Original Article

Self monitoring of blood glucose among persons living with diabetes mellitus in a tertiary hospital in Southern Nigeria

Ochuko Otokunefor [1], Kariba Akhidue [2]

[1] Department of Chemical Pathology, University of Port Harcourt, Choba, Port Harcourt, Nigeria.
[2] Department of Internal Medicine (Endocrinology unit), University of Port Harcourt, Choba, Port Harcourt, Nigeria.

Abstract

Background: Self-monitoring of blood glucose is a critical part of diabetes management. It promotes personal responsibility, provides opportunities for better control and allows for detection of blood glucose extremes, while reducing fluctuations. It also helps both the patient and the provider make informed decisions and potentially reduces complications. Studies have shown that haemoglobin A1c levels are lower if glucose is tested more frequently.

Aim: To determine the frequency of self-monitoring of blood glucose, among patients living with diabetes mellitus in a tertiary Hospital in Southern Nigeria.

Methods: This was a cross-sectional study of 85 patients attending the medical outpatient clinic of University of Port Harcourt Teaching Hospital in 2023 using a self-administered questionnaire. Data was analysed using the SPSS version 26.

Results: A total of eighty-five (85) patients between the ages of 20 to 80 years were recruited, 34(69%) were females and 26 (31.0%) were males. Of all participants 73.5% owned a glucometer and 26.5% didn't own one. Only 79% performed self-monitoring of blood glucose while 21% did not perform it. Slightly above a quarter checked their blood glucose once daily (26.6%), 13.9% checked more than once a day, 11.4% checked once a week and others checked less frequently.

Conclusion: The frequency of practise of self-monitoring of blood glucose was higher (79%) than previous studies. Over a quarter 26.6% checked daily and 13.9% checked more than once a day. Persons living with diabetes mellitus should be encouraged to practise individualised SMBG to achieve better glycaemic control and have better outcomes.

Keywords: Diabetes mellitus, blood glucose, self blood glucose monitoring

Access this article online	
Quick Response Code:	**Website:** www.phmj.org.ng
	DOI: https://doi.org/10.60787/ phmj.v19i1.190

INTRODUCTION

The prevalence of diabetes mellitus is increasing all over the world. The average prevalence in Southern Nigeria has been reported to be 9%. [1] A recent community-based study in Rumuomasi, Port Harcourt Nigeria revealed a prevalence of diabetes of 6.5%. [1] A bigger community-based study involving nine sub-urban communities in Rivers, Enugu and Akwa Ibom States in Nigeria had a prevalence rate of 7.96%. [2]

Another study done among Oil and Gas workers in Port Harcourt had a much higher prevalence rate of 19.8%. [3]

People living with DM are at an increased risk of having higher morbidity and mortality with a tertiary hospital in Port Harcourt recording a case fatality of up to 17.8% of all diabetic admissions. [4] Several factors account for this including urbanisation, technology and lifestyle. [1]

Effectively managing diabetes mellitus is key to improving the quality of life of patients. This is the primary mechanism required to reduce the incidence of both acute and chronic complications of diabetes mellitus. One key point in assessing if DM is properly managed is to maintain the blood glucose level and glycated haemoglobin level within the reference range for the said group. This is why the blood glucose level of affected patients are taken at every contact with the hospital and those on admission sometimes have daily monitoring. To improve outcomes, self-monitoring of blood glucose has been introduced. It is now an integral part of diabetes Management. [5] Hence patients and care -givers are currently encouraged to be involved in their own management. This has remarkably improved outcomes. [6]

World-wide, self-monitoring devices became available in the 1970's. Over time the size and price of these devices have reduced, while the efficacy has increased. [6,7] These changes have made it more easily accessible by the end user. Self-monitoring of blood glucose is a situation where the patient (or care giver) is involved in his or her own management by regularly monitoring his blood glucose at home. For maximum results, the value of the glucose reading obtained or the pattern has to influence management options, [7] such as diet and exercise and more. Moreover, it is important to note that while plasma glucose values are averagely 11% higher than whole blood values when using the same method,[8] and postprandial venous blood glucose is 7% lower than post prandial capillary glucose using the same method, [9] glucometers give higher readings than semi-automated laboratory methods.[8,10,11]

Monitoring blood glucose only during clinic visits is not adequate for effective diabetic management. Maintaining optimal glycaemic control for persons living with diabetes is a challenge worldwide. [12] SMBG is therefore vital for tighter control. Guidelines for SMBG was established by the American Diabetic Association in 1987. Most patients on intensive insulin therapy would require SMBG, several times a day. This will apply to persons with Type 1DM and a sub fraction of those with Type 2DM. At least before meals, sometimes after meals, at bed time, before exercise, when on treatment for hypoglycaemia and when low blood glucose is suspected. The implication is that the exact number of times in a day is individualized and not fixed even for an index person. [12-14] Other categories of persons that will benefit from SMBG include those on sulfonylurea or meglitinide, those who drive frequently or operate machinery and diabetic patients who are pregnant or considering pregnancy. A stable patient on oral hypoglycaemic agents, would however not need to have multiple daily checks. [7, 15] Alternate day or weekly testing might suffice.[14, 15]

It is worth emphasizing that WHO guidelines have a goal for all persons with Type 1DM to have access to a glucometer for SMBG. [16]

A study done in an endocrinology clinic in north central Nigeria established that patients that practised self-monitoring of glucose had better diabetic control than those who did not. [5] This was evidenced by lower values of fasting blood glucose, fasting glucose range and two hours post prandial tests. Out of all participants 66.8% admitted to practising SMBG. [5] A study done in Lagos state Nigeria had similar findings as that of the study in North Central; short term control was improved. [17] In their study, 64.8% of participants who were patients in a diabetic clinic practised SMBG.[17] While a study done in Enugu revealed a participation rate of 60.7%. [18] No data was found for tertiary hospitals in Port Harcourt, Rivers State.

All the above studies corroborate with established findings worldwide; SMBG, (when the findings are utilised by both the patient, care givers and doctors), would achieve more effective control of blood glucose which will in turn improve outcomes (morbidity and mortality) and the quality of life of persons living with diabetes. [12, 14] Therefore self-

monitoring of blood glucose is an effective tool to reduce the prevalence of diabetic complications worldwide.

Therefore, the aim of this study was to determine the frequency of self-monitoring of blood glucose among patients living with diabetes mellitus in a tertiary hospital in Rivers State Nigeria. This will be done by establishing the percentage of people that own glucometers and the frequency of its use.

METHODOLOGY

Study design: This was a cross sectional, descriptive study design carried out over a space of three months, from June to August, 2024.

Study site: The study was carried out in the University of Port Harcourt Teaching Hospital. The First tertiary hospital in Port Harcourt Rivers State. It is an 800 bedded hospital with a multi-team internal medicine Department. Adult Diabetic patients are seen mainly by the Endocrine unit of the Internal Medicine department.

Study tools: A self-administered structured questionnaire was used to obtain information from the participants.

Study population: The study population was all patients attending the adult endocrine clinic of the University of Port Harcourt Teaching Hospital. Inclusion criteria was all patients living with diabetes who gave consent. Exclusion criteria was all patients without diabetes.

Sampling technique: A total of 85 participants were recruited by convenience sampling technique.

Data analysis: Data were inputted into an excel sheet and exported into SPSS version 26 (IBM Corp., NY, USA). Descriptive analysis was done using frequencies and percentages.

Ethical clearance was obtained from the hospital's Research and Ethics Committee.

RESULTS

A total of eighty-five participants were recruited for the study. Up to 93% of participants had at least primary education and more than half were females (Table 1).

Concerning the time of the day for glucose check, 94.9% checked their blood glucose in the morning before meals, 2.6% checked their blood glucose, both before and after breakfast in the morning, while 1.3% checked at bedtime and another 1.3% checked only when they felt unwell. Over seventy -seven percent, (73.5%) of participants owned glucometers while 26.5% did not. Self monitoring of glucose was done by 77.8% of participants and 21.2% did not check their glucose levels at home.

As regards recording of glucose values after glucometer readings, 52% found it convenient and easy, 24% found it inconvenient and hard, 14.7% sometimes forgot to write any value and 1.3% wrote the wrong number sometimes.

Table 1: Sociodemographic characteristics of study participants

Table 2: Proportions of participants in the different classes of diabetes

Variable	Frequency	Percentage
Sex (n=85)		
Female	58	68.2
Male	26	30.6
Not specified	1	1.2
Age Group (n=85)		
21 to 40 years	14	16.5
41 to 50 years	14	16.5
51 to 60 years	24	28.2
61 to 70 years	19	22.4
71 and above	14	16.5
Highest Education (n=85)		
Primary	11	12.9
Secondary	22	25.9
Tertiary	26	30.6
Postgraduate	20	23.5
No formal education	6	7.1
Type of Diabetes	Frequency	Percentage (%)

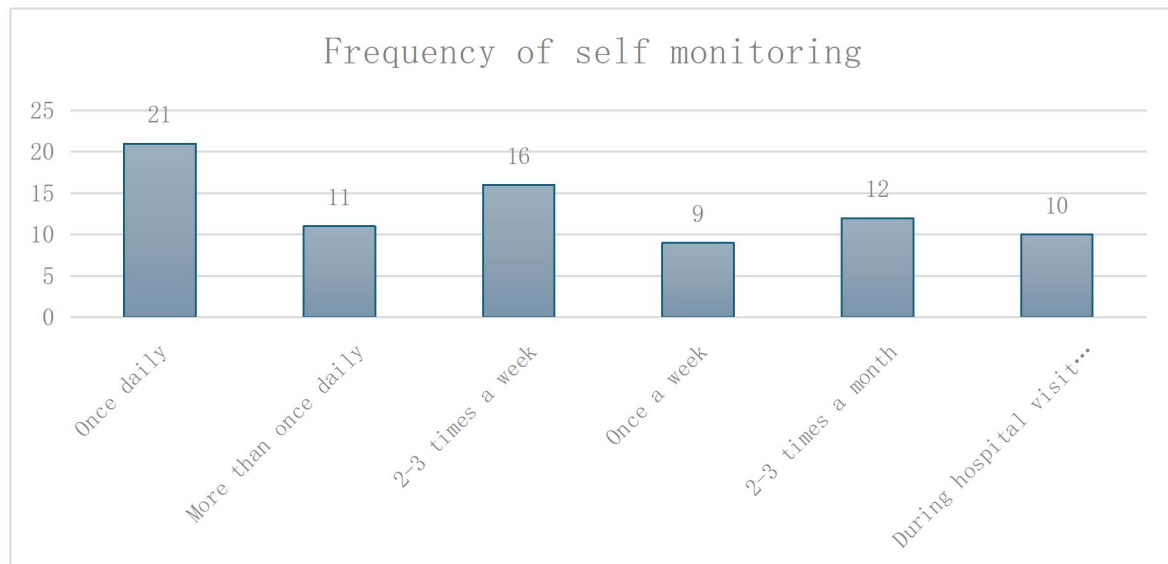|		
Type 1	15	20.3
Type 2	55	74.3
Gestational	1	1.4
Others	3	4.1

Figure 1: Frequency of self -monitoring of blood glucose

DISCUSSION

In this study 79% of participants admitted to the use of SMBG. This is higher than the three studies carried out in Nigeria, [5, 17, 18] and it is a definite improvement in percentage participation. Slightly above fifty-four percent, (54.1%) had tertiary and post tertiary education in our study. In the study in Enugu what influenced the use of glucometers at home was not level of education but participation in health talks by medical personnel, longer duration of illness and being on insulin therapy. [18] A study done in China however found a positive correlation between level of education and adaptation to SMBG. [19] A further 38.8% in our study had at least primary education. Regular self-monitoring of blood glucose is a major step, in effective glucose management. A further step is to make meaning of the figures, adequately interpret them and take action. [20]

The highest frequency of SMBG (26.6%) in our study was once a day. This was followed by the two to three times a week group

(20.3%). Regular tracking of blood glucose values is beneficial because the day-to-day alterations (glycaemic variability) have been found to play a role (as an independent risk factor) in the evolution of endothelial dysfunction, vascular complications, and mortality. [21] Regular tracking of blood glucose can also help identify short term causes for spikes and variations in blood glucose and encourage compliance. Regular monitoring of blood glucose has also been found to improve self-confidence and independent motivation in patients. [21]

Most of the participants (74.3%) in our study had type 2 DM and most (73.5%) of them owned their own glucometers. A large-scale study done in Taiwan among T2DM patients not receiving insulin established that the institution of SMBG at diagnosis improved treatment outcomes remarkably. [20,22] Owning a glucometer makes this easier.
Most of the subjects in this study, took their blood glucose value before breakfast in the morning. While this is the standardised time

for a fasting specimen, blood for SMBG can be taken at various times, including before any meal, two hours after and before bedtime. The timing is individualised, based on treatment options and current state of the patient.[22,23] Acute crises and insulin therapy usually necessitates an increased frequency. Those with out-of-control diabetes, those initiating therapy and those yet to achieve their target glycaemic control value will all benefit from more frequent monitoring. Patient involvement will help improve the outlook and management.

Limitations of the study: It was a self-administered questionnaire based study and subject to bias. The questionnaire did not include a question on the make of the glucometer used.

CONCLUSION

The frequency of practise of self-monitoring of blood glucose was higher (79%) than previous studies. Over a quarter (26.6%) checked daily and 13.9% checked more than once a day. Persons living with Diabetes Mellitus should be encouraged to practise SMBG in a structured manner to enable them have better glycaemic control. SMBG should be individualised to suit index patient and have better outcomes.

Recommendations
Further studies are required to determine if the individualized use of glucometers is adequate as related to the stated WHO guidelines as well as using HbA1c to assess the effectiveness of SMBG.

Conflicts of interest
There are no conflicts of interest

REFERENCES

1. Nwafor CE, Edeogu J, Stanley R, Enyichukwu B, Ogomegbunam M. Prevalence of diabetes mellitus among adult population within a Southern Nigerian community. Eur J Med Health Res 2024;2(1):131-137.

2. Cookey SN, Gomba V, Wariboko CM. Prevalence of diabetes in rural communities in South South and South East Nigeria: a retrospective, cross sectional community based survey. IOSR J Dent Med Sci 2022;21(2):26-32.

3. Salome CO, Ordinioha B, Penuel A, Fente AE, Clement TY. Diabetes and its associated factors among oil and gas company workers in Port Harcourt. Saudi J Med 2023;8(11):596-614.

4. Unachukwu CN, Uchenna DI, Young E. Mortality among diabetes in-patients in Port-Harcourt, Nigeria. Afr J Endocrinol Metab 2008;7(1):1-4.

5. Mshelia-Reng R, Lawal Y, Adediran O, Anumah FE. The prevalence of the practice of self-monitoring of blood glucose and association with glycemic control: a cross-sectional study in a tertiary hospital in North Central Nigeria. South Asian Res J Med Sci 2024;6(2):20-24.

6. Klimek M, Knap J, Reda M, Masternak M. History of glucose monitoring: past, present, future. J Educ Health Sport 2019;9(9):222-227.

7. Pleus S, Freckmann G, Schauer S, Heinemann L, Ziegler R, Ji L, et al. Self-monitoring of blood glucose as an integral part in the management of people with type 2 diabetes mellitus. Diabetes Ther 2022;13(5):829-846.

8. Otokunefor O, Ogu R. Comparing the glucose results by glucometer and laboratory methods: a prospective hospital based study. J Adv Med Med Res 2018;26(3):1-7.

9. Geetha P, Vishakha K, Pooja S, Vyshnav M. Comparative study on venous and capillary blood collection for estimation of glucose. SALT J Sci Res Healthc 2021;1(2):13-23.

10. Iqbal HB, Kashif M, Hamid Y, Hayat T, Bilal. Comparison of results of glucometer and laboratory technique for glucose measurement among children. Medtigo J Med 2024;2(4):e30622411.

11. Lakshmi N, Kiranmai P. A comparative study of blood glucose level measurement between glucometer and semi autoanalyser. Int J Clin Biochem Res 2018;5(3):423-426.

12. Rinzo L. Self-monitoring blood glucose: A vital tool for effective diabetes management. Diabetes Manag 2024;14(3):621–622.

13. Kirk J, Stegner J. Self-monitoring of blood glucose: practical aspects. J Diabetes Sci Technol 2010;4(2):435-439.

14. Bergenstal R, Gavin JR 3rd; Global Consensus Conference on Glucose Monitoring Panel. The role of self-monitoring of blood glucose in the care of people with diabetes: report of a global consensus conference. Am J Med 2005;118(suppl 9A):1S-6S.

15. Lowe J. Self-monitoring of blood glucose in type 2 diabetes. Aust Prescr 2010;33(5):138-141.

16. WHO. Guidance on global monitoring for diabetes prevention and control. Framework, indicators and application. Geneva:World Health Organization, 2024;1-94. Available online @ https://cdn.who.int/media/docs/default-source/ncds/ncd-surveillance/guidance-on-global-monitoring-for-diabetes.pdf?sfvrsn=ccb261b8_4. Accessed 3rd April, 2025.

17. Adeleye O, Ogbera A, Ugwu E, Brodie-Mends A. Impact of self-monitoring of blood glucose on glycaemic control in type 2 diabetic Nigerians who reside in Lagos. Open Diabetes J 2019;9(1):1-7.

18. Ugwu ET, Orjioke CJG, Young EE. Self monitoring of blood glucose among patients with type 2 diabetes mellitus in Eastern Nigeria: need for multi-strategic interventions. Curr Diabetes Rev 2018;14(2):175-181.

19. Zeng Y, Wu J, Han Y, Chen F, Chen L, Yang S, et al. Educational disparities in the associations between self-monitoring of blood glucose and glycemic control in type 2 diabetes patients in Xiamen, China. J Diabetes 2018;10(9):715-723.

20. Klonoff DC. Benefits and limitations of self-monitoring of blood glucose. J Diabetes Sci Technol 2007;1(1):130-132.

21. Schnell O, Alawi H, Battelino T, Ceriello A, Diem P, Felton AM, et al. Self-monitoring of blood glucose in type 2 diabetes: recent studies. J Diabetes Sci Technol 2013;7(2):478-488.

22. Sia HK, Kor CT, Tu ST, Liao PY, Wang JY. Self-monitoring of blood glucose in association with glycemic control in newly diagnosed non-insulin-treated diabetes patients: a retrospective cohort study. Sci Rep 2021;11(1):1176.

23. Kemp T. Routine monitoring of diabetes mellitus in adults at primary health care level, and self-monitoring of blood glucose (SMBG). Contin Med Educ 2010;28(10):452-457.

24. Benjamin EM. Self-monitoring of blood glucose: the basics. Clin Diabetes 2002;20(1):45–47.