GLYCAEMIC CONTROL AND PRACTICE OF SELF-CARE BEHAVIORS AMONG PEOPLE WITH TYPE 2 DIABETES IN NIGERIA

Nnena A. Osuji
Federal Medical Centre, Abeokuta, Nigeria

Oluwaseun S. Ojo
Federal Medical Centre, Abeokuta, Nigeria

Sunday O. Malomo
Federal Medical Centre, Abeokuta, Nigeria

Adegbola M. Ige
Federal Medical Centre, Abeokuta, Nigeria

Ademola O. Egunjobi
Federal Medical Centre, Abeokuta, Nigeria

Adesoji J. Adeyemo
Federal Medical Centre, Abeokuta, Nigeria

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ABSTRACT

Objective: The practice of self-care behaviors by patients with diabetes mellitus plays a vital role in achieving optimal glycaemic control. Previous Nigerian studies discussed how the knowledge of self-care behaviors among people with diabetes influences glycaemic control rather than the impact of these behaviors on glycaemic control. This study assesses the relationship between the practice of diabetes self-care behaviors and glycaemic control.

Research Design and Methods: A cross-sectional study was conducted among people with type 2 diabetes at the medical outpatient clinic of the hospital. Three hundred and sixteen participants were recruited over four months, however, due to incomplete data only 313 of these participants were analyzed. Data on respondents' characteristics and level of self-care behaviors were obtained using a pretested questionnaire and the Summary of Diabetic Self-Care Activities (SDSCA). A1C was used as an indicator of glycaemic control.

Results: The proportion of the participants with "good" glycaemic control and "good" practice of self-care behaviors were 40.6% and 26.8% respectively. Female gender (P=0.002, OR=4.23), using only oral hypoglycaemic agents (P=0.029, OR=4.83), the absence of truncal obesity (P<0.001, OR=15.33), and "good" practice of self-care behavior (P<0.001, OR=5.86) were predictors of "good" glycaemic control.

Conclusion: The proportion of patients with "good" glycaemic control and "good" practice of self-care behaviors were low. The predictors of glycaemic control in this study, which included medical and non-medical components of diabetes care, underscores the importance of a multi-pronged approach involving prescriptive practices by physicians and improved self-care behavioral practices by patients.

INTRODUCTION

Diabetes mellitus is a global health problem that has reached a pandemic proportion. Globally, the number of people with diabetes in 2017 was estimated to be 425 million with a prevalence of 8.8%. By 2045, the estimate is projected to increase to 629 million [1]. Nigeria has the largest number of people living with diabetes in Africa due to its size [1]. According to a Nigerian review paper, type 2 diabetes (T2D) accounts for 95% of those with diabetes, while the remaining 5% live with type 1 diabetes (T1D) [2]. The International Diabetes Federation (IDF) estimated that about 1,240-3,876 million cases of diabetes occurred in Nigeria in 2017 with a current overall prevalence of 4.6% [1]. This represents more than a two-fold increase in prevalence from the previously reported national prevalence rate of 2.2% [3]. Reports from subsequent studies have indicated an alarming increase in the prevalence of diabetes among all ethnic groups, with a higher prevalence rate in urban populations when compared to rural populations [4, 5].

Diabetes poses great monetary challenges for the individual, family, and national health care system. According to IDF, the cost of care for a patient with diabetes in Nigeria (age 20–70 years) is roughly double that of other patients [1]. A Nigerian diabetes patient spends approximately US$137 annually [6]. The financial burden on patients is even made worse as the majority of these patients procure their treatment out of pocket.

The high prevalence and burden of diabetes make the effective management of diabetes imperative. In theory, the information on how the disease should be managed abounds. People living with chronic diseases such as diabetes require lifestyle modifications to guarantee a positive health outcome. Lifestyle change demands active participation of patients [7]. For example, affected individuals must engage in self-care activities and monitor their blood glucose, nutrition, physical activity, foot care, and adherence to medication. These personal care activities carried out by patients to maintain their health are called self-care. Self-care is a multi-dimensional concept which is defined as a personal activity to take care and maintain one's own health, illness, or prevention of disease-related complications [7]. Studies have shown that self-care reduces healthcare costs, prevents complications, and enhances the quality of life in patients with chronic diseases [8].

Studies aimed at improving glycaemic control among Nigerian diabetes patients focused on how physicians and patients can improve glycaemic control through pharmacotherapy [9]. The prescription of a simple dosing regimen by physicians and adherence to medication on the part of patients are aspects of self-care that is not enough for a lifestyle-related disease like diabetes. A focus on the medical prescriptive approach (which is one of the components of self-care as seen in most of these studies) is not patient-centred.

The few Nigerian studies that were done on self-care behaviors among T2D patients focused on how the knowledge of self-care practices among T2D patients influences glycaemic control rather than the effect of the level of practice of these behaviors on glycaemic control [10-12]. A look at the practice of self-care behaviors by T2D patients may provide more insight regarding the self-management of diabetes and the likely reasons for poor glycaemic control in our setting. It may also point out the similarities and differences among people living with T2D in developed and developing countries with regards to the practice of self-care behavior. This study aimed to determine the relationship between the practice of diabetes self-care behaviors and glycaemic control, as well as to assess other factors that are associated with glycaemic control among T2D patients.

METHODS

Study Design

This study was a cross-sectional, hospital-based study carried out at the Medical Outpatient Clinic of a tertiary hospital in Nigeria. The Medical Outpatient Clinic is one of the specialist clinics of the hospital. The clinic runs every weekday from 8 am - 4 pm. Each clinic day usually begins with health education given by the nurses and dieticians, especially for diabetes and hypertensive patients. Both adult male and female patients are seen in the clinic.

The study population consisted of adult patients aged 18 years and above with established T2D attending the Medical Outpatient Clinic of the hospital. All consenting T2D patients aged 18 years and above attending the Medical Outpatient Clinic for at least one year were included in this study. Excluded from the study were patients who

had a major psychiatric illness and could not follow the study protocol, or patients that were very ill and required emergency care.

The sample size was calculated using the formula n=z2pq/d2 [13]. At z=1.96, the proportion of T2D with good glycaemic control from a previous study (p) of 29.3% and d=0.05, the sample size was 316 [14]. Systematic random sampling technique was used to recruit 316 (sample size) participants for this study using a sampling interval of 2 [724 (estimated respondents in four months of data collection) /316 (sample size)]. The first person was selected from the first two patients with T2D that arrived at the clinic by simple random sampling (balloting) on each day. Thereafter, every consenting second person was recruited until the sample size was reached. The case files of those selected at the end of each clinic were marked with a sticker to avoid including them again in the study.

Data Protocol

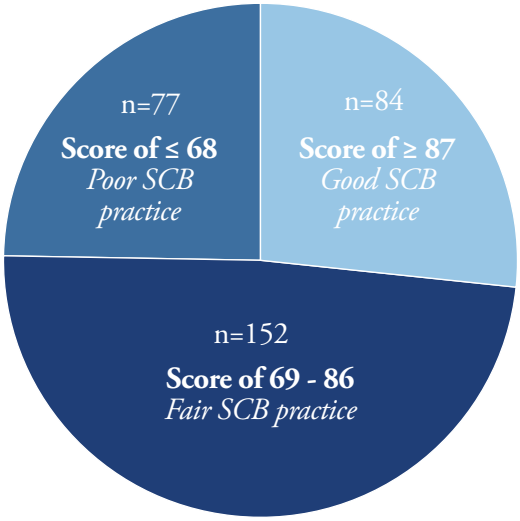
Consent was taken from patients who were eligible for the study. Information was obtained by the investigators using a pre-tested interviewer-administered questionnaire and standardized tool for assessment of self-care practices. The pre-tested questionnaire consisted of five sections (A-E) as follows: socio-demographic data, clinical characteristics, standardized tool for assessing the practice of self-care behaviors, physical examination followed by the laboratory investigation. It extracted information about patients' demographic factors and clinical factors which included the level of education, monthly earnings, duration of diabetes, treatment modality, co-morbid conditions, and family history of diabetes. The treatment modality was divided into four options: (1) non-pharmacology (NP) alone; (2) oral hypoglycaemic agents alone; (3) oral hypoglycaemic medications and insulin; and (4) insulin alone. The non-pharmacology implies patients on lifestyle modifications.

The standardized instrument used in this study was the Summary of Diabetic Self-Care Activities (SDSCA) [15]. The SDSCA was originally designed to measure five key components of the diabetes regimen: general diet, specific diet, exercise, medication taking, and blood glucose monitoring. The revised version used in this study with little modifications to suit our local context included additional questions on foot care and complementary therapy. The revised questionnaire has six components [diet, medication, exercise, self-monitoring of blood glucose (SMBG), foot care, and use of complementary alternative therapy (CAM)]. There were fifteen questions in total: 4 questions each for diet and foot care; 2 questions each for the practice of medication adherence, exercise, and self-monitoring of blood glucose; and 1 question under CAM.

The face validity of the questionnaire was approved by an expert (a family physician with interest in diabetes). The test-retest reliability of the questionnaire was assessed through a pilot study of 30 adults with T2D. The questionnaire was administered to the same patients twice in a 2-week interval. The correlation between the items of the SDSCA questionnaire in the two measurements (correlation coefficient "r") ranged from 0.58 for foot care subscale to 0.73 for diet subscale, which shows an acceptable reliability of the questionnaire.

Using a continuous scale ranging from "0 (no weekly participation in a diabetes self-care activity) to 7 (participation in a diabetes self-care activity every day of the week)," each participant indicated the number of days in a week that they

Figure 1: Pattern of practice of self-care behavior (SCB) among the respondents



The revised version of the Summary of Diabetic Self-Care Activities (SDSCA) with six components [diet, medication, exercise, self-monitoring of blood glucose (SMBG), foot care, and use of complementary alternative therapy (CAM) was used in this study. Participants were asked 15 questions to assess their overall level of practice of SCB. Each question has a potential score range of 0-7 giving a minimum and maximum overall score of 0 and 105 respectively. The overall level of practice of SCB of the participants was grouped into good, fair and poor using less than 25th, 25th-75th and more than the 75th percentile of their possible scores respectively.

performed any of the self-care behaviors. Potential scores ranged from 0 to 7, according to the number of days the behavior was practiced during the previous 7 days. A reversal score was given for a negative item (item 4 in diet subscale and the complementary therapy subscale). The minimum and the maximum overall scores were 0 and 105 respectively. The overall scores were categorized using less than the 25th percentile, 25th-75th percentile, and more than the 75th percentile of the possible range of participants' scores into poor, fair, and good self-care practices respectively.

Self-care practices of the different domains were categorized into "good" self-care practice (participants' score more than or equal to 50th percentile of the range of scores in that domain) and "poor" self-care practice (participants' score less than the 50th percentile of the range of scores in that domain). The minimum and maximum scores under diet and foot care (4 questions each) were 0 and 28 respectively. Medication, exercise, and SMBG domains (2 questions each) had minimum and maximum scores of 0 and 14 respectively. The minimum and maximum scores under CAM domain (one question) were 0 and 7 respectively.

The blood pressure measurement for each participant was taken twice in the clinic using mercury sphygmomanometer (Accosson® brand) and Littman's stethoscope after participants had rested for five minutes with an interval of two minutes in between the two readings. The average of the two blood pressure readings was calculated. Blood pressure greater than or equal to 130/80mmHg in the subjects was classified as uncontrolled [16].

Height (cm) and weight (kg) were measured according to the standard protocol [17]. The body mass index was calculated using the formula Weight (kg)/Height2 (m2) and stratification using the World Health Organization (WHO) classification of body mass index (BMI) was used: Normal 18.5–24.99, Overweight 25.0 –29.99, and Obese ≥30.0 [17]. The waist and the hip circumference were also measured following the standard protocol by World Health Organization [18]. A waist circumference of more than 40 inches (102cm) in men and greater than 35 inches (88cm) for women was considered abnormal [18].

The glycated haemoglobin levels (A1C) of the participants were used as an indication of glycaemic control. Three millilitres of venous blood sample was drawn from each participant into fluoride sample bottles. The following formula given by the manufacturer of the kit was used to obtain the Diabetes Control and Complications Trial (DCCT) referenced values: A1C National Glycohaemoglobin Stan-

Table 1: Socio-demographic characteristics of the respondents

Variables	*Categories*	*Frequency*	*Percentage*
Gender	Male	128	40.9
	Female	185	59.1
Age group (years)	Young (18-44)	16	5.1
	Middle-aged(45-64)	163	52.1
	Elderly (≥65)	134	42.8
Ethnicity	Yoruba	304	97.1
	Igbo	5	1.6
	Hausa	0	0.0
	Others	4	1.3
Marital status	Single	1	0.3
	Married	272	86.9
	Separated	5	1.6
	Divorce	5	1.6
	Widowed	30	9.6
Type of family	Monogamy	249	79.6
	Polygamy	64	20.4
Household size	≤5	119	38.0
	>5	194	62.0
Level of education	No formal education	46	14.7
	Primary	73	23.3
	Secondary	72	23.0
	Tertiary	122	39.0
Religion	Christianity	236	75.4
	Islam	76	24.3
	Traditional belief	1	0.3
Occupation	Unemployed	10	3.2
	Retired	58	18.5
	Artisans	32	10.2
	Trading	109	34.8
	Civil servants	85	27.2
	Others	19	6.1
Monthly earnings	<10,000 naira	60	19.2
	10,000-50,000 naira	120	38.3
	51,000-100,000 naira	87	27.8
	>100,000 naira	46	14.7

dardization Program (NGSP)] (%) = 0.86 A1C-Dialab (%) + 0.24. A1C levels of participants were categorized according to American Diabetes Association into A1C less than 7% (53mmol/mol)] and A1C over ≥7.0% (53mmol/mol)] [19].

Data Analysis

Data were collected over a period of 4 months, and analyzed using the Statistical Package for Social Sciences™ (SPSS Inc., Chicago, IL, USA) version 22.0. Data were presented with tables and charts. Continuous variables were summarized with mean and standard deviation; categorical variables were summarized with ratios, proportions, and percentages. Chi-square statistical test was used to determine the association between glycaemic control and each independent variable. The level of statistical significance was set at a p-value of ≤ 0.05 and Confidence Interval (CI) of 95%. Significant independent variables were entered into a logistic regression analysis to determine the independent predictors of glycaemic control. The odds ratios (OR) and 95% confidence intervals (95%CI) for the predictor variables were calculated.

Ethical Considerations and Consent

Ethical approval was obtained from the Health Research Ethics Committee of the hospital. Informed written consent was obtained from each study participant. The respondents had the benefits of knowing their A1C level and body mass index, and were educated on the importance of self-care practices in the management of diabetes.

RESULTS

A total of 316 participants were recruited for the study. Three subjects had incomplete data; therefore, data for 313 participants were analysed, yielding a completion rate of 99.05%.

The age range of the respondents was 34 to 86 years. The overall mean age was 60.96±10.1. Most of the respondents were middle-aged [n=163(52.1%)] and married [n=272(86.9%)]. There were more female [n=185 (59.1%)] than male [n=128 (40.9%)] respondents (Table 1).

The mean duration of diabetes was 6.5±5.98 years. Over half of the respondents [n=179 (57.2%)] were diagnosed within 5 years. While none of them were on insulin only, the majority of the respondents were on oral hypoglycaemic agents alone [n=278 (88.8%)]. Among the study participants, 143 (45.7%) respondents had co-morbid hypertension, and 66.8% were overweight and obese (Table 2).

Using less than 25th percentile, 25th-75th percentiles, and more than 75th percentile of their scores to categorize their overall level of self-care behavior into "good," "fair," and "poor" respectively, participants with total scores ≤ 68 were regarded as having "poor" self-care behavior practice, those with scores between 69 and 86 were regarded as having "fair" self-care behavior practice, and participants with total scores ≥ 87 were regarded as having "good" self-care behavior practice. Of the 313 respondents, 26.8% (n=84)

Table 2: Clinical characteristics of the respondents

Variables	*Categories*	*Frequency*	*Percentage*
Duration of diabetes (years)	1-5	179	57.2
	6-10	71	22.7
	11-15	37	11.8
	>15	26	8.3
Treatment modality	NP only	0	0.0
	OHA only	278	88.8
	OHA+ Insulin	35	11.2
	Insulin only	0	0.0
	Others	0	0.0
History of hypertension	No	170	54.3
	Yes	143	45.7
Family history of diabetes	No	264	84.3
	Yes	49	15.7
Clinic attendance	Regular	215	68.7
	Not regular	98	31.3
Body mass index (kg/m2)	Underweight (<18.5)	9	2.9
	Normal weight (18.5-24.9)	95	30.3
	Oveweight (25.0-29.9)	116	37.1
	Obese (≥30.0)	93	29.7
Waist circumference	No truncal obesity (M<102cm, F<88cm)	201	64.2
	Truncal obesity (M≥102cm,F≥88cm)	112	35.8

NP- Non-pharmacological, OHA- oral hypoglycaemic agent

had "good" self-care behavior practice, 48.6% (n=152) had "fair" self-care behavior practice, and 24.6% (n=77) had "poor" self-care behavior practice (Figure 1).

Using participants' scores greater than or equal to 50th percentile of the possible range of scores in each self-care practice domain as "good" self-care behavior, participants with scores ≥ 23 and ≥ 21 out of a total score of 28 were regarded to have good dietary and foot care practice respectively. Participants with scores ≥ 14, ≥10, and ≥ 4 out of a total score of 14 were categorized to have a "good" medication adherence, exercise, and blood glucose monitoring respectively. Participants with a score of 7 out of a total score of 7 were regarded to have a "good" practice of CAM. Based on this, 85.3% had "good" medication adherence, followed by use of CAM (82.1%), diet (63.8%), exercise (49.0%), and foot care (23.6%), while SMBG was the least practiced self-care behavior (21.7%) (Figure 2).

The mean A1C was 7.72±2.39%. Seventy-four (23.6%) respondents had A1C range between 4.0-5.9%, 73 (23.3%) had A1C range between 6.0-6.9%, 116 (37.1%) had A1C range between 7.0-9.9%, and 50 (16.0%) had A1C ≥10%. A greater proportion of the participants [n=186(59.4%)] had A1C ≥ 7% (Figure 3).

Table 3: Relationship between glycaemic control and socio-demographic factors

Variables	*Categories*	*A1C<7%*	*A1C≥7%*	X^2	*Df*	*P-value*
Gender	Male	42 (32.8)	86 (67.2)	15.905	1	<0.001
	Female	103 (55.7)	82(44.3)			
Age group	18-44 (young)	5 (31.2)	11 (68.8)	10.550	2	0.005
	45-64 (middle aged)	64 (39.3)	99 (60.7)			
	≥65 (elderly)	76 (56.7)	58 (43.3)			
Marital status	Single	0 (0.0)	1 (100.0)	4.026	4	0.269
	Married	121 (44.5)	151 (55.5)			
	Divorced	2(40.0)	3 (60.0)			
	Separated	3 (60.0)	2 (40.0)			
	Widowed	17 (56.7)	13 (43.3)			
Family type	Monogamous	101(40.6)	148 (59.4)	0.048	1	0.827
	Polygamous	25 (39.1)	39 (60.9)			
Household size	≤5	55 (46.2)	64 (53.8)	0.001	1	0.976
	>5	90 (46.4)	104 (53.6)			
Education	No formal education	19 (41.3)	27 (58.7)	1.902	3	0.593
	Primary	31 (42.5)	42 (57.5)			
	Secondary	33 (45.8)	39 (54.2)			
	Tertiary	62 (50.8)	60 (49.2)			
Occupation	Unemployed	5 (50.0)	5 (50.0)	8.493	5	0.131
	Retired	35 (60.3)	23 (39.7)			
	Artisans	15 (46.8)	17 (53.2)			
	Trading	48 (44.0)	61 (56.0)			
	Civil servants	34 (40.0)	51 (60.0)			
	Others	6 (31.6)	13 (68.4)			
Monthly earnings	< 10,000 naira	35 (58.3)	25 (41.7)	5.123	4	0.275
	10,000-50,000 naira	54 (45.0)	66 (55.0)			
	51,000-100,000 naira	44 (50.6)	43 (49.4)			
	>100,000 naira	17 (37.0)	29 (63.0)			

There was a significant association between glycaemic control and gender (p<0.001), age group (p=0.005), treatment modality (p<0.001), comorbid hypertension (p=0.005), truncal obesity (p<0.001), and practice of self-care behavior (p<0.001) (Table 3-5). The independent predictors of A1C < 7% were female gender (p=0.002, OR= 4.23, 95% CI= 1.68-10.68), oral hypoglycaemic agents only (p=0.029, OR= 4.83, 95% CI= 1.17-19.93), absence of truncal obesity (p<0.001, OR= 15.33, 95% CI= 5.82-40.38), and good practice of self-care behavior (p<0.001, OR= 5.86, 95% CI= 2.31-14.87) (Table 6).

DISCUSSION

The presence of hypertension in 45% of T2D participants studied further reinforced the high prevalence of hypertension among patients with diabetes reported in previous studies [20, 21]. Hypertension and diabetes can be described as "conjoined twins" of chronic diseases; they coexist at a greater frequency than chance alone would predict [21]. The presence of one may warrant screening for the other. Although diabetic nephropathy has been pointed out as an important factor involved in the development of hypertension among T2D patients, the aetiology of hypertension in people with diabetes cannot be explained by only the underlying renal disease alone and remains "essential" in nature [21].

The shared aetiology/risk factors common to both hypertension and diabetes may also explain their co-existence. For instance, overweight/obesity was present in approximately 67% of T2D patients studied. This shared risk factor may be responsible for high prevalence of hypertension seen in this study. It is imperative to aggressively treat T2D patients with hypertension because the co-existence of both increases the mortality rates among diabetes patients [21]. This was the reason for a lower target blood pressure of less than 130/80mmHg in diabetes patients, unlike the general population with a target blood pressure goal of less than 140/90mmHg [16, 22].

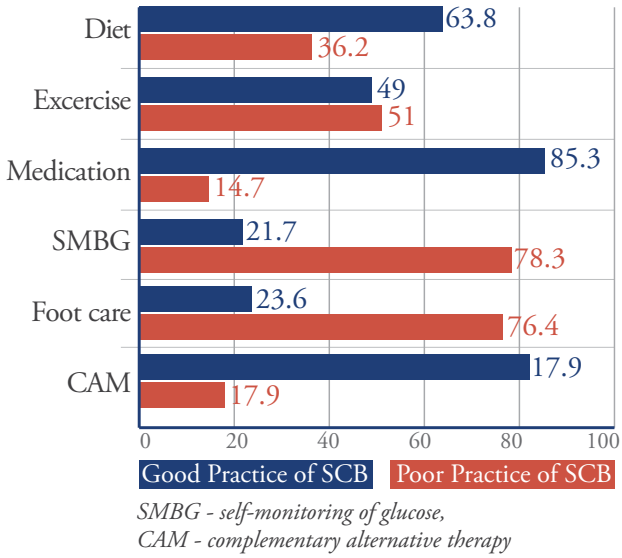
The proportion of patients with overall "good" level of diabetes self-care behavior practice was low in this study (26.8%). Similar low proportions have been documented in previous studies [23-27]. Ayele and others in Hanari, Eastern Ethiopia recorded good self-care practices in 39.2%

Table 4: Relationship between glycaemic control and clinical factors of the respondents

Variables	*Categories*	*A1C<7%*	*A1C≥7%*	X^2	*Df*	*P-value*
Duration of diabetes	1-5	81 (45.3)	98 (54.7)	1.141	3	0.767
	6-10	33 (46.5)	38 (53.5)			
	11-15	20 (54.1)	17 (45.9)			
	>15	11 (42.3)	15 (7.7)			
Treatment modality	NP only	0 (0.0)	0 (0.0)	10.984	1	<0.001*
	OHA+NP	138 (49.6)	140 (50.4)			
	OHA+Insulin+NP	7 (20.0)	28 (80.0)			
	NP+ Insulin	0 (0.0)	0 (0.0)			
	Others	0 (0.0)	0 (0.0)			
History of hypertension	No	91 (53.5)	79 (46.5)	7.765	1	0.005
	Yes	54 (37.8)	89 (62.2)			
Family history of diabetes	No	120 (45.5)	144 (54.5)	1.048	1	0.306
	Yes	25 (51.0)	24 (49.0)			
Clinic attendance	Regular	110 (51.2)	105 (48.8)	1.859	1	0.173
	Not regular	42(42.9)	56 (57.1)			
Body mass index	Not obese	110 (50.0)	110 (50.0)	4.020	1	0.055
	Obese	35 (37.6)	58 (62.4)			
Waist circumference	No truncal obesity	126 (62.7)	75 (37.3)	60.470	1	<0.001
	Truncal obesity	19 (17.0)	93 (83.0)			

** Fisher's Exact test*

Figure 2: Level of practice of the different components of self-care behaviors among the respondents



SMBG - self-monitoring of glucose,
CAM - complementary alternative therapy

The level of self-care practices of the different domains in the SDSCA was categorized into good self-care practice (participants' score more than or equal to 50th percentile of the range of scores in that domain) and poor self-care practice (participants' score less than 50th percentile of the range of scores in that domain). Participants with score ≥ 23 and ≥ 21 out of a total score of 28 were regarded to have good dietary and foot care practice respectively. Participants with score ≥ 14, ≥10 and ≥ 4 out of a total score of 14 were categorized to have a good practice of medication, exercise and blood glucose monitoring respectively. Participants with score of 7 or more out of a total score of 7 were regarded to have a good practice of CAM.

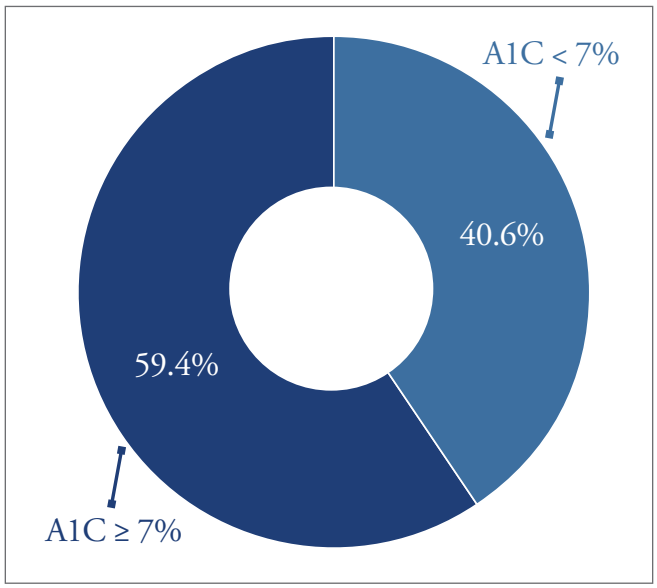
Table 5: Relationship between glycaemic control and self-care behavior of the respondents

Variables	*Categories*	*A1C<7%*	*A1C≥7%*	X^2	*Df*	*P-value*
Overall practice of self-care behaviors	Good	80 (95.2%)	4(4.8%)	125.676	2	P<0.001
	Fair	61 (40.1%)	91 (59.9%)			
	Poor	7 (9.1%)	70 (90.9%)			

Table 6: Logistic regression analysis of significant factors associated with glycaemic control

Variable	*Categories*	*Beta*	*P-value*	*Odd ratio*	*95% CI*
Gender	Female	1.442	0.002*	4.23	1.68-10.68
	Male				
Age group	Elderly	1.036	0.311	2.82	0.38-20.86
	Middle aged	0.530	0.595	1.70	0.24-11.96
	Young				
Treatment modality	OHA+NP	1.575	0.029*	4.83	1.17-19.93
	OHA+Insulin+NP				
History of hypertension	No	0.518	0.188	1.68	0.78-3.63
	Yes				
Waist circumference	No truncal obesity	2.730	<0.001*	15.33	5.82-40.38
	Truncal obesity				
Practice of self-care behavior	Good	1.769	<0.001*	5.86	2.31-14.87
	Poor				

Figure 3: Glycaemic control among the 313 respondents



of their subjects [25]. Another study done in Kenya showed that 41% of the participants had good self-care practices [26]. There is a paucity of study on the level of self-care behaviors among T2D patients in Nigeria. A majority of the Nigerian studies focused on the knowledge of T2D patients on self-care behavior rather than the practice of these behaviors [10-12]. The common denominator in these studies was a low level of knowledge of self-care behaviors among T2D patients [10-12]. However, the few respondents that were reported to have good knowledge of self-care behavior in these studies may not practice them because knowledge does not always translate into practice. A previous Kenyan study showed that having diabetes knowledge alone is insufficient to produce behavioral changes required for effective self-management and eventual glycaemic control [27]. Thus, asides from assessing the knowledge of self-care practices among T2D in Nigeria, future researchers on this theme should focus on the level of practice of self-care behaviors among T2D patients as well as explore factors that promote the practice of self-care behaviors among T2D patients.

In our study, we found that participants highly adhered to medication, complementary alternative therapy, and exercise regimes, while foot care and self-monitoring of blood glucose were least adhered to by patients. These same behavorial patterns had also been documented in previous studies [24, 27]. These patterns may be a reflection of quality and content of self-care diabetes education given to people with diabetes during their routine clinic visits. For most patients in resource-poor countries like the study area, the doctor and other health care providers involved in diabetes care are at the center of their care, and therefore, patients may solely rely on information from them [28-30]. This underscores the importance of good provider-patient relationships in these environments.

Unfortunately, in resource poor countries, the provider-patient relationship is still that of paternalism, and the communication between doctors and patients is lacking [28-30]. Health care providers managing diabetes in developing countries may place more emphasis on diet, medication adherence, use of complementary alternative medicine and exercise with little or no information to patients on foot care and self-monitoring of blood glucose [9, 31]. This is further worsened by a low doctor-patient ratio and the limited time available to attend to people with diabetes in busy clinics. Financial limitations in procuring glucometers and attitude of diabetes patients towards self-care behavior are among other reasons that have been attributed to overall poor self-care practices noticed in the area of foot care and self-monitoring of blood glucose [26, 27]. The use of patient-centered clinical approach may be best suited to address areas of concern related to self-care. Future research should also focus on the nature of the partnership between people living with diabetes and healthcare professionals, as well as looking for ways to provide self-management support [9].

The glycaemic control in this study was low with 40.6% achieving A1C less than 7% (<53mmol/mol). This finding corroborates previous reports and has remained unchanged in many parts of the world, especially in developing countries [9, 32-35]. A review of empirical studies on self-management of diabetes in Africa revealed that suboptimal glycaemic control was recorded in more than 50% of persons living with diabetes across different settings [33-35]. Studies conducted in various centers in Nigeria also showed suboptimal glycaemic control [33, 35]. The complex nature of diabetes management which involves inputs from patients and health care providers may be a major impediment to achieving optimal glycaemic control; therefore, interventions aimed at improving glycaemic control must be designed to improve medical management, provider-patient relationship and self-care practices among T2D patients.

Our study showed that female gender was an independent predictor of A1C <7% (OR=4.23, 95% CI=1.68-10.68). Reports from previous studies that investigated the influence of gender on glycaemic control are conflicting. Our study is consistent with a number of previous studies reporting that females usually have A1C < 7% [36, 37], yet another study had documented better control in men [38], while other studies have also shown no association [35, 39]. The varying reports could be due to the study site, gender-based roles in the study areas, and differential health seeking behavior among males and females in the study areas [35-39]. In view of this, interventional approaches should go beyond gender differences in glycaemic control. It should be a patient-centred approach that encompasses understanding patient comprehension of the disease and collaborative partnership between healthcare professionals and patients.

In this study, patients treated with oral hypoglycaemic agents only tended to have A1C <7% when compared to respondents treated with a combination therapy of oral hypoglycaemic agents and insulin (p=0.029, OR= 4.83, 95% CI= 1.17-19.93). The general consensus in previous studies is that glycaemic control among insulin users tends to be more difficult [23, 40]. This may be attributed to the likely increased disease severity among patients on insulin. In addition, inadequate dosage regime, the cumbersome procedure of insulin administration, and the preservation of insulin may adversely affect the ability to maintain sub-optimal glycaemic control. This calls for more aggressive treatment and monitoring of T2D patients on insulin, both in terms of adequate dosing and improved adherence in order to achieve A1C <7%.

The results of this study indicated that absence of truncal obesity was an independent predictor of A1C < 7%. This finding concurs with other studies [41, 42]. Mogre et al. [41] in a cross-sectional study of T2D patients from Tamale, Ghana found a positive correlation between waist circumference and fasting blood glucose. The prevention of obesity is an aspect that can only be handled by the roles that are performed outside the physicians' office. T2D patients should be encouraged to actively participate in diet and exercise-related self-care practices that will prevent truncal obesity.

This study showed that respondents with good self-care behavior practice were approximately 6 times more likely to have A1C <7% than those with poor self-care behaviors (OR=5.86, 95%CI=2.31-14.87). Aside from diabetes, researchers in the field of caring science and self-care activities of chronic disease have emphasized the role of lifestyle interventions in improving health outcomes [7, 23, 27, 32, 43]. A 12-week intervention study that was conducted among 80 previously diagnosed T2D patients who were equally randomized into intervention and control groups in South-West Nigeria showed that increasing self-care behavior practices resulted in significant improvement of glycaemic control [43]. Patients' ability to self-manage their health behavior plays a crucial role in diabetes management. Health care providers should include all aspects of self-care behaviors when treating people with diabetes in order to improve self-care behavior practices, and hence, achieve optimal glycaemic control.

The following limitations were considered in this study. Firstly, this was a hospital-based study, and thus the results may not be generalized to the entire diabetes population within the community, especially the rural areas. Secondly, as a result of the cross-sectional design of this study, findings from it cannot address issues of causal relationships between glycaemic control and the factors found to be associated with it. The self-care behaviors of the study participants were based on self-reports, and performance of these behaviors was not observed and could not be confirmed.

CONCLUSION

The majority of the respondents studied had "poor" levels of self-care behavior and suboptimal glycaemic control. The predictors of glycaemic control in this study included medical and non-medical components of diabetes management. This underscores the importance of a multi-pronged approach that focuses on the collaborative partnership between healthcare professionals and patients, better medical and non-medical prescriptive approaches by T2D multi-disciplinary teams, and improved self-care behaviors by patients. Overall, the findings of this study will improve the quality of life of people living with diabetes.

RECOMMENDATIONS

T2D multidisciplinary teams (doctors, nurses, dieticians, diabetes educators, etc.) working in developing countries should routinely assess self-care behaviors of their clients, especially those that tend to be poorly practiced (such as foot care practices and self-monitoring of blood glucose). All health care providers involved in the management of diabetes should also counsel patients on the importance of practising diabetes self-care behaviors with special emphasis on foot care and self-monitoring of blood glucose that were noticed to be rarely practiced by respondents in this study. In addition, all health care providers involved in diabetes management should aim towards having a collaborative partnership with patients in order to promote the practice of self-care behaviors by patients. Health institutions should also provide self-management education to people living with diabetes as an important component of diabetes care. This education should not be just disease-centered, but also problem solving-centered. Further studies are needed to investigate the content and quality of physicians' communication of diabetes self-care practices to patients in Nigeria.

CONFLICT OF INTEREST DISCLOSURES

The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. The authors report no potential conflicts of interest relevant to this article.

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