4.0	0-7	32.6%
Meal timing adherence (per week)	4.8 ± 2.1	5.0	0-7	41.3%
Avoiding prohibited foods (per week)	3.9 ± 2.0	4.0	0-7	28.8%
Physical Activity Compliance				
Days with ≥30 min exercise (per week)	2.8 ± 2.1	2.0	0-7	18.4%
Total exercise minutes per week	98.5 ± 76.3	90.0	0-420	22.9%**
Clinical Indicators				
HbA1c levels (%)	8.4 ± 2.2	8.1	6.1-14.2	23.6%***
BMI (kg/m^2)	28.7 ± 4.8	28.2	19.1-41.5	-

High compliance defined as ≥5 days per week
For behavioural measures **≥150 minutes/week
For exercise ***HbA1c <7% considered good glycaemic control

3.4. Relationship Between Knowledge and Compliance

As shown in Table 4, a positive correlation was obtained between the knowledge levels and compliance behaviours. The dietary knowledge was also positively correlated with dietary compliance ($r = 0.542$, $p < 0.001$) whereas physical activity knowledge was only weakly correlated with exercise compliance ($r = 0.486$, $p < 0.001$). The two knowledge domains were negatively correlated with HbA1c levels, indicating that the higher the knowledge the better the glycaemic control.

Table 4. *Correlation Analysis Between Knowledge, Awareness, and Compliance (N=288).*

Variables	Pearson Correlation (r)	p-value	95% CI
Dietary Knowledge vs. Dietary Compliance	0.542	<0.001	0.461-0.615
PA Knowledge vs. PA Compliance	0.486	<0.001	0.398-0.567

Variables	Pearson Correlation (r)	p-value	95% CI
Dietary Knowledge vs. HbA1c	-0.312	<0.001	-0.412-0.205
PA Knowledge vs. HbA1c	-0.278	<0.001	-0.382-0.168
Dietary Compliance vs. HbA1c	-0.445	<0.001	-0.532-0.351
PA Compliance vs. HbA1c	-0.389	<0.001	-0.481-0.291

PA = Physical Activity

Table 5 demonstrates the relationship between knowledge categories and compliance behaviours. Participants with "Very Good" dietary knowledge demonstrated significantly higher compliance rates (5.8 ± 1.2 days/week) compared to those with "Poor/Very Poor" knowledge (2.1 ±1.4 days/week, $p < 0.001$). Similar patterns were observed for physical activity compliance, with participants having "Very Good" knowledge exercising 4.2 ± 1.9 days per week compared to 1.3 ±1.2 days among those with poor knowledge.

Table 5. *Relationship Between Knowledge Levels and Compliance Behaviours (N=288).*

A. Dietary Knowledge vs. Dietary Compliance.

Knowledge Level	N	Mean Dietary Compliance Days/Week (±SD)	Compliance (%)	p-value*
Very Good	58	5.8 ±1.2	62.1%	<0.001
Good	120	4.6 ±1.5	35.0%	
Fair	80	3.2 ±1.8	16.3%	
Poor/Very Poor	30	2.1 ±1.4	6.7%	

B. Physical Activity Knowledge vs. Physical Activity Compliance.

Knowledge Level	N	Mean Exercise Days/Week (±SD)	High Compliance (%)	p-value*
Very Good	48	4.2 ±1.9	41.7%	<0.001
Good	110	3.1 ±2.0	20.9%	
Fair	90	2.2 ±1.8	11.1%	
Poor/Very Poor	40	1.3 ±1.2	5.0%	

*ANOVA test for continuous variables, Chi-square for categorical variables

3.5. Predictors of Compliance Behaviours

Dietary knowledge had the greatest impact on predicting dietary compliance (Table 6) with an explanation of the variance in compliance behaviors of 38.7 percent. The level of education and duration of diagnosis were also the significant variables whereas age had a narrower tendency towards significance.

The analysis with multiple regression (Table 6) indicated that dietary knowledge was the strongest predictor of dietary compliance ($\beta = 0.458$, $p < 0.001$, which explained 38.7 percent variance in adherence behaviours. Education level and length of diagnosis were also significant predictors and age had a trend towards significance.

Table 6. *Multiple Regression Analysis - Predictors of Dietary Compliance (N=288).*

Predictor Variable	β	SE	t	p-value	95% CI
Dietary Knowledge Score	0.458	0.087	5.264	<0.001	0.287-0.629
Age (years)	0.023	0.012	1.917	0.056	-0.001-0.047
Education Level	0.156	0.078	2.000	0.046	0.003-0.309
Gender (Female)	-0.234	0.189	-1.238	0.217	-0.606-0.138
Duration of Diagnosis	0.089	0.045	1.978	0.049	0.001-0.177

$R^2 = 0.387$, Adjusted $R^2 = 0.376$, $F(5,282) = 35.64$, $p < 0.001$

4. Discussion

This study evaluated the relationship between knowledge and awareness of dietary and physical activity recommendations and the impact it has on compliance among T2DM patients in North Central Nigeria.

The demographic profile of the study participants reflects the global prevalence of T2DM as the highest number of patients belong to the age group between 41 and 50 years [1]. The greater percentage of female respondents (51.4%) is similar to that reported by Fasanmade et al and Ariyo et al [7, 8] in their studies. Such trends could be a reflection of gender differences in health seeking behaviour among people leaving with diabetes.

Educational level showed that participants with secondary education were the highest proportion (34.7%), followed by tertiary education (27.8%). However, 27.7% of participants had primary education or no formal education, which may limit their ability to understand diabetes education materials and practice effective self-management. Previous research has shown that diabetes knowledge directly relates to educational level as reported in studies by Odili et al and Jackson et al [9, 16] suggesting that educational programs requires well-planned approaches for varying levels of literacy.

4.1. Knowledge and Awareness Findings

The participants had moderate levels of diabetes-related knowledge, with the majority of the respondents reporting their knowledge of dietary (41.7%) and physical activity (38.2%) guidelines as "Good". The proportion that rated their knowledge as "Good" or "better" was however higher in dietary management (61.8%) than in physical activity (54.8%), signifying better awareness in dietary management. This observation is similar to the findings from studies done in other parts of Nigeria which demonstrated that there is better dietary knowledge than exercise knowledge among diabetes patients regarding the the management of their condition [10, 17].

The fact that dietary counselling is more readily offered than exercise guidance in the Nigerian healthcare facilities might be the reason why participants had better dietary knowledge than physical activity knowledge according to a study by Odenigbo et al [11]. This knowledge deficit in physical activity may influence the readiness of patients to continue exercising at an adequate level because they lack proper knowledge about the benefits of physical activity and it's benefit in achieving good glycaemic control.

4.2. Compliance Behaviours and Clinical Outcomes

Although the diabetes-related knowledge of participants was moderate, there was a poor compliance behaviour. The mean of the dietary compliance of 4.2 days per week and physical activity of 2.8 is below the recommended standard. The level of dietary compliance was adequate in only 32.6% of the participants, and it is also worrying that only 18.4% of the participants had adequate physical activity levels, given the emphasis on lifestyle change in the management of diabetes [3]. These low compliance rates corresponded to poor clinical outcome, with an average HbA1c level of 8.4%, which is well above the recommended <7%. Less than one-fourth of the participants had good glycaemic control, and this fact shows the necessity of more effective measures.

Similar trend was observed in a sub-saharan African study according to results by Ageru et al [14] where only 38.5% of diabetes self-care interventions in the region resulted in improvement in the primary or secondary outcomes, with SMS-based intervention having little effect on physical activity and glycemic control. Likewise, Stephani et al. [16] concluded that patients in SSA did not self-monitor glucose very often, were physically inactive, and moderately adhered to the diet and medication instructions.

4.3. Knowledge-Compliance Relationship

Another key finding of this study is the positive correlation between the degree of diabetes-related knowledge and adherence to dietary and physical activity prescriptions of the patients. There was a significant dose-response relationship between the level of knowledge and the compliance rates

where participants with the knowledge of Very Good rated significantly higher on compliance rates than those with Poor knowledge. This gradient indicates that the higher the knowledge the higher the chances of adherence - an insight that supports the behavioural theory which relates awareness to action [13]. The correlation coefficients (dietary: r = 0.542; physical activity: r = 0.486) confirm to positive relationships, which supports the hypothesis that the stronger knowledge is, the more effective self-management behaviours become. These are most relevant in the setting of chronic disease management where behavioural adherence may be affected by a multiplicity of determinants.

A second analysis conducted; multiple regression indicated that knowledge was the best predictor of dietary adherence (38.7% of the variance). This is a significant percentage, which highlights the centrality of the special educational interventions in patient outcomes. It indicates that knowledge is not just a passive aspect but it is an active element of behaviour change.

These results are in line with the earlier research carried out both in Nigeria and other countries. A study by Olonisakin et al [12] reported that 98.2% of the respondents in Ibadan had a good understanding of the management of diabetes, yet a considerable number of them were still experiencing problems with medication adherence, indicating that behavioral reinforcement should be accompanied by education. Similar study by Oluwatoyin et al [13], found that diabetes knowledge and dietary adherence were significantly correlated, and 84% of their participants had moderate knowledge and 77.3% moderate compliance with dietary adherence-in line with the dose-response association found in this study.

Ariyo et al. In their study [8] also found that 53.5% of patients had good knowledge and 77.2 percent had good dietary compliance, implying that the knowledge can have a significant role, although other variables like access to dieticians and support systems can boost compliance. On a larger scope, Ageru et al [14] demonstrated in a systematic review that diabetes self-management education resulted in better glycemic control and adherence in almost every third case, particularly when the intervention was culturally appropriate and family supported.

According to Ferreira et al [15], lack of knowledge, especially in identifying symptoms and in making dietary decisions, was attributed to poor self-management outcomes in Portugal. Their results support the significance of specific education in the prevention of complications and better long-term results.

4.4. Clinical Implications

The positive correlation between knowledge/awareness and compliance, and the inverse relationship between the two variables with the levels of HbA1c, are indicative of educational interventions as a way of enhancing clinical outcomes. Nonetheless, this does not show that knowledge is enough or all that is needed.

The Limitations and Recommendations

The cross-sectional nature of the study and the small sample size may not allow for generalization of the finding, and longitudinal studies with larger sample sizes in the future would help more clearly determine the causal nature of the relationship between the acquisition of knowledge and behavioral change as it relates to diabetes management. The use of self-reported measures of compliance can introduce bias and objective measures of compliance, e.g. continuous glucose monitoring or activity trackers, would provide more accurate results.

5. Conclusion

Knowledge and awareness are important determinants that play a vital role towards dietary and physical activity adherence among T2DM patients. Although this study revealed that the knowledge level of the participants was moderate, the compliance was low, indicating the importance to conduct comprehensive programs of diabetes self-management education that will not only increase knowledge but also eliminate barriers to behavioral change.

Knowledge and compliance have strong correlations with clinical outcomes, which proves the possible benefits of specific instructional interventions. Healthcare providers should introduce a systematic diabetes education program that will offer continuous assistance in making dietary and physical activity recommendations with emphasis on the gaps identified in physical activity awareness.

Future research should aim at developing and testing comprehensive interventions to educate patients with diabetes to fill the knowledge-to-action gap and thus improve both compliance behaviour and clinical outcomes in this patient group.

Abbreviations

DM	Diabetes Mllitus
SPSS	Statistical Package for Social Science
T2DM	Type 2 Diabetaes Mellitus

Author Contributions

Solomon Mercy Luka: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Writing – original draft

Sadiya Haruna Warshu: Supsupervision, Validation, Writing – review & editing

Conflicts of Interest

The authors declare no conflicts of interest.

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