Zagazig University Medical Journal
www.zumj.journals.ekb.eg
https://doi.org/10.21608/zumj.2025.399502.4031 Volume 31, Issue 9 September. 2025
Manuscript ID ZUMJ-2507-4031
DOI 10.21608/ZUMJ.2025.399502.4031

ORIGINAL ARTICLE

Knowledge, Attitude, and Practice Toward Self-Monitoring of Blood Glucose Among Patients with Type 1 Diabetes: A Descriptive Study

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Submit Date 04-07-2025
Revise Date 26-07-2025
Accept Date 04-08-2025

ABSTRACT

Background: Type 1 diabetes mellitus (T1DM) requires continuous self-management, including self-monitoring of blood glucose (SMBG), which is essential for achieving optimal glycemic control. However, effective practice depends on patients' knowledge, attitude, and behavior, particularly in low-resource settings. We aimed to assess the knowledge, attitude, and practice (KAP) regarding SMBG among T1DM patients and to explore the sociodemographic and clinical predictors of adequate self-monitoring behavior. **Methods**: A cross-sectional study was conducted on 157 T1DM patients attending the family medicine outpatient clinic at Zagazig University Hospitals from January to March 2025. Data about sociodemographic characteristics and clinical history was recorded. KAP related to SMBG and self-adjustment of insulin doses were assessed by pre-validated questionnaire developed by Krishnan & Thirunavukkarasu. Anthropometric and laboratory data (BMI, HbA1c, cholesterol) were also collected. **Results**: Inadequate KAP was reported in 64.3% of our study participants A statistically significant inverse correlation was observed between KAP scores and HbA1c and total cholesterol levels. Inadequate KAP was more common among patients with higher BMI and lower family income. Multivariate analysis showed that family income status was a significant predictor of inadequate KAP. **Conclusion**: Despite high rates of follow-up and glucose monitoring practices, gaps in knowledge and self-care behavior persist among T1DM patients. Socioeconomic factors, rather than clinical history alone, were strongly associated with inadequate KAP.

Keywords: Attitude, Knowledge, Practice, Type 1 Diabetes Mellitus, Self-Monitoring of Blood Glucose

INTRODUCTION

Type 1 diabetes mellitus (T1DM) is a chronic autoimmune disease characterized by pancreatic β-cell destruction, resulting in absolute insulin deficiency and lifelong insulin dependency. It commonly manifests in childhood or adolescence, although it can develop at any age **[1]**. Globally, over 1.2 million children and adolescents are affected by T1DM, and the prevalence is steadily increasing, with substantial disparities between countries **[2]**. In Egypt, the burden of T1DM is growing, contributing to increasing demands on the healthcare system and families. Egypt is among the top 10 countries in the number of children and adolescents (0–19 years) living with T1DM, with an estimated 37,000 cases in this age group alone **[3]**.

Evidence on KAP toward SMBG among type 1 diabetic patients in Egypt is scarce. Previous studies have rarely assessed knowledge, attitude, and practice separately or linked them to clinical outcomes. This study addresses these gaps by evaluating KAP and its predictors in this population.

Effective management of T1DM hinges on the patient's ability to monitor and respond to daily fluctuations in blood glucose levels. Self-monitoring of blood glucose (SMBG) is a core component of modern diabetes care, providing real-time feedback that guides insulin dosing, dietary intake, and physical activity **[4]**. SMBG has been linked to improved glycemic control, reduced complications, and enhanced quality of life among patients when used consistently and appropriately **[5]**.

However, the effectiveness of SMBG depends on the patient's knowledge, attitude, and practice (KAP) regarding its use. Patients who are adequately informed and motivated are more likely to adhere to recommended monitoring schedules and to act on the results appropriately **[6]**. In contrast, lack of education or misbeliefs about SMBG may lead to poor compliance and suboptimal outcomes **[7]**. The role of healthcare providers, particularly family physicians, in supporting SMBG through counseling and education is essential **[8]**.

Understanding the socio-demographic and clinical predictors of KAP among patients with T1DM is crucial to improving educational strategies and clinical interventions. This is particularly important in resource-limited settings like Egypt, where barriers to care and health literacy may hinder effective diabetes self-management **[9]**.

This research aimed to assess the level of knowledge, attitude, and practice toward SMBG among patients with T1DM and to explore associated socio-demographic and clinical factors.

METHODS

This cross-sectional study was conducted at the Family Medicine Outpatient Clinic of Zagazig University Hospitals, Egypt. The study included 157 patients with type 1 diabetes mellitus (T1DM) who attended routine follow-up visits from January to March 2025. Inclusion criteria were adult patients aged 18–30 years, diagnosed with T1DM for at least one year, currently on insulin therapy, and able to communicate effectively. Exclusion criteria included patients with type 2 or gestational diabetes, mental or cognitive impairment, orthose with incomplete data or refusal to consent.

Sample size:

Assuming that the prevalence of adequate knowledge regarding self-monitoring of blood glucose (SMBG) among T1DM patients is 24.2%, with a target population of 350 and a 95% confidence level, and an assumed effect size of 1, the sample size was calculated to be 157 patients using **OpenEpi software [10]**.

Sampling technique:

Patients were recruited using a systematic random sampling technique during routine clinic visits. Every second eligible patient presenting during the study period was invited to participate until the required sample size was achieved.

Operational Design:

KAP-related data was collected using a pre-validated questionnaire developed by Krishnan & Thirunavukkarasu, to assess patients' knowledge, attitude, and practice (KAP) regarding SMBG and insulin self-adjustment. The KAP questionnaire comprised 15 yes/no questions **[7].** The questionnaire was translated into Arabic first to make it accessible to the target population. The cut-off for each parameter is 70%. The total KAP scoring ranged from 0 to 15, with a cut-off of 7 to categorize participants into:

- Adequate KAP (≥7 points)
- Inadequate KAP (<7 points)

Sociodemographic data was collected using the **Fahmy socioeconomic scale [11]**, which is widely used in Egyptian health research. The scale assigns a total score out of 48 based on variables such as parental education, occupation, income adequacy, family size, crowding index, and sanitation. Participants were classified into three levels: high (≥70%, score 33.6–48), medium (40–<70%, score 19.2–<33.6), and low (<40%, score <19.2).

Sociodemographic data was collected by a structured questionnaire developed by the research team. It included variables such as age, sex, parental education and employment status. Socioeconomic status was assessed using the

Fahmy Socioeconomic Scale [11], which is widely used in Egyptian health research.

Clinical data including body mass index (BMI), HbA1c, and total cholesterol levels were extracted from the most recent lab results in the patients' medical records. BMI was calculated using the standard formula: weight in kilograms divided by the square of height in meters (kg/m^2), based on anthropometric measurements recorded during the clinic visit.

Statistical analysis:

Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS), version 25. Descriptive statistics were used to summarize sociodemographic and clinical data. Chi-square tests were used to examine associations between categorical variables. Spearman's correlation was used to assess relationships between KAP scores and continuous clinical variables. Univariate logistic regression analysis was performed to identify predictors of inadequate KAP. A p-value <0.05 was considered statistically significant.

IRB Approval, Confidentiality, and Consent:

The Institutional Review Board (IRB10464/26-2-2023) of the Faculty of Medicine, Zagazig University approved the study's protocol. The Study was conducted later on in the late 2023 and the statistical work was conducted in 2024. Participants were informed about the study's purpose and procedures, and written informed consent was obtained from all participants prior to inclusion. Confidentiality of personal data was maintained throughout the study.

RESULTS

The present study included 157 patients with type 1 diabetes mellitus. Nearly half (47.8%) of the participants were under 20 years of age, and the gender distribution was balanced, where 80 (51%) were female and 77 (49%) were male, indicating a nearly equal gender distribution. In terms of parental education, 48% of fathers and 37% of mothers held university degrees. Additionally, 88% of fathers and 64% of mothers were employed. Around 67% of the families reported sufficient income, with or without savings, and 69.4% of the patients were classified as having a middle socioeconomic level (Table 1).

Regarding clinical approximately 60% of participants had been diagnosed with diabetes for over 10 years. A previous history of hospitalization was reported in 31.2% of cases, and 51% indicated that diabetes negatively affected their academic performance. A family history of diabetes was present in 29.9% of patients. Hypoglycemic attacks occurred three to four times per week in 42% of participants. The mean BMI was 23.61 kg/m^2, mean HbA1c was 8.4%, and mean total cholesterol level was 202.59 mg/dL (Table 2).

Assessment of knowledge, attitude, and practice (KAP) using the Krishnan & Thirunavukkarasu (2016) questionnaire showed that 70% had regular follow-up, 68.2% purchased glucometers upon physician advice, and 69.4% had received training on self-monitoring at least once. Additionally, 77.1% performed hand drying by blowing, 79% used the same finger and first blood drop, and 62.4% maintained glucose records. Recognition of hypoglycemia symptoms was near-universal (99.4%), with 98.7% having experienced symptomatic hypoglycemia. Based on a cutoff score of 7, 64.3% of patients demonstrated inadequate KAP (Table 3, Figure 1).

Significant negative correlations were found between HbA1c, total cholesterol, and baseline KAP scores, suggesting that poorer glycemic and lipid control were associated with worse knowledge and self-care behaviors (Table 4).

Family income level showed a statistically significant association with KAP adequacy, while other sociodemographic factors such as age, sex, and parental education did not show significant relationships (Table 4).

Univariate analysis indicated that patients with lower financial income, especially those living in families with per-capita income that is "not enough + loan not repaid" as per the Fahmy questionnaire, were significantly more likely to have inadequate KAP. In contrast, having a non-working mother appeared protective against inadequate KAP levels (Table 6).

Table (1): Distribution of the patients studied according to baseline data

	items	N=157	%
Age	**<20 years** **20 – 25 years** **>25 years**	**75** **67** **15**	**47.8%** **42.7%** **9.6%**
Gender	**Female** **Male**	**80** **77**	**51%** **49%**
Father Education	**Illiterate/read and write** **Literacy certificate** **Primary** **Preparatory** **Secondary** **University** **Postgraduate**	**9** **8** **9** **20** **26** **76** **9**	**5.7%** **5.1%** **5.7%** **12.7%** **16.6%** **48.4%** **5.7%**
Mother Education	**Illiterate/read and write** **Literacy certificate** **Primary** **Preparatory** **Secondary** **University** **Postgraduate**	**9** **7** **11** **31** **33** **58** **8**	**5.7%** **4.5%** **7%** **19.7%** **21%** **36.9%** **5.1%**
Father Occup.	**No** **Yes**	**19** **138**	**12.1%** **87.9%**
Mother Occup.	**No** **Yes**	**56** **101**	**35.7%** **64.3%**
Family Income	**Not enough, not repaid loan** **Not enough, big loan** **Not enough, small loan** **Enough only** **Enough, and saving**	**6** **22** **24** **75** **30**	**3.8%** **14%** **15.3%** **47.8%** **19.1%**
SE Class	**Low** **Medium** **High** **Score (mean ±SD)**	**1** **109** **47** **30.82 ± 4.8**	**0.6%** **69.4%** **30%**

Table (2): Distribution of the patients studied according to clinical and disease-specific data

	N=157	%
Disease onset		
0 – 5 years ago	16	10.2%
6 – 10 years ago	47	29.9%
>10 years ago	94	59.9%
Previous hospitalization	49	31.2%
Negative effect on studying	80	51%
Family history of diabetes	47	29.9%
Hypoglycemia events/week		
1 – 2 times	33	21%
3 – 4 times	66	42%

	N=157	%
≥5 times	58	36.9%
	Mean ± SD	**Range**
BMI (kg/m^2)	23.61 ± 3.61	17 – 36
HbA1c (%)	8.4 ± 1.55	6 – 13
Total cholesterol (mg/dl)	202.59 ± 27.18	160 – 269

Table (3): Distribution of the studied patients according to Krishnan & Thirunavukkarasu Questionnaire, 2016

	N=157	%
Knowledge		
Teaching at least once how to do self-monitoring by physician	109	69.4%
Knowing insulin drug name and dose	72	45.9%
Antidiabetics adverse effects	72	45.9%
Recognize hypoglycemia symptoms	156	99.4%
Attitude		
Regular follow up	109	69.4%
Buying monitoring instrument based on physician advice	107	68.2%
Regular records measured sugar level till your consult to physician	98	62.4%
Practice		
Wash hands and let them dry before measuring	51	32.5%
Blow your hand to make hands dry before measuring	121	77.1%
Puncture the same finger every time	124	79%
Measure level with first drop of blood from finger	124	79%
Discard needle/lancet after using	51	32.5%
Skip or take more insulin after self-monitoring before consulting physician	41	26.1%
Adjusting insulin after self-monitoring of sugar before consulting physician	48	30.6%
	Median (IQR)	**Range**
Knowledge score	2(2 – 4)	1 – 4
Attitude score	3(0 – 3)	0 – 3
Practice score	2(0 – 3)	0 – 7
Total Inadequate (≤7) Adequate **(>7)**	 101 56	 64.3% 35.7%

Table (4) : Correlation between Social score, HbA1c, BMI, total cholesterol and baseline KAP score

	Social score		BMI		HbA1c		Total cholesterol	
	r	p	r	p	r	p	r	p
Knowledge	0.009	0.911	-0.063	0.432	-0.331	<0.001**	-0.267	<0.001**
Attitude	0.146	0.068	-0.087	0.279	-0.259	<0.001**	-0.168	0.036*
Practice	0.067	0.406	-0.087	0.279	-0.295	<0.001**	-0.249	0.002*
Total score	0.088	0.273	-0.072	0.37	-0.39	<0.001**	-0.31	<0.001**

r Spearman rank correlation coefficient *p<0.05 is statistically significant **p≤0.001 is statistically highly significant

Table (5) Relation between KAP adequacy and baseline data of studied patients

	Adequate N=56 (%)	Inadequate N=101 (%)	χ^2	p
Age				
<20 years	31 (41.3%)	44 (58.7%)		
20 – 25 years	20 (29.9%)	47 (70.1%)	1.365¥	0.243
>25 years	5 (33.3%)	10 (66.7%)		
Gender				
Female	26 (32.5%)	54 (67.5%)		
Male	30 (39%)	47 (61%)	0.714	0.398
Father education				
Illiterate/read& write	4 (44.4%)	5 (55.6%)		
Literacy certificate	1 (12.5%)	7 (87.5%)		
Primary	1 (11.1%)	8 (88.9%)		
Preparatory	8 (40%)	12 (60%)		
Secondary	6 (23.1%)	20 (76.9%)	0.858¥	0.354
University	34 (44.7%)	42 (55.3%)		
Postgraduate	2 (22.2%)	7 (77.8%)		
Mother education				
Illiterate/read&write	4 (44.4%)	5 (55.6%)		
Literacy certificate,primary	4 (22.2%)	14 (77.8%)		
Preparatory	9 (29%)	22 (71%)		
Secondary	7 (21.2%)	26 (78.8%)	1.76¥	0.185
University	30 (51.7%)	28 (43.8%)		
Postgraduate	2 (25%)	6 (75%)		
Father occupation				
No	8 (42.1%)	11 (57.9%)	0.39	0.632
Yes	48 (34.8%)	90 (65.2%)		
Mother occupation				
No	24 (42.9%)	32 (57.1%)	1.96	0.161
Yes	32 (31.7%)	69 (68.3%)		
Family income				
Not enough&not repaired loan	1 (16.7%)	5 (83.3%)		
Not enough, big loan	3 (13.6%)	19 (86.4%)		
Not enough&small loan	8 (33.3%)	16 (66.7%)		
Enough only	28 (37.3%)	47 (62.7%)	9.058¥	0.003*
Enough, and saving	16 (53.3%)	14 (46.7%)		
Socio-economic class				
Low	0 (0%)	1 (100%)		
Medium	36 (33%)	73 (67%)	1.619¥	0.203
High	20 (42.6%)	27 (57.4%)		

χ^2Chi square test ¥Chi square for trend test t independent sample t test

Table (6): Univariate analysis of factors associated with inadequate knowledge, attitude and practice

	COR (95% CI)	p
Mother occupation (no)	0.49 (0.23 – 1.01)	0.052
Family income		
Not enough & not repaired loan	6.27 (0.64 – 61.92)	0.116
Not enough, big loan	9.03(2.11 – 38.61)	0.003*
Not enough & small loan	2.78 (0.88 – 8.78)	0.081
Enough only	2.01 (0.84 – 4.798)	0.116
Enough, and saving	1 (reference)	0.035*

COR crude odds ratio CI Confidence interval

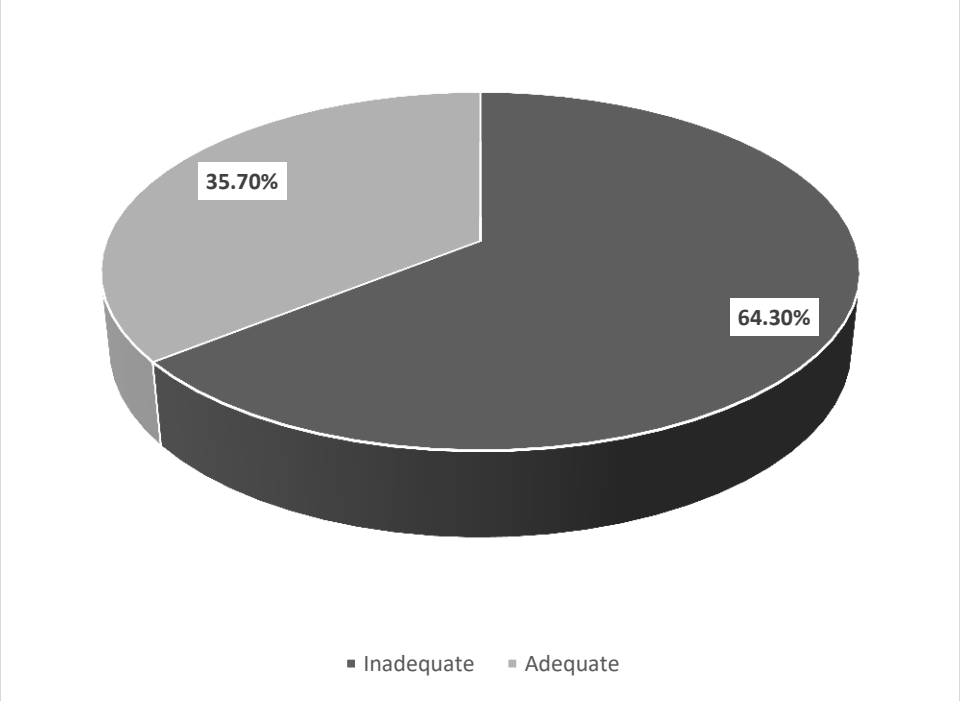

Figure (1): Pie chart showing distribution of patients according to level of KAP

DISCUSSION

Type 1 diabetes mellitus (T1DM) is a lifelong condition that requires continuous self-care and insulin management. Among the core components of diabetes self-management is self-monitoring of blood glucose (SMBG), which enables patients to make informed decisions about insulin dosing, dietary intake, and physical activity. Regular and effective SMBG is associated with improved glycemic control and reduced risk of complications. However, patient engagement in SMBG is often influenced by multiple factors, including knowledge, motivation, socioeconomic context, and access to resources.

This study revealed that 64.5% of the participants were classified as inadequate (Figure 1). This reflects a concerning gap in self-care practices among type 1 diabetic patients. The findings are consistent with Krishnan and Thirunavukkarasu, who reported a similarly low proportion of adequate KAP among Indian patients. Additionally, a study by

AbouElmagd et al. [12] in Egypt reported inadequate SMBG knowledge in 59% of insulin-dependent patients, highlighting a pervasive issue across LMICs. Given the pivotal role of SMBG in diabetes self-management, such inadequacy could compromise glycemic control and increase complication risks.

Out of the 157 participants, 51% were females, indicating a nearly equal gender distribution (Table 1). While gender itself was not found to be a statistically significant predictor of KAP adequacy in this study, the nearly equal distribution allowed us to observe comparable engagement between males and females. This is contrary to previous literature suggesting that females with diabetes may be more likely to engage in SMBG but also face psychological barriers like diabetes distress, according to **Balfe et al. [13]**.

This study showed that 48% of fathers and 37% of mothers had received university-level education, and the majority of parents were employed, 88% of fathers and 64% of mothers (Table 1). However, parental education was not found to significantly influence participants' KAP levels. This contrasts with findings from **Elnour et al. [14]**, who observed a strong association between parental literacy and diabetic self-care behaviors in adolescents. The lack of association in our study might reflect either the older age of participants (47.8% were aged ≥20 years) or cultural dynamics where medical knowledge is less commonly transferred from parent to child. Furthermore, mothers' employment status did show a protective role, as having a non-working mother significantly decreased the risk of inadequate KAP (Table 6). This may suggest increased maternal availability for supervision and support in diabetes management.

About 67% of participants reported sufficient or surplus family income, and 69.4% were classified as having middle socioeconomic status (Table 2). However, univariate analysis showed that inadequate income, especially when coupled with unpaid loans, significantly increased the risk of inadequate KAP, with adjusted odds ratios up to 9.03 in the case of insufficient income with large loans (Table 6). This is supported by **El-Sayed et al. [15]**, who found that financial burden is a key barrier to diabetes self-care in Egypt. Limited financial resources may restrict access to glucometers, testing strips, and structured education, thereby perpetuating inadequate SMBG practices.

A total of 60% of participants had been living with type 1 diabetes for more than 10 years (Table 4). Despite the prolonged disease duration, this was not significantly associated with improved KAP. This finding mirrors a study conducted by **Al-Khaldi et al. [16]** in Saudi Arabia, which found no correlation between disease duration and knowledge scores among diabetic patients. Long-standing diabetes without structured education may result in habituation to poor practices. This underlines the importance of periodic reinforcement rather than assuming time alone improves knowledge or behavior.

Regarding hypoglycemia episodes, 42% of participants reported experiencing symptoms 3–4 times weekly, and 37% had even more frequent events (Table 5). Frequent hypoglycemia could be an indicator of improper insulin dosing and inadequate SMBG practices. Despite this, 99.4% recognized symptoms of hypoglycemia and 98.7% had experienced it symptomatically (Table 5). This paradox may reflect a reactive rather than preventive approach to diabetes management. Similar trends were observed in the **Nathan et al. [17]**, where inadequate SMBG correlated with higher rates of hypoglycemic episodes. In resource-limited settings, reactive management may stem from cost concerns or lack of education.

Statistical analysis showed a significant negative correlation between total KAP scores and both HbA1c and total cholesterol levels (Table 4). Patients with inadequate KAP had higher mean HbA1c and cholesterol, suggesting that poor SMBG practices contribute to uncontrolled glycemia and dyslipidemia. This is supported by **Battelino et al. [18]**, who emphasized that effective SMBG and insulin

titration significantly reduce HbA1c and cardiovascular risk markers. Thus, KAP is not just a theoretical construct but a clinical determinant of outcomes.

Although 69.4% of patients were taught SMBG at least once, and 70% were on regular follow-up, this did not translate into high KAP levels (Table 5). This suggests that current educational efforts may lack depth, reinforcement, or personalization. Family physicians are uniquely positioned to fill this gap by integrating SMBG counseling into every visit. As highlighted by Sunaert et al., continuous, patient-centered diabetes education in primary care settings leads to significant improvement in self-care behaviors. Egypt's primary care infrastructure should leverage this opportunity.

Over 50% of participants reported that diabetes negatively impacted their academic performance (Table 3). Although this factor was not statistically associated with KAP level, it remains clinically significant. Poor glycemic control, frequent hypoglycemia, and the psychosocial burden of chronic illness can all affect concentration and attendance. A study by **Shulman et al. [19]** similarly noted that children and adolescents with T1DM face significant academic and psychosocial challenges, often due to inadequate disease management strategies. In LMICs like Egypt, school-based diabetes support systems are limited, exacerbating the burden on students and families.

Among participants, 64% reported adjusting their insulin or medication dose after SMBG before consulting a physician (Table 5). While this demonstrates a degree of autonomy, it raises questions about the appropriateness and safety of such adjustments in the absence of proper training. Structured programs like DAFNE have emphasized that insulin titration should be taught systematically to avoid hypoglycemia or worsening hyperglycemia, as shown by **Gallen et al. [20]**. In Egypt, where access to diabetes education is uneven, these self-directed actions may stem from necessity rather than informed decision-making. This underscores the urgent need to include insulin self-adjustment training within primary care services.

A total of 75.8% of patients knew their insulin dose and drug name, and 69.9% were aware of common side effects (Table 5). Additionally, 99.4% recognized hypoglycemia symptoms, and 98.7% had experienced them. This suggests that knowledge about acute complications is relatively high, likely due to lived experience and direct feedback from hypoglycemic events. However, this does not necessarily translate into better SMBG practice or better glycemic outcomes. As shown by **Fisher et al. [21]**, knowledge alone is insufficient unless accompanied by practical skills and behavior change support. Interventions should thus address both informational and motivational aspects.

Despite expectations, no statistically significant association was observed between KAP adequacy and family history of diabetes, previous hospitalization, disease duration, or frequency of hypoglycemia (Table 4). These findings may reflect a gap between exposure to diabetes (e.g., through family or years of living with the disease) and actual engagement in self-care. Similar trends were reported by Krishnan & Thirunavukkarasu, who found that even among patients with long-standing diabetes or affected family members, KAP levels remained suboptimal unless structured education had been provided. These results call for universal diabetes education rather than selective targeting based on disease duration or family background.

While 69.4% of participants had been taught SMBG at least once, gaps in proper technique were evident—79% used the same finger, and only 62.4% recorded results consistently (Table 5). This suggests incomplete or unsustained training. The literature emphasizes the central role of family physicians in bridging these gaps through repeated, context-sensitive counseling. As front-line healthcare providers, family physicians are ideally positioned to reinforce correct SMBG behaviors, adjust education to patient literacy levels, and provide behavioral

support during routine visits, according to **Karter et al. [22]**.

Conclusion: This study revealed that a significant proportion of T1DM patients had inadequate knowledge, attitude, and practice (KAP) regarding SMBG. Poor glycemic control was strongly associated with lower KAP scores. Socioeconomic factors, particularly income level and financial burden, emerged as important predictors of self-care behavior. These findings highlight the need for structured education, ongoing physician support, and strategies to improve accessibility to SMBG tools.

Recommendations: To improve SMBG among type 1 diabetic patients, structured and recurrent education should be integrated into primary care visits. Educational efforts must be practical, personalized, and culturally appropriate. Expanding access to affordable SMBG supplies, especially for low-income patients, is essential. Engaging family members in the educational process and training healthcare providers in effective counseling techniques can further enhance self-care practices.

Limitations: This study was limited by its single-center setting and cross-sectional design, which restricts the generalizability and causal interpretation of findings. Additionally, reliance on self-reported data may have introduced recall or social desirability bias. The narrow age range of participants also limits applicability to younger or older populations.

Conflict of interest: None

Financial disclosures: None.

REFERENCE

1. American Diabetes Association. Classification and diagnosis of diabetes: Standards of medical care in diabetes—2022. Diabetes Care. 2022;45(Suppl 1):S17–38.

2. International Diabetes Federation. IDF Diabetes Atlas (10th ed.). Brussels: Int Diabetes Fed. 2021.

3. Ministry of Health and Population [Egypt], El-Zanaty and Associates, & ICF International. (2015). *Egypt Demographic and Health Survey 2014*. Cairo, Egypt, and Rockville, Maryland, USA: Ministry of Health and Population and ICF International.

4. Pickup JC, Freeman SC. Self-monitoring of blood glucose in type 1 diabetes: A meta-analysis. BMJ. 2020;371:m3484.

5. Bergenstal RM, Tamborlane WV, Ahmann A, Buse JB, Dailey G, Davis SN. Effectiveness of sensor-augmented insulin-pump therapy in type 1 diabetes. N Engl J Med. 2016;363(4):311–20.

6. Shrivastava, S. R., Shrivastava, P. S., & Ramasamy, J. (2013). Role of self-care in management of diabetes mellitus. *Journal of Diabetes & Metabolic Disorders*, 12(1), 14..

7. Krishnan M, Thirunavukkarasu R. A study on knowledge, attitude and practice of self-monitoring of blood glucose among diabetic patients. Int J Community Med Public Health. 2016;3(5):1151–6.

8. Grunberger G, Abelseth J, Bailey T, Blevins T, Bode B, Handelsman Y. Consensus statement on the use of continuous glucose monitoring. Endocr Pract. 2020;26(9):1076–89.

9. Sunaert P, Vandekerckhove M, Van Hecke A, De Maeseneer J, Devroey D, Willems S. Implementation of type 2 diabetes guidelines in primary care. Br J Gen Pract. 2011;61(585):e528–32.

10. OpenEpi. Open Source Epidemiologic Statistics for Public Health. 2024. http://www.openepi.com

11. Fahmy, S. I., & El-Sherbini, A. F. (1983). Determining simple parameters for social classifications for health research. Bulletin of the High Institute of Public Health, 13(5), 95–107.

12. AbouElmagd E, Abdelrahman A, Soliman A. Knowledge, attitude, and practice of diabetic patients towards self-monitoring of blood glucose. Egypt J Hosp Med. 2018;70(7):1169–74.

13. Balfe M, Doyle F, Smith D, Morrison T, O'Connell A, Brugha R. What's distressing about having type 1 diabetes? A qualitative study. BMC Endocr Disord. 2013;13:25.

18. Elnour AA, Alagib AE, Elsheikh AA. Parental knowledge and practice in children with diabetes in Sudan. Sudan J Paediatr. 2016;16(1):45–51.

15. El-Sayed NA, Al-Domi HA, Abdelrahman HM, Alwan A, Zidan M, Khamis N. Barriers to effective diabetes self-care in Egypt: a multicenter study. Diabetes Res Clin Pract. 2015;110(1):e21–2.

16. Al-Khaldi YM, Al-Sharif AI, Al-Ghamdi H. Knowledge and practices of patients with diabetes mellitus in Abha, Saudi Arabia. East Mediterr Health J. 2013;19(11):1014–21.

17. Nathan, D. M., Zinman, B., Cleary, P. A., Backlund, J. Y. C., Genuth, S., Lachin, J. M., Orchard, T. J., & DCCT/EDIC Research Group. (2009). Modern-day clinical course of type 1 diabetes mellitus after 30 years' duration: The Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications and Pittsburgh Epidemiology of Diabetes Complications Experience. Archives of Internal Medicine, 169(14), 1307–1316..

18. Battelino, T., Danne, T., Bergenstal, R. M., Amiel, S. A., Beck, R., Biester, T., ... & Phillip, M. (2019). Clinical targets for continuous glucose monitoring data interpretation: Recommendations from the International Consensus on Time in Range. Diabetes Care, 42(8), 1593–1603..

19. Shulman, R., Cohen, M., Osborn, M., & Edginton, T. (2020). The impact of type 1 diabetes on academic performance: A population-based study. Pediatric Diabetes, 21(6), 1073–1081.
20. Gallen IW, Hume C, Lumb A. Fuelling the athlete with type 1 diabetes. Diabet Med. 2011;28(7):740–6.
21. Fisher L, Glasgow RE, Strycker LA. Diabetes distress, depression, and glycemic control in type 2 diabetes. Diabetes Care. 2010;33(5):1034–6.
22. Karter, A. J., Parker, M. M., Moffet, H. H., Gilliam, L. K., & Dlott, R. (2018). Association of patient-level factors with self-monitoring of blood glucose: Findings from a large, diverse population with diabetes. Diabetes Care,41(3),623–631..

Citation

Nagah, M., Rashad, N., Bahgat, S., Frere, N. Knowledge, Attitude, and Practice Toward Self-Monitoring of Blood Glucose Among Patients with Type 1 Diabetes: A Descriptive Study. Zagazig University Medical Journal, 2025; (4701-4711): -. doi: 10.21608/zumj.2025.399502.4031