Assessment of self-monitoring of blood glucose practice among type 2 diabetics attending General Out-Patient Clinic in a Tertiary health facility in Osun State, South-west Nigeria

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ABSTRACT

Background: Diabetes mellitus (DM) is a chronic non communicable disease that has reached a global pandemic proportion with increasing prevalence, morbidity and mortality, especially in low and middle-income countries. An important component of modern therapy for DM is self-monitoring of blood glucose (SMBG) to inform changes for an improved glycaemic control. However, despite the fact that SMBG is one of the most effective monitoring and control measures for DM, the prevalence of poor glycaemic control among diabetics in this environment still calls for concern, hence the impetus for this study. The purpose of this study was to assess the prevalence and pattern of SMBG practice among adult type 2 diabetics attending General Out-Patient Clinic (GOPC) in Osun State University (UNIOSUN) Teaching Hospital, Osogbo, Osun state, Nigeria. This was to determine the frequency, timing and level of SMBG practice among the participants.

Methods: It was a descriptive cross-sectional study that used a pre-tested interviewer administered questionnaire to obtain information on the socio-demographic and clinical characteristics, prevalence and pattern of SMBG practice. One hundred and seventy five adult type 2 diabetics who attended the GOPC between November 2019 and January 2020 who met the inclusion criteria were recruited. The data was analyzed using Statistical Package for Social Science (SPSS).

Results: A total of 175 participants took part in this study and 49.1% of them practiced SMBG. Among the participants that practiced SMBG, 56.9% checked their fasting blood glucose on daily basis while others checked it on weekly or monthly basis.

Conclusion: This study revealed that the level of SMBG practice among the study participants was fair with a structured pattern of practice, therefore advocacy on SMBG practice with emphasis on knowledge of the structured pattern of practice is strongly recommended for improved glycaemic control.

Keywords: Self monitoring of blood glucose, type 2 Diabetes, General Out-Patient Clinic.

INTRODUCTION

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action or both.[1] Globally, one in ten (10.5%) adults are currently living with diabetes and the total number is predicted to rise to 643 million (11.3%) by 2030 and to 783 million (12.2%) by 2045.[2] In Africa, Nigeria has the greatest number of people living with diabetes, with an estimated burden of about 1.7 million which is estimated to increase to 4.8 million by 2030.— Type 2 diabetes accounts for more than 95% of people with diabetes and it results from the body's ineffective use of insulin.[2,3]

Type 2 DM is an issue of focus worldwide not only because of its alarming increase but also because of its consequences on general health and correlation with other medical problems.[2] Hence, World Health Organization (WHO) stimulated and supported the adoption of effective measures for the surveillance, prevention and control of diabetes and its complications, particularly in low- and middle-income countries.[2] To this end, in April 2021 WHO launched the Global Diabetes Compact, a global initiative aiming for sustained improvements in diabetes prevention and control.[2] Currently, an approach used in monitoring and control of diabetes is Self-Monitoring of Blood Glucose (SMBG).

SMBG is defined as the collection of detailed information on blood glucose levels at many time

points during the day on a day-to-day basis to aid adjustments in therapy and lifestyle activities and ultimately improve glycaemic control and prevent diabetes complications.[4] It is said to be structured SMBG when the blood glucose data are gathered according to a defined regimen, interpreted, and then utilized to make appropriate pharmacologic and/or lifestyle adjustments.[4] The best persons to manage a disease that is affected so markedly by daily fluctuations in environmental stress, exercise, diet, and infections are the patients themselves and their families. SMBG is a cornerstone of diabetes care that can ensure patient participation in achieving and maintaining specific glycaemic target. The most important objective of monitoring is the assessment of overall glycaemic control and initiation of appropriate steps in a timely manner to achieve optimum control. SMBG provides immediate feedback regarding the levels of glycaemia, which may help achieve better control if it is used to adjust the time, type or dose of insulin therapy or oral drugs as applicable. It may reduce the risk of undetected, asymptomatic hypoglycemia and enable patients to safely intensify medication adherence to achieve better or tighter glycaemic controls and prevent complications.[5] In this view, focus is on SMBG as the most widely used way to assess pattern of blood glucose and determine changes in therapy.[6]

SMBG has been recommended in guidelines released by American Diabetes Association (ADA).[7] However, despite the recommendation and the increasing prevalence of diabetes and its complications, the SMBG implementation is far from satisfactory worldwide.[7]

In Africa, as in most developing countries, the practice of SMBG is poor.[4] Edah et al in Jos, Nigeria, found a sub-optimal SMBG of 47.8% with over 50% of respondents not practicing it as recommended.[8] Also, It was reported that the practice of SMBG in DM ranges from 3.4% in rural settings to 73% in urban settings.[9] The inadequate practice of SMBG may be attributed to inadequate education on SMBG, poor attitude of diabetics towards self-care and the cost of glucometers and test strips.[8,9]

The American Diabetes Association (ADA) recommended SMBG to be done three to four times a day in patients with type 1 DM and once a day in pharmacologically treated type 2 diabetics.[10] The pattern of SMBG practice should be structured in a way that it has a regular time and frequency of testing, with appropriate steps taken in response to the results of the tests.[10] Edah et al found that 44% of the respondents who practiced SMBG did it less frequently than ADA recommendation ADA.[8] In another survey conducted in three hospitals (Enugu State University Teaching Hospital, Mother of Christ Specialist Hospital, Enugu and Bishop Shanahan Hospital, Enugu) in Eastern Nigeria, 60.7% practiced SMBG at frequencies sub-optimal to the recommended.[11] It has been hypothesized that structured SMBG, in which timing and frequency of capillary glucose measurements are clearly defined, is more effective in reducing HbA1c than unstructured or sub-optimal SMBG.[12-14] Randomized Control Trials (RTCs) comparing structured with unstructured SMBG revealed that structured SMBG pattern produced a significantly greater reduction in HbA1c levels compared to the unstructured SMBG regimen.[15-16]

Thus, patients with diabetes should start practicing structured SMBG as soon as possible, and continue it throughout life. With the increasing global burden of diabetes, there is a need to assess the prevalence and pattern of SMBG practice among type 2 diabetics attending GOPC of UTH, Osogbo.

Methods

The study was conducted in November 2019 at the General Out-patient clinic (GOPC) of Uniosun Teaching Hospital (UTH), Osogbo. The study population were adult type 2 DM patients who presented for care during the study period. The sample size was determined using the prevalence of SMBG practice among diabetics derived from a study carried out by Eregie et al in South East Nigeria, which was 72%. The minimum sample size was 175 and the total number of 175 diabetics was recruited by systematic and simple random sampling method. It was a descriptive cross-sectional study that used a pre-tested interviewer administered questionnaire to obtain information on the socio-demographic characteristics, clinical characteristics, prevalence and pattern of SMBG practice. The SMBG scores were calculated such that higher scores are indicative of more effective practice. The data was analyzed using the Statistical Package for Social Sciences (SPSS) version 25.0. Summary statistics using mean, median and standard deviation for continuous variables such as age. Frequency/percentages for categorical variables were generated for socio-demographic characteristics of the respondents. The prevalence and pattern of SMBG practice among the respondents was analyzed using frequency table and bar charts to express various proportions. Chi-square was used to examine the relationship between SMBG practice and socio-demographic characteristics of the respondents.

Ethical Consideration: Ethical approval was obtained from the Ethical committee of UNIOSUN Teaching Hospital, Osogbo. The purpose of the study was

explained to the respondents and written informed consents were obtained prior to the study.

Results

Table 1: Socio-demographic characteristics of the respondents

Variables	Frequency (N=175)	Percentage (%)
Age group (years)		
18-39	2	1.1
40-49	23	13.2
50-59	46	26.3
60-69	66	37.7
≥ 70	38	21.7
Gender		
Male	65	37.1
Female	110	62.9
Marital status		
Single	1	0.6
Married	161	92.0
Widowed	13	7.4
Tribe		
Yoruba	171	97.7
Igbo & Hausa	4	2.3
Religion		
Christianity	121	69.1
Islam	54	30.9
Level of Education		
No Formal Education	4	2.3
Primary	25	14.3
Secondary	53	30.3
Tertiary	93	53.1
Occupation		
Unemployed	27	15.4
Self Employed	37	21.2
Civil Servant	111	63.4

Socio-demographic characteristics of the respondents A total of 175 adult type 2 DM patients were recruited and most (37.7%) were aged 60-70 years. Since the study was conducted in a Yoruba dominated community, majority of the respondents were Yoruba (97.7%) with a few from other ethnic groups and most were married (92.0%) while others were singles or widow. The level of education of the respondents was fair with 53.1% having tertiary education and civil servants constituted 63.4% of the respondents.

Table 2: Awareness and practice of SMBG among the respondents

Variables	Frequency	Percentage (%)
Aware of SMBG		
Yes	125	71.4
No	50	28.6
Total	175	100
Do you have your own glucometer		
Yes	76	43.4
No	99	56.6
Total	175	100
SMBG Practice		
Yes	86	49.1
No	89	50.9
Total	175	100

In table 2, majority (71.4%) of the respondents were aware of SMBG while only (49.1%) practiced it.

Day time pattern of SMBG practice

Table 3: Day time pattern of SMBG practice among the respondents

Variables	Frequency (n=86)	Percentage (%)
Checked blood glucose level		
Before breakfast	75	87.1
2hrs after breakfast	4	4.7
Before bed time	4	4.7
Ooccasionally	3	3.5
Response to high blood glucose level		
Increased drugs	53	61.6
Reduced diet	16	18.6
Called doctor	10	11.7
Did nothing	7	8.1
Response to low blood glucose level		
Reduced drugs	50	58.1
Increased diet	14	16.3
Called doctor	18	20.9
Did nothing	4	4.7
Considered SMBG Practice as		
Extremely unhelpful	2	2.3
Very unhelpful	1	1.2
Unhelpful	4	4.7
Helpful	29	33.7
Very helpful	48	55.8
Extremely helpfull	2	2.3
Discussed SMBG practice with health care provider		
Yes	69	80.2
No	17	19.8

In table 3, majority (87.1%) checked their blood glucose before breakfast and most (55.8%) considered SMBG practice as very helpful. Only a few (8.1% for hyperglycaemia, 4.7% for hypoglycaemia) did nothing in response to the interpretation of their results.

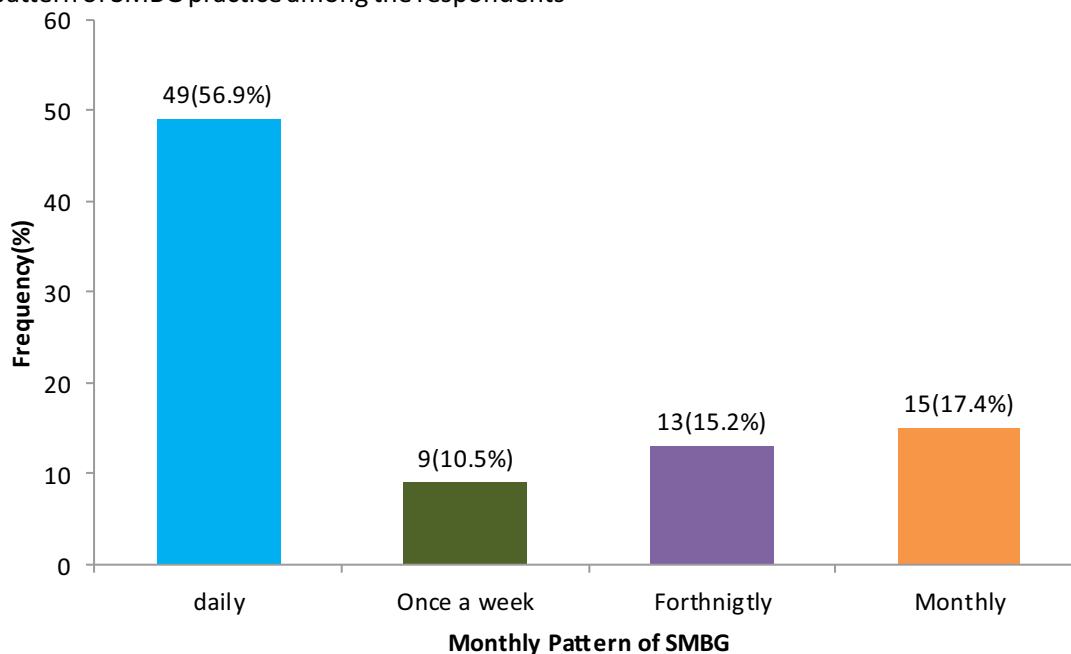Monthly pattern of SMBG practice among the respondents

Figure 1: Bar chart showing the monthly pattern of SMBG practice.

Figure 1 illustrates the monthly pattern of SMBG practice. Among the respondents, 56.9% of those who practiced SMBG checked their fasting blood glucose on daily basis while 17.4% checked it once every month.
Relationship between socio-demographic characteristics and SMBG practice among the respondents

Table 4: Relationship between socio-demographic characteristics and SMBG Practice

CHARACTERISTICS	SMBG PRACTICE		Total	df	χ^2	p-value
	Yes(n=86)	No(n=89)				
	N (%)	N(%)	N=175			
Age group (years)						
≤60	32 (45.1)	39 (54.9)	71(100.0)	1	0.793	0.373
>60	54 (51.9)	50 (48.1)	104(100.0)			
Gender						
Male	33 (50.8)	32 (49.2)	65(100.0)	1	0.109	0.741
Female	53 (48.2)	57 (51.8)	110(100.0)			
Marital status						
Married	82 (50.9)	79 (49.1)	161(100.0)			
Unmarried	4 (28.6)	10 (71.4)	14 (100.0)	1	2.577	0.108
Ethnicity						
Yoruba	84 (49.1)	87 (50.9)	171(100.0)			
Others	2 (50.0)	2 (50.0)	4 (100.0)	1	0.007	0.972
Religion						
Christianity	65 (53.7)	56 (46.3)	121(100.0)			
Islam	21 (38.9)	33 (61.1)	54 (100.0)	1	4.486	**0.046**
Education						
Secondary education and above	81 (55.5)	65 (44.5)	146(100.0)			
Below secondary education	5 (17.2)	24 (82.8)	29 (100.0)	1	14.154	**0.0001**
Occupation						
Employed	72 (48.6)	76 (51.4)	148(100.0)			
Unemployed	14 (51.9)	13 (48.1)	27 (100.0)	1	0.670	0.715

*statistically significant at p< 0.05   unmarried = singles and widow   employed= self employed and civil servants

In table 4, it was observed that education and religion showed a statistically significant relationship with SMBG practice among the respondent (p <0.05). Proportion of SMBG practice was higher among the Christians (53.7%) than the Muslims (38.9%). Considering education, SMBG practice was higher among those with higher level of education (55.5%) compared to those with below secondary school level of education (17.2%).

Discussion

People living with type 2 diabetes mellitus are particularly at risk of immediate and long term complications.[13] The practice of SMBG by adult type 2 diabetics is a strongly recommended approach to ensure adequate control and prevent complications.– Thus, this study aimed to assess the prevalence and pattern of SMBG practice among diabetics.

Level of awareness and practice of SMBG among the respondents

The present study observed that although 71.4% of the respondents were aware of SMBG practice, only 49.1% practiced it. This infers that the high level of awareness did not necessarily translate to its practice. A similar trend was observed in a cross-sectional study done in Jos, Nigeria, where majority (85.6%) of the study population were aware of the importance of SMBG but only (47.8%) practiced it.[8] Also, in another study done in Port Harcourt, Nigeria it was shown that only 27% of respondents practiced SMBG despite 96% being aware of its existence.[17]

In contrast to above findings, previous Nigerian studies had reported much lower prevalence of SMBG practice ranging from 27% to 33%.[17,18] Osuji reported that SMBG was the least practiced self-care behavior with 21.7% of the studied population practicing it,[19] while Anene-Okeke, et al[20] found that only 46.2% of the respondents practiced SMBG. This is similar to the observations of Iwuala et al.[21] and Raimi et al.[22] Low prevalence of SMBG practice was also observed in other developing countries like Bangladesh (8.6%)[23] and Western Kenya (34%).[24] However, some other studies have reported higher prevalence of SMBG practice among their respondents. Adeleye et al[9] found that 64% type 2 diabetics practiced SMBG while Ugwu et al[11] observed that 60.7% practiced SMBG in a study done in Eastern Nigeria.

The difference in the findings of this study compared to other studies may be attributed to the knowledge acquired through health education and counseling of diabetics in the facility. Despite all the varied prevalence of SMBG practice, all the studies were consistent with the fact that SMBG practice exist among adult type 2 diabetics in this environment.

Pattern of SMBG practice among the respondents

In this study, the pattern of SMBG practice was structured and fair, in line with recommendations of American Diabetes Association (ADA).[25] This study found that 49.1% of the respondents practiced SMBG and 56.9% of those who practiced SMBG checked their blood glucose on daily basis while the weekly and monthly pattern of practice were 10.4% and 17.4% respectively. Similar to these findings, Edah et al[8] in a descriptive cross-sectional study in Jos, North central Nigeria, reported a structured though suboptimal pattern in which only 47.7% checked their glucose level on daily basis, 7.0% checked twice a day and 1.2% checked it thrice daily. Thirty-eight participants (44.2%) practiced SMBG less frequently than as recommended by the ADA.

Ugwu et al[11] also recorded SMBG practice at frequencies ranging from ≥1 per day in 7.9% patients, ≥ 1 per week in 26.1%, to < 1 per week in 26.7%, while Adeleye et al[9] discovered that 36 (23%) of the patients did SMBG daily, 58 (37%) patients twice weekly, 48 (30%) patients weekly, 11 (7%) patients monthly and 5 (3%) patients did it for unspecified time period. This pattern is also similar to the findings of this study but with lower frequencies of daily and monthly practice.

The structured but suboptimal pattern of SMBG practice in these studies may be due to lack of adequate knowledge on the recommended way of practice and financial limitation.[11]

It should also be emphasized that efficacy of SMBG practice is guaranteed only when used consistently in a structured pattern.[26,27] Evidences for the benefit of SMBG both in insulin-treated and non-insulin treated patients with type 2 diabetes are increasing,[5,26,28] and the HbA1c reduction was greater with structured SMBG and when structured SMBG data were used to adjust diabetes therapy.[14]

Relationship between socio-demographic characteristics and SMBG practice among the respondents

It was observed that religion and education showed a statistically significant relationships with the practice of SMBG (p <0.05). The proportion of SMBG practice was higher among Christians and those with higher level of education. This is likely to be due to the larger proportions of Christians and those with higher level of education amongst the study population. Similarly, Sindhu et al., in a study conducted at Basaveshwara Hospital, India, showed that SMBG practice was significantly higher among respondents with higher educational qualifications, better socio-econo mic status and those with better awareness of diabetes

self-management.[29] Other socio-demographic variables did not show statistically significant relationship with SMBG practice among the respondents.

Conclusion: The findings of this study revealed that the prevalence of SMBG practice was fair among adult type 2 diabetics though the awareness rate was high. The pattern of practice was structured and there was a statistically significant relationship between religion, level of education and SMBG.

Recommendation: There is a need to strengthen the policy on diabetes control education as an integral component of diabetes care in primary care settings to enhance awareness and utilization of control measures like SMBG. Understanding diabetes control measures such as SMBG interpretation with appropriate adjustment of medication, nutrition and physical activity by adult type 2 diabetics is an essential element in diabetes control. The government should ensure improvement in the cost of living to enhance utilization of glucometers.

Conflict of interest: We the authors declare that we have no financial or personal relationship(s) which may have inappropriately influenced us in writing this paper.

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