Original Research Article

Social factors associated with practice of self-monitoring of blood glucose among type-2 diabetic patients

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ABSTRACT

Background: Self-monitoring of blood glucose (SMBG) is an effective self-management tool to achieve desirable haemoglobin A1c (HbA1c) targets and minimizing glucose variability, when the data is timely reviewed and acted upon by healthcare providers and diabetic patients to actively modify behaviour and/or adjust treatment. SMBG improves patient's disease awareness and participation in disease management.
Methods: This cross-sectional study was conducted at Basaveshwara Hospital, Chitradurga, to estimate percentage of type-2 diabetics practicing SMBG and to assess social factors associated with SMBG practice. Diabetic patients in age-group of 18-75 years were included in the study. Information was collected by interview technique, clinical examination and review of laboratory reports.
Results: A 21.5% patients were practicing SMBG. SMBG practice was significantly higher among patients who were urban-area residents (25.0%), with higher educational qualifications (42.2% of patients who studied up-to 12th standard and/or above), with better awareness of diabetes self-management (28.9%) and with better socio-economic status (35.3%). Majority of patients with longer duration of diabetes (4.9±1.5 years), relatively older age group (57.3±2.5 years), with associated co-morbid conditions (26.8%) were found to be practicing SMBG. HbA1c levels were significantly lower among SMBG practicing group (6.6±0.7%).
Conclusions: Better health literacy, higher educational qualifications, financial stability, easier access to specialized anti-diabetic health-care are favourable factors for SMBG practice. Study also highlighted favourable effect of SMBG practice on effective achievement of target HbA1c levels.

Keywords: Self-management of blood glucose, Diabetes mellitus, Haemoglobin A1c levels, Health literacy, Access to health care services

INTRODUCTION

Diabetes is a major health problem with around 370 million diabetics across the world. India has become the diabetes capital of the world with 65 million diabetics and the magnitude is increasing exponentially.[1-3] Landmark studies have documented that better glycaemic control reduces risk of diabetes complications and improves quality of life. But the measures to address hyperglycaemia have been mainly health-care centric (prescribing multi-drug combination of newer generation of oral hypoglycaemic drugs and/or insulin) and improving blood sugar level screening rates. Whereas, sub-optimal focus is evident in improving patient's skills in diabetes self-management like self-monitoring of blood

glucose (SMBG), dietary, physical activity and lifestyle modifications.[4]

SMBG is an effective self-management tool in achievement of required haemoglobin A1c (HbA1c) targets, minimizing glucose variability and to predict severe hypoglycaemia, only when SMBG data is timely reviewed and acted upon by healthcare providers and diabetic patients to actively modify behaviour and/or adjust treatment.[5-7] SMBG also helps in increasing patient's disease awareness and promotes their active participation in disease treatment and control.[8,9] Expert groups recommend SMBG among diabetics who use oral hypoglycaemic agents and/or combined treatments to help detect hypoglycaemia.[4-6]

With this background, present study was conducted at a tertiary health-care centre. Aim and objectives of the study were to estimate the percentage of type-2 diabetics practicing SMBG, to assess the social factors associated with practice of SMBG among them and to estimate the HbA1c levels among these SMBG practicing and non-practicing group of patients.

METHODS

A cross-sectional study was conducted in Basaveshwara Medical College Hospital and Research Centre, Chitradurga, after obtaining Institutional Ethics Committee Clearance. This study was conducted for a period of 6 months (June 2019 to November 2019). All the type 2 DM patients who visited the Out Patient Department of General Medicine Department, who belonged to age-group of 18-75 years were included in the study after explaining the purpose of the study and obtaining their informed consent. Patients recently diagnosed to be suffering from type 2 diabetes mellitus (within past 6 months) and with impaired cognitive functions were excluded from the study.

The patients were administered a pre-tested validated questionnaire and the information was collected by interview technique, clinical examination and review of laboratory reports.

The questionnaire had three sections. The first section comprised of socio-demographic information such as age, gender, marital status, occupation and monthly income and socioeconomic status which was calculated according to Modified BG Prasad classification.[10] The second section included information gathered by clinical examination of patient which included the data about duration of diabetes, current pharmacological treatment, patient's physical activity and anthropometric measurements. The participants' recent HBA1c levels were noted by checking their blood test reports of past 2 months. The third section of study questionnaire included a validated modified diabetes knowledge questionnaire which was utilized for assessing participant's awareness of diabetes and its self-management.

The study questionnaire was developed by adopting the questionnaire of studies conducted by Mansouri et al and patients' awareness about diabetes and diabetes self-management was assessed by the diabetes self-management questionnaire.[11-13] Patients' co-morbidities and diabetic complications and details of SMBG practice were recorded. Accordingly, they were classified as SMBG practicing group and SMBG non-practicing group.

Statistical analysis

Data was compiled in MS excel spreadsheet and analyzed SPSS Statistics for Windows, version 20.0. Categorical data was expressed in frequency and percentages while continuous data was expressed in mean and standard deviations. Pearson Chi-square test was applied to test for association between categorical variables. Independent student t test was applied to test for significant difference among the age, duration of diabetes, HbA1c levels and body mass index (BMI) levels among SMBG practicing and non-practicing groups. The associations with p value <0.05 were considered significant.

RESULTS

A total of 200 diabetic patients (53% males and 47% female participants) who fulfilled the study criteria participated in the study. The prevalence of SMBG practice among diabetics in this hospital-based study was found to be 21.5%. The average age of participants was 55.0±5.6 years. A majority of 64% of patients were from urban area, a 33% of patients had studied up-to primary level of schooling and a 46% of patients belonged to class 3 socio-economic status (SES) according modified BG Prasad classification, whereas a 17% belonged to SES class 4 or class 5. Average duration of diabetes, HbA1c levels and BMI of participant patients were 4.5±1.2 years, 7.4±0.8% and 27.5±2 kg/m^2 respectively. The anti-diabetic medication pattern among the study patients was as follows: a majority of 58.5% of diabetics were on treatment with oral hypoglycaemic agents (OHA) only, a 33% patients were on combined OHA and insulin treatment whereas an 8.5% were on insulin therapy only (Table 1).

A significantly higher percentage of patients who were residents of urban area (25.0%) were found to practicing SMBG when compared to patients from rural area (15.3%). Educational qualification was found to be significantly associated with practice of SMBG, wherein, a majority of patients who had studied up-to 12th standard/degree/diploma were practicing SMBG (42.2%) when compared to those diabetic patients who were either illiterates or those who had up-to primary level of schooling (11.8%). Higher SES was found to be a favouring factor for SMBG practice. A 35.3% of patients belonging to SES class 1 or class 2 practiced SMBG compared to 15.2% of patients belonging to SES class 3 and 12.5% of patients belonging to SES class 4 or class 5.

Table 1: Socio-demographic and clinical characteristics of participants (n=200).

Characteristics	Parameters	Frequency (N)	Percentage (%)
Educational status	Illiterate	18	9.0
	Primary school (up-to 7th standard)	52	26.0
	Higher primary (8th to 10th standard)	66	33.0
	Up-to 12th/ diploma/ degree	64	32.0
SES	SES class 1 and 2	68	34
	SES class 3	92	46
	SES class 4 and 5	40	20
Family history of diabetes	Present	127	63.5
Medications	OHA only	117	58.5
	OHA and insulin	66	33.0
	Insulin only	17	8.5
Co-morbidities*	Hypertension	126	63
	Cardiac problems	27	13.5
	Dyslipidaemia	134	67
	Retinopathy	09	4.5
Patients who practiced SMBG	-	43	21.5
Total	-	200	100

*Multiple options possible.

Table 2: Social factors associated with practicing of SMBG.

| Variables	Parameters	SMBG practicing group	SMBG non-practicing group	Total	Test of association and p value
		N (%)	N (%)	N (%)	
Place of residence	Rural	11 (15.3)	61 (84.7)	72 (100)	χ^2: 6.4343 p value <0.01
	Urban	32 (25.0)	67 (52.3)	128 (100)	
Educational status	Illiterate/ primary/ higher primary school (up-to10th std.)	16 (11.8)	120 (88.2)	136 (100)	χ^2: 23.866 p value <0.01
	Up-to 12th/diploma/degree	27 (42.2)	37 (57.8)	64 (100)	
Awareness of diabetes management	Present	37 (28.3)	94 (71.8)	131 (100)	χ^2: 10.233 p value <0.01
	Absent	6 (8.7)	63 (91.3)	69 (100)	
SES	SES class 1 or class 2	24 (35.3)	44 (64.7)	68 (100)	χ^2: 11.738 p value <0.01
	SES class 3	14 (15.2)	78 (84.8)	92 (100)	
	SES class 4 or class 5	5 (12.5)	35 (87.5)	40 (100)	
Physical activity (minimum 40 mins per day)	Minimum of 5 days per week	24 (25.5)	70 (74.5)	94 (100)	χ^2: 1.708 p value=0.191
	Less than 5 days per week	19 (17.9)	87 (82.1)	106 (100)	
Co-morbidities	Present	38 (26.8)	104 (73.2)	142 (100)	χ^2: 80.29 p value <0.01
	Absent	5 (8.6)	53 (91.4)	58 (100)	
Family history of diabetes mellitus	Present	23 (18.1)	104 (81.9)	127 (100)	χ^2: 2.369 p value=1.238
	Absent	20 (27.4)	53 (72.6)	73 (100)	
Total		43 (21.5)	157 (78.5)	200 (100)	

A total of 131 participants (65.5%) had awareness about diabetes management. A significantly higher percentage of these patients practiced SMBG (28.3%) compared to those who lacked awareness regarding diabetes management (8.7%). Although SMBG practice was also found to be higher among those patients who performed the recommended physical activity for 40 minutes per day for minimum of 5 days/week (25.5%) compared to those who did-not perform this recommended physical activity (17.9%), this association was not statistically significant. A significantly higher percentage of patients who had associated co-morbid conditions (hypertension, dyslipidaemia, cardiovascular diseases) practiced SMBG (26.8%) when compared to those participants without such co-morbid conditions (8.6%). Family history of diabetes mellitus was not found to be significantly associated with SMBG practice (Table 2).

Table 3: Factors affecting practice of SMBG.

Variables	Patient groups according to SMBG practice	Mean	Standard deviation	P value
Patients' age (years)	SMBG practicing group	57.3	2.5	0.01
	SMBG non-practicing group	52.6	2.4	
Duration of diabetes (years)	SMBG practicing group	4.9	1.5	0.01
	SMBG non-practicing group	4.2	0.9	
BMI (kg/m^2)	SMBG practicing group	26.1	2.7	0.06
	SMBG non-practicing group	27.5	2.2	
HbA1c (%)	SMBG practicing group	6.6	0.7	0.01
	SMBG non-practicing group	7.9	0.2	

Independent samples t-test applied for continuous variables.
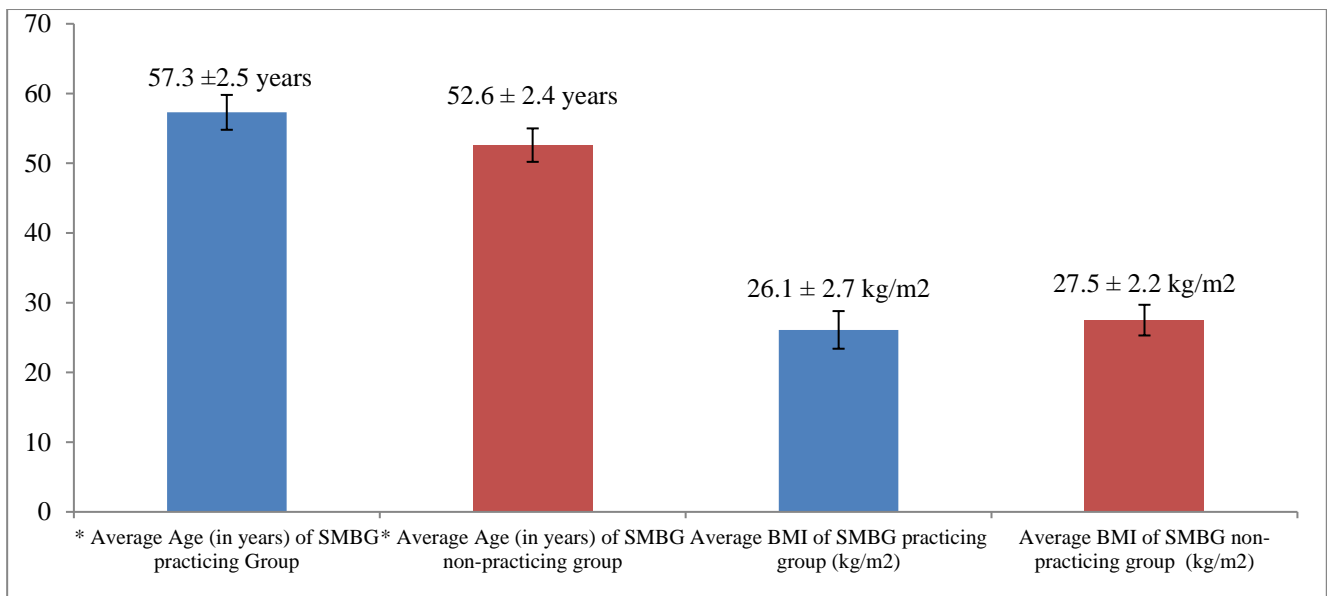
Figure 1: Association of SMBG practice with age and BMI of patients.
Independent samples-t test applied. *Implies significant association with p<0.05.
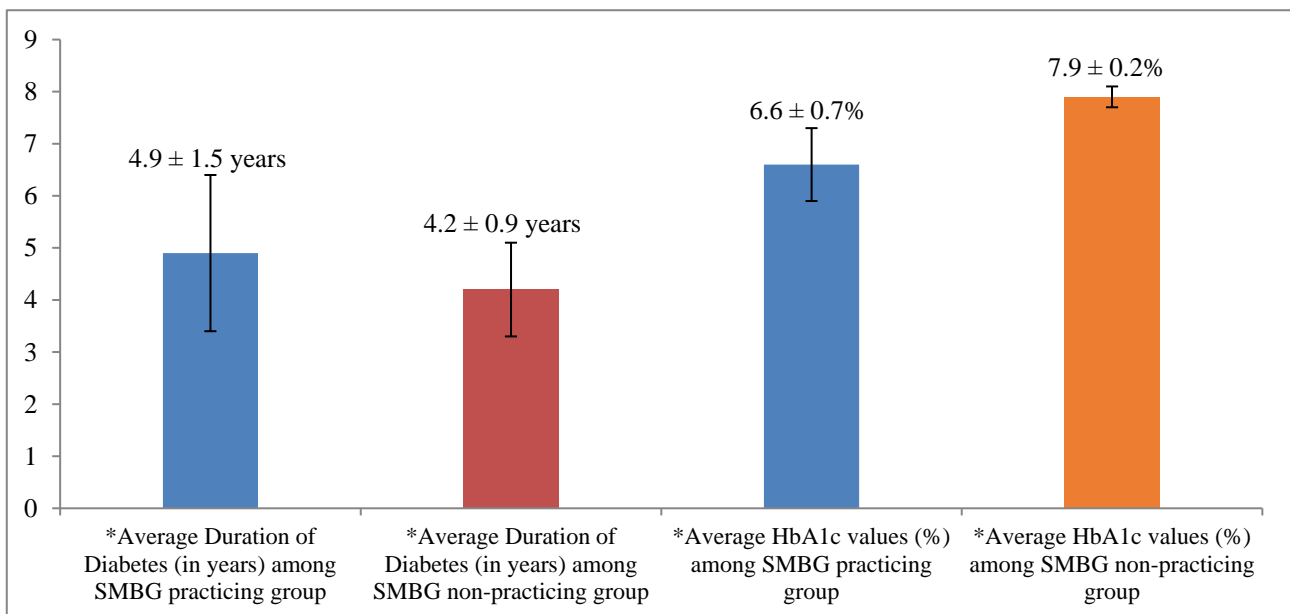
Figure 2: Association of SMBG practice with duration of diabetes and HbA1c values of patients.
Independent samples-t test applied. *Implies significant association with p<0.05.

Relatively older age group (average: 57.3±2.5 years) and longer duration of diabetes mellitus (4.9±1.5 years) were found to be significantly associated with SMBG practice. HbA1c levels were also significantly lower among SMBG practicing group (6.6±0.7%) compared to SMBG non-practicing group (7.9±0.2%) (Table 3). Although average BMI of SMBG practicing patient group was comparatively lesser (26.1±2.7 kg/m^2) compared to SMBG non-practicing group (27.5±2.2 kg/m^2), association was not significantly significant (Table 3, Figures 1 and 2).

DISCUSSION

The present study was conducted at a tertiary care hospital located in an urban area of Central Karnataka. Self-monitoring of blood glucose was practiced by a total of 21.5% of diabetics in our study (Table 1). These results are similar to the findings of a multi-centric study conducted across all 4 zones of India using multi-stage cluster random sampling method, by Tharkar et al.[1] In their study, the authors Tharkar et al, found that a 26.8% of diabetic patients accessing treatment at diabetes specialty centres and 10.8% of diabetic patients visiting private clinics, practiced SMBG.[1]

India is primarily an agrarian country, with significantly higher percentage of population still in the below poverty line bracket. The inequitable distribution of health-care resources is still the major concern in Indian public health system. The lack of awareness about disease management, inequitable distribution of health care facilities in rural areas coupled with high cost of SMBG test strips, financial constraints have led to comparatively decreased utilization of SMBG in rural areas.[14,15] The specialized health-care centres which are located in urban areas, generally provide more comprehensive medical care with greater focus on patient satisfaction with their medical care and patient-provider relationship.[1,14,15] This is also reflected in the present study wherein a significantly lesser percentage of diabetics from rural areas practised SMBG when compared to the diabetics who were residents of urban areas (Table 2).

Awareness about diabetes and necessary self-care in disease management form a crucial arm in diabetes self-care. Self-care for diabetes management involves attending regular health check-ups and adherence to doctor advised medication and lifestyle modifications. High costs of glucometer test strips and inconvenience in repeated blood glucose monitoring coupled with anxiety regarding one's blood glucose levels are major hindrance in practice of SMBG.[4,6,16-18] Whereas, better health literacy, financial stability, social and family support as well as better access to affordable health-care services are facilitating factors for self-management of diabetes, which result in achieving desired euglycaemic levels.[6,16-18] Accordingly, in our study, it was found that higher educational qualification, better awareness about diabetes

self-management and higher socio-economic status resulted in better SMBG practice (Table 2). Also, this practice of SMBG was found to be significantly associated with better glycaemic control among diabetics (Table 3). This reduction of HbA1c levels among SMBG practicing patients could be due to the fact that accurate SMBG monitoring data encourage patients to contemplate on potential adjustments they can do with diet, exercise and stress management, thereby improving their health problem-solving and decision-making skills. It also helps the treating doctors in better understanding of patients' glycaemic changes to make better adjustments in medication. Similar results are found in studies conducted elsewhere.[4,6,18,19] Whereas in a study done by Young et al, no statistically significant differences were found at glycaemic control or Health related quality of life between patients who performed SMBG compared with those who did not perform SMBG.[20]

In the present study, SMBG practicing patients predominantly belonged to relatively older age group (57±2.5 years) with co-morbidities (26.8%) (Tables 2 and 3). Similar results are found in studies conducted elsewhere.[20-22] The possible explanation to this could be that the median age at onset of diabetes among Indians has largely reduced with majority of patients having diabetes as early as by 35-40 years age. With increasing age, the co-morbidities start to rise. With the progression of the disease, when disease is not controlled by oral hypoglycaemic drugs only, insulin therapy will be started as per the standard guidelines, which warrants the regular monitoring of blood glucose levels.[23,24]

CONCLUSION

The study highlights the major social factors influencing the self-monitoring of blood glucose among the type 2 diabetic patients. Better health literacy, educational qualifications and financial stability were found to be favourable factors for practice of SMBG. Even though the practice of SMBG was relatively less at 21.5%, the data highlighted the favourable effect of SMBG on effective achievement of target HbA1c levels. Better access to health care services, availability of diabetic specialty clinics and tertiary health care centres in urban areas helped patients to be more aware about their disease and this provided an opportunity to patients to be motivated to pro-actively involved in self-management of disease.

Recommendations

Educating diabetic patients regarding SMBG interpretation, adjustment of medication, nutrition and physical activity have to be increasingly focussed by health care-providers. Along with the existing modality of health-centre blood sugar screening and medication advice, efforts have to be stepped up to address the barriers for SMBG practice such as high cost of

glucometer test strips, easy and affordable access to specialised health care services and more focus has to be given on creating awareness in patients regarding self-management techniques thereby empowering them in proactive participation for diabetes self-management.

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