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Case Study

Neglect of Self-Blood Glucose Monitoring (SMBG) and Factors Influencing its Implementation in Semi-Urban cities in India: An Observational Study

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Abstract

Technological advancements have transformed various sectors, simplifying and improving our lives. However, many cutting-edge diabetes management techniques, such as glucose monitoring sensors and automatic insulin pumps, remain inaccessible to the lower and lower-middle-class populations in India. This observational study aims to shed light on the neglect of self-blood glucose monitoring (SMBG) in India, known as the diabetes capital of the world, and explore the associated factors.

Keywords: Diabetes; Type 2 diabetes mellitus; SMBG; Monitoring; Diabetes awareness; Diabetes education; Diabetes complications; Semi-urban cities.

Introduction

Diabetes is a global health concern, with a projected significant increase in the number of affected individuals in the coming years. India, with its large population, bears a significant burden of diabetes, making it the diabetes capital of the world. As of the latest available data in 2021, The majority of people worldwide has type 2 diabetes mellitus (T2DM) live in India. The prevalence of T2DM in India is estimated to be around 10.8%, varying across states and regions. Unfortunately, a considerable percentage of individuals with diabetes in India remain undiagnosed, and the incidence of diabetes-related complications is on the rise. According to the most recent ICMR-INDIAB study, between October 18, 2008, and December 17, 2020, the overall weighted prevalence of diabetes was 11.4 percent (95% CI 10.2-12.5), prediabetes was 15.3 percent (13.9-16.6), hypertension was 35.5% (33.8%-37.3), generalized obesity was 28.6 percent

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(26.9-30.3), abdominal obesity was 39.5% (37.7-41.4), and dyslipidaemia [1].
Complications associated with diabetes, such as macrovascular and microvascular complications, contribute to morbidity and mortality rates. Inadequate glycaemic control, long disease duration, poor medication adherence, and insufficient blood glucose monitoring are significant factors contributing to the development of these complications.

Notably, the prevalence of diabetic complications like retinopathy, nephropathy, and neuropathy is high among individuals with diabetes in India. In the population-based Chennai Urban Rural Epidemiology (CURES) cohort, patients with self-reported diabetes mellitus had retinopathy prevalence rates of 17.6% [2].

Microalbuminuria prevalence rates of 36.3% and frank nephropathy prevalence rates of 6.9% [3,4]. Additionally, 19.5% of people with newly diagnosed T2DM had neuropathy, compared to 27.8% of those with known disease [5].

Concerns should also be raised about the prevalence of type 1 diabetes (T1D). The International Diabetes Federation (IDF) and International Society for Paediatric and Adolescent Diabetes (ISPAD) have introduced the T1 Index (Type 1), they estimated that approximately 8.75 million individuals worldwide have T1D, with a significant proportion residing in low-income and lower-middle-income countries.

It is essential to improve monitoring and management of diabetes to prevent complications and enhance the quality of life for individuals with diabetes [6].

However, the financial burden of diabetes management is substantial, especially in developing countries like India, where patients bear a significant portion of healthcare expenses.

Self-blood glucose monitoring (SMBG) plays a crucial role in achieving good glycaemic control and preventing complications. Patients are unfortunately prevented from practicing SMBG on a regular basis by a number of obstacles, including lack of knowledge, budgetary limitations, and a phobia of needles. This study's goal is to track SMBG trends in the general population in two semi urban cities of India and identify the factors influencing its implementation.

Materials and methods

This observational study was conducted in two private clinics, one is Kanpur Uttar Pradesh and another one Berhampore, West Bengal respectively.

The study population consisted of diabetic patients attending the outpatient departments of these clinics. Patients with significant diabetic complications or those unable to understand the study requirements were excluded.

Data collection involved the use of pre-set questionaries, and statistical analysis was performed using SPSS version 25.

Results

800 participants in total, including 265 women and 535 men, took part in the study.

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The educational background of the participants varied, with 38% having postgraduate degrees, 49% holding graduate degrees, 6% completing secondary education, and the remaining 7% having primary education or less. Based on socioeconomic status, 51% belonged to the middle class, 29.5% to the upper-middle class, 9.5% to the upper class, and 10% to the lower class according to modified Kuppuswamy Naidu's classification of socioeconomic status in India [7]. Regarding occupation, 40% were unskilled workers, 1.5% were skilled workers, 31.5% were salaried employees, 4% were professionals, and 23% were involved in business. Most participants were married (78%) and received treatment with oral hypoglycaemic agents (92%) rather than insulin. Only 22% of participants reported performing SMBG regularly, while 78% did not adhere to regular monitoring.

Complications	**Response**	**%**
Hypertension	Yes	42%
	No	58%
Hypothyroidism	Yes	12%
	No	88%
Cardiovascular disease	Yes	4.50%
	No	95.50%
Diabetic Nephropathy	Yes	26%
	No	74%
Diabetic Retinopathy	Yes	4.50%
	No	95.50%
Diabetic Neuropathy	Yes	11%
	No	89%
Dyslipidaemia	Yes	3.50%
	No	96.50%
Stroke	Yes	1%
	No	99%
Peripheral vascular disease	Yes	2.50%
	No	97.50%

Table 1: Percentage of patients with associated co-morbidities from medical history: The table presents the prevalence of various complications and their corresponding responses. Among the population, 42% had hypertension. Hypothyroidism was present in 12% of individuals. Cardiovascular disease affected 4.5% of the population. Diabetic Nephropathy and Diabetic Retinopathy had a prevalence of 26% and 4.5%, respectively. Diabetic Neuropathy affected 11% of the population, while Dyslipidaemia was present in 3.5%. Stroke and Peripheral vascular disease had a low occurrence rate, affecting only 0.1% and 2.5% of individuals, respectively.

Parameter	Min	Max	Mean	Std Dev
Duration of diabetes (years)	1	36	8.56	±6.47
Weight (kg)	37	114	70.17	±11.65
Height (cm)	135	178	159	±8.74
BMI	18	42	27.7	±4.26
Systolic blood pressure	110	200	135.8	±13.24
Diastolic blood pressure	30	110	80.7	±8.59
HbA1c (%)	5	13	8.22	±1.74

Table 2: Analysis of patient parameters.

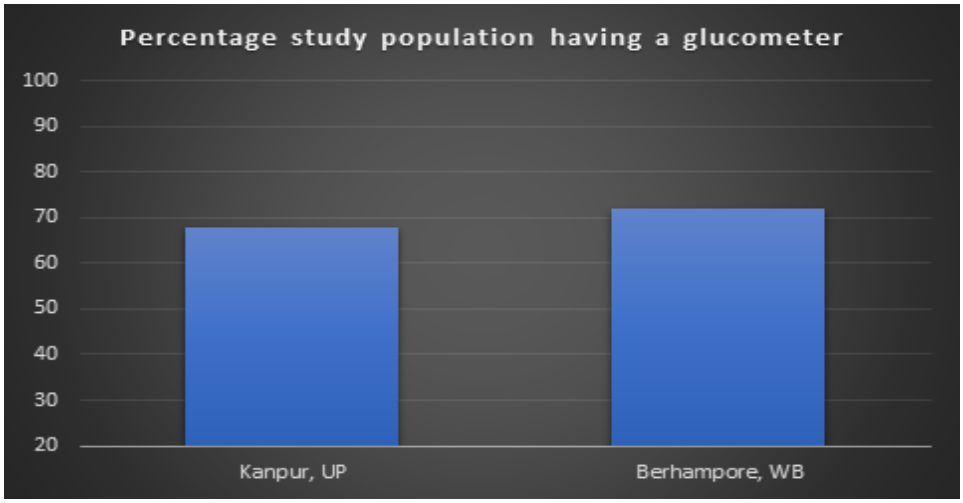

Figure 1: Percentage of population having glucometer.

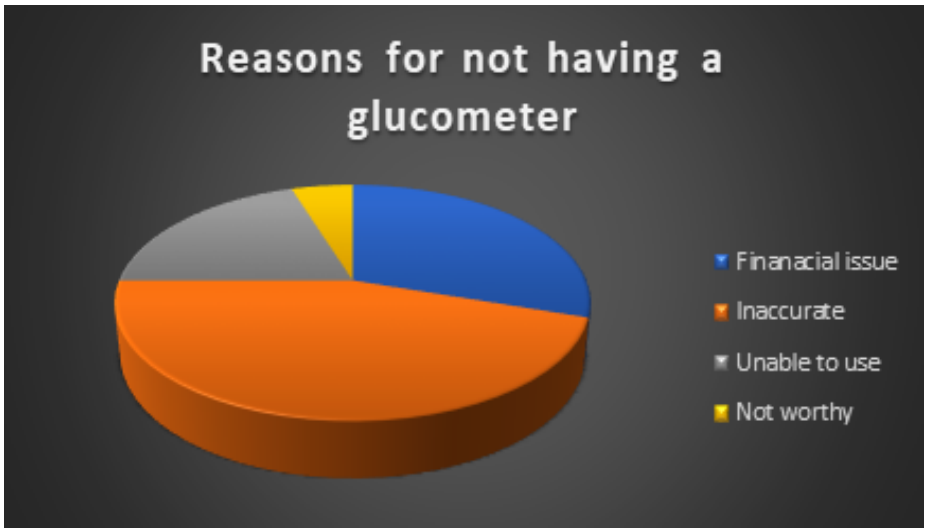

Figure 2: Reasons for not having a glucometer.

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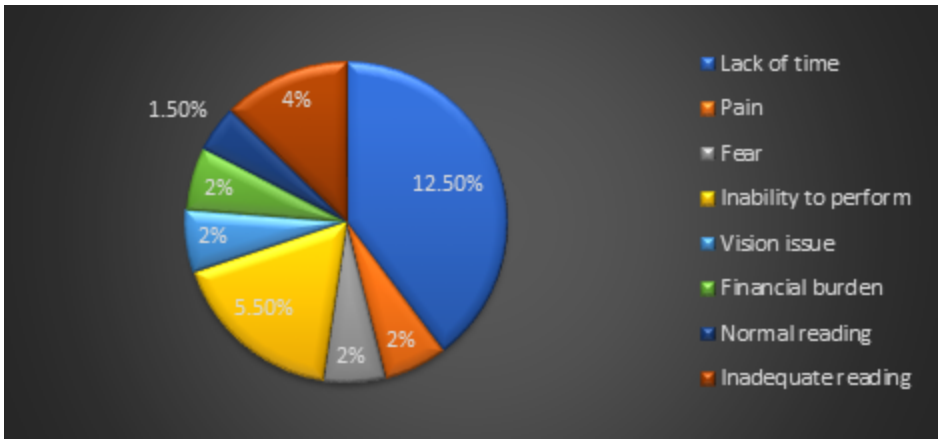

Figure 3: Reasons for not performing SMBG amongst those patients had a glucometer.

	Sig.	t	Sig. (2 tailed)	95% CI	
				Lower	Upper
SMBG and HbA1c relation	0	-14.5	0	-1.62	-1.23

Table 3: Hba1c and frequency of SMBG relation (Independent Samples Test).

Discussion

The observational study conducted at two centers revealed that many patients face financial constraints that prevent them from affording a glucometer. Even if they manage to purchase one, the cost of strips and fear of pricking themselves hinder regular monitoring. Lack of knowledge and dependence on others also contribute to the reluctance to invest in a glucometer.

It is widely known that diabetes and its associated complications escalate if not properly managed from the time of diagnosis. In this study, we found that the majority of participants owned a glucometer, but the frequency of self-blood glucose monitoring (SMBG) was low. Lack of time (12.5%) and inability to perform (5.5%) were the main causes of non-performance. Women and the elderly in India depend on the younger generation for technical tasks because of the low literacy rate, especially in the northern section of the country.

In a randomized controlled trial (RCT) conducted by Mannucci E, et al., structured, and unstructured SMBG were compared among respectively 757 and 750 patients. The group using structured SMBG, which also aided in adjusting diabetes medications, exhibited a difference in HbA1c levels of -0.27% (95%CI-0.49 to-0.04%, P<.018) at the end of the study. In this study, we observed an HbA1c level of 8.2%, which could be associated with inadequately performed SMBG or poor medication compliance. Another meta-analysis by Xu Y et al. found that performing SMBG 8 to 14 times per week was correlated with better HbA1c control at 6 months (MD -0.46%, 95% CI -0.54 to -0.39) and 12 months (MD -0.20%, 95% CI-0.29 to-

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0.11). Similar studies by Machry RV, et al., showed that at 12 weeks (-0.31%; 95% CI: -0.57 to-0.05) and 24 weeks (-0.34%; 95% CI: -0.52 to-0.17), SMBG was linked to a decrease in HbA1c.

A statistically significant association between SMBG and glycemic control was also discovered in thisstudy (p=.00). These findings emphasize the importance of SMBG in achieving better glycaemic control and preventing microvascular and macrovascular complications. Diabetic nephropathy, with a prevalence of 26% in thisstudy, can be prevented through diabetic awareness and education.

A comprehensive team comprising consultants, trained diabetic educators, and clinical psychologists should be established. Patients should receive proper training in addition to guidance on medication compliance and blood sugar monitoring. Patiently addressing SMBG non-performance and offering patients workable remedies are both important. According to Xu Y et al., performing SMBG 8 to 14 times per week was linked to a lower BMI (MD -0.46, 95% CI -0.84 to -0.08). The mean BMI in sample, however, was quite high at 27.7 kg/m^2. Encourage patients to exercise and continue taking their medications on a regular basis. Key findings of this study include:

- Diabetes and its consequences are becoming more common.
- Medication compliance and SMBG are crucial for preventing diabetes-related complications.
- Diabetic awareness and motivation are necessary for managing this chronic disease.
- SMBG can contribute to reducing the financial burden on the healthcare sector.
- Glucometers should be accessible, affordable and simple to use, which will facilitate effective SMBG in countries like India.

Conclusion

This observational study highlights the neglect of self-blood glucose monitoring (SMBG) among individuals with diabetes in India.

The findings underscore the need for increased awareness, improved access to diabetes management technologies, and targeted interventions to promote regular SMBG.

Addressing financial constraints, expanding health insurance coverage to chronic OPD care, and providing education and support to patients can contribute to better diabetes management outcomes and reduce the incidence of complications in India.

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