ORIGINAL RESEARCH

Self-Monitoring of Blood Glucose for Gestational Diabetes Mellitus: A Nationwide Survey of Perspectives and Clinical Practices among Clinicians in India

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ABSTRACT

Background and aim: Self-monitoring of blood glucose (SMBG) is an essential part of gestational diabetes mellitus (GDM) management. However, there is still a lack of adherence to SMBG in India, and it is unclear how actual clinician practices affect its uptake. This study evaluated the knowledge, attitudes, and practices of gynecologists and endocrinologists/diabetologists in India towards SMBG. **Methods:** A cross-sectional, digital knowledge, attitude, and practice (KAP) survey was conducted from May to July 2025 among 588 clinicians (311 endocrinologists/diabetologists and 277 gynecologists). Two validated, structured questionnaires captured awareness of guideline recommendations, attitudes toward SMBG, perceived patient barriers, and routine clinical practices. Responses were summarized using descriptive statistics. **Results:** A strong adherence to national guidelines was shown by both gynecologists and endocrinologists/diabetologists. Gynecologists identified patient noncompliance and lack of motivation, psychological resistance, and discomfort from repeated finger pricks as major obstacles, while endocrinologists emphasized on cost associated with glucose monitoring devices and strips, lack of acceptance, and limited knowledge on SMBG techniques. SMBG was widely recommended for insulin-treated GDM, but attitudes toward its role in lifestyle-controlled GDM varied. Although postpartum follow-up and referral patterns remained uneven, the majority of clinicians concurred that SMBG supports timely therapy decisions. **Conclusion:** Initiating SMBG at the level of gynecologists itself promotes earlier glycemic stabilization, which is essential for improving perinatal outcomes and reducing the burden of future diabetes and metabolic complications.

Keywords: Gestational diabetes mellitus, self-monitoring of blood glucose, KAP survey, clinical practice patterns, India

Gestational diabetes mellitus (GDM), a form of hyperglycemia that develops during pregnancy, posing significant risks to the mother and fetus, is increasing in prevalence globally[1]. According to International Diabetes Federation (IDF) data, in 2024, approximately 23.0 million live births (15.6%) globally were affected by some form of hyperglycemia during pregnancy. Of these, 79.2% were due to GDM[2]. In India, the situation is no different. The pooled prevalence of GDM among pregnant women in India has been estimated at around 13%, as per a meta-analysis by Mantri et al[3].

GDM is associated with a higher likelihood of adverse pregnancy outcomes, including pre-eclampsia, preterm delivery, macrosomia, neonatal hypoglycemia, and shoulder dystocia. In addition, it can contribute to maternal psychological stress and elevate the long-term risk of developing type 2 diabetes mellitus (T2DM) and cardiovascular disease in the mother after pregnancy. The likelihood of progression to T2DM is influenced by maternal age, family history, glycemic status during pregnancy, and genetic susceptibility, all of which are nonmodifiable after delivery[4].

Adopting a healthy diet, engaging in regular physical activity, and monitoring of metabolic health are essential strategies for preventing the risk of T2DM in

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For access to the supplementary file, please visit https://ojs.ijcp.in/index.php/IJCP

women with a history of GDM. Importantly, the impact of GDM extends beyond the mother. Children exposed to GDM *in utero* are also at increased risk of developing T2DM and other metabolic disorders later in life. Early intervention in this population can reduce the risk of GDM and support better long-term health outcomes[5].

For decades, self-monitoring of blood glucose (SMBG) has been considered a cornerstone of adequate diabetes management. Structured SMBG can follow different monitoring patterns, and it results in improved glycemic control, reduced hypoglycemia, and a better quality of life of persons with diabetes[6]. In its latest guidelines on optimal glucose monitoring in diabetes mellitus, the Research Society for the Study of Diabetes in India (RSSDI) recommends that the SMBG procedure should be clearly explained to patients, who should then be regularly assessed and provided with appropriate feedback on its use[7].

SMBG remains the standard of care for glycemic monitoring in women with GDM. The goal is to provide timely and reliable glucose measurements so that adequate treatment can be implemented[8]. When integrated with comprehensive care including insulin therapy, nutritional counseling, and ongoing prenatal support from health care providers, it is generally associated with comparable or improved maternal and neonatal outcomes vis-à-vis conventional antenatal care[9].

Meal-based SMBG identifies postprandial glucose excursions and provides immediate feedback on dietary choices. In the absence of SMBG, medical nutrition therapy (MNT) receives little reinforcement, resulting in reduced adherence to the meal plan. For women requiring insulin to achieve glycemic targets, paired-meal SMBG offers essential guidance for therapy adjustments[10]. Although specific data of SMBG usage among women with GDM in India are limited[11], overall SMBG adoption remains extremely low, with past estimates suggesting usage as low as 0.2% among people with diabetes[12].

This highlights the importance of tailored education, accessible monitoring tools, and structured support systems to help GDM patients adhere to SMBG, as timely and effective glycemic control is vital for ensuring optimal outcomes[13]. This survey was undertaken to capture the perspectives of gynecologists and endocrinologists/diabetologists across India regarding the use of SMBG in the management of GDM. It focused on identifying barriers and enabling factors influencing its adoption in routine practice. By understanding these insights, the study aimed to address gaps in knowledge, attitudes, and practices (KAP) related to SMBG in the Indian context. The aim was to equip gynecologists with the evidence and practical guidance needed to initiate SMBG confidently at the time of GDM diagnosis.

METHODS

Study Design

This cross-sectional, digital KAP survey was conducted from May 01, 2025 to July 31, 2025 with endocrinologists/diabetologists and gynecologists across India. The survey did not involve the collection of any patient-related data, and therefore ethics committee approval was not required or sought.

Participants

Eligible participants were practicing physicians from all over India with recognized medical qualifications in endocrinology/diabetology or gynecology, and were actively involved in the management of patients with GDM. Participants were selected using systematic random sampling from the invitation list.

These specialties were specifically chosen to ensure representation of both key perspectives in GDM care: endocrinologists/diabetologists, who play a central role in the diagnosis and management of diabetes, and gynecologists, who are directly responsible for the care of pregnant women with GDM. Over 2,000 doctors were invited for participation in the survey through a combination of digital invitations and direct professional engagement.

Survey Design

Two structured questionnaires were designed with 15 questions for endocrinologists/diabetologists and 18 questions for gynecologists.

The questionnaires were developed based on existing literature and underwent multiple rounds of review and refinement by the research team. They were first reviewed and validated by a panel of experts to ensure their clarity and relevance before being shared with the survey participants.

- The endocrinologist/diabetologist questionnaire focused on awareness of Diabetes in Pregnancy Study Group India (DIPSI)[14], RSSDI[7], and Non-communicable Diseases (NCD) program [introduced across selected districts and states in India with the objective of preventing and controlling major NCDs[15]], use of SMBG and continuous glucose monitoring (CGM), reliance on monitoring data for therapy adjustments, barriers to SMBG, and postpartum follow-up.

- The gynecologist questionnaire addressed knowledge of guideline-recommended testing, confidence in recommending SMBG, patient engagement, referral practices, challenges in SMBG adherence, and postpartum monitoring.
- Both questionnaires included multiple-choice and Likert-scale questions and responses were collected digitally for subsequent analysis.

Data Analysis

All responses were collected digitally, compiled, and analyzed using descriptive statistics. Data were examined separately for endocrinologists/diabetologists and gynecologists to compare KAP patterns. Results were summarized as frequency distributions and percentages to highlight trends in guideline awareness, attitudes toward SMBG, and clinical practices in GDM management.

RESULTS

Demographics

A total of 588 doctors participated, including 311 endocrinologists/diabetologists and 277 gynecologists. The participant pool exhibited a broad geographic distribution across 24 Indian states. The majority of the endocrinologists/diabetologists were based in urban centers (56.9%), while 27.3% practiced in semi-urban regions and 15.8% in rural or small-town settings.

Most gynecologists were from urban areas (59.6%), followed by rural or small towns (24.5%); 15.9% of them were based in semi-urban regions.

Knowledge

Endocrinologists/Diabetologists

Among the endocrinologists/diabetologists surveyed, knowledge of specific national guidelines (DIPSI and RSSDI) related to GDM and SMBG varied across key areas.

A majority of respondents (58.2%) identified the increased risk of developing diabetes within 5 to 10 years as the key reason for maintaining long-term glycemic control in women with GDM; followed by prevention of hypertension in future pregnancies (37.3%), while 2.3% each cited minimal long-term effects of GDM or avoidance of insulin use in subsequent pregnancies.

Endocrinologists/diabetologists reported that cultural beliefs about medication (38.3%) were the most common reason for nonadherence to SMBG and self-care among rural T2DM patients, followed by limited knowledge and inadequate community-based education (32.8%) and lack of access to insulin (26.0%); only 2.9% attributed it to the unavailability of glucose meters.

Nearly half (47.9%) believed that SMBG intensity and frequency should be adjusted based on age and gender, while 28.3% recommended a case-by-case approach depending on glycemic control and therapy type, 20.9% supported uniform monitoring for all patients, and 2.9% restricted it to insulin-treated individuals.

For postpartum follow-up testing in women with GDM, 57.2% reported it should be done at 3 months, 34.4% at 6 weeks post-delivery, 8.0% only if hyperglycemic symptoms appear, and 0.3% indicated no follow-up was required.

Regarding DIPSI recommendations for glucose testing during pregnancy, 54.3% stated that the testing should be conducted only between 24 and 28 weeks of gestation, 37.0% suggested testing at multiple time points (before 12 weeks, at 24-28 weeks, and at 32-34 weeks if required), while 4.8% and 3.9% recommended testing after 28 weeks if symptomatic or once during the third trimester, respectively (Table 1).

Gynecologists

Knowledge of national guidelines among gynecologists was generally consistent across multiple domains related to GDM and SMBG.

Most respondents (91.3%) stated that, as per DIPSI guidelines, blood glucose testing during pregnancy should be performed before 12 weeks, at 24 to 28 weeks, and at 32 to 34 weeks if required, while 8.3% recommended testing only between 24 and 28 weeks, and 0.4% advised a single test in the third trimester.

Similarly, 95.0% indicated that postpartum follow-up for women with GDM, under the NCD program, should occur at 6 weeks after delivery, whereas 2.5% each suggested testing at 3 months or only if hyperglycemic symptoms appear.

Regarding SMBG in women managed with lifestyle interventions, 82.0% reported its primary role as identifying postprandial spikes and guiding dietary adjustments, while 6.9%, 5.8%, and 5.4% believed it delays pharmacologic intervention, replaces antenatal visits, or has no significant role, respectively.

Nearly all respondents (94.2%) indicated that, per RSSDI and DIPSI guidelines, the ideal SMBG pattern for GDM patients on intensive insulin therapy is 7-point monitoring, which includes pre-meal, 2-hour post-meal, and bedtime glucose checks.

Table 1. Knowledge of Endocrinologists/Diabetologists Regarding Gestational Diabetes Management and SMBG Recommendations

Question	Ideal Response	Percentage (%)
Why is long-term glycemic control important in GDM women as per DIPSI guidelines?	Increased risk of developing diabetes in the next 5-10 years	58.2
Why are rural T2DM patients in India often nonadherent to SMBG and self-care?	Limited knowledge and insufficient community-based education	32.8
According to RSSDI recommendations, what should SMBG intensity and frequency be?	Tailored case-by-case, depending on glycemic control and therapy type	28.3
As per the NCD program, when is postpartum follow-up testing advised for women diagnosed with GDM?	At 6 weeks after delivery to assess glycemic status	34.4
According to DIPSI guidelines, when is blood glucose testing recommended during pregnancy?	Before 12 weeks, at 24-28 weeks, and at 32-34 weeks if required	37.0

GDM = Gestational diabetes mellitus; DIPSI = Diabetes in Pregnancy Study Group India; T2DM = Type 2 diabetes mellitus; SMBG = Self-monitoring of blood glucose; RSSDI = Research Society for the Study of Diabetes in India; NCD = Noncommunicable diseases.

Table 2. Knowledge of Gynecologists Regarding Gestational Diabetes and SMBG Practices

Question	Ideal Response	Percentage (%)
According to DIPSI guidelines, when is blood glucose testing recommended during pregnancy?	Before 12 weeks, at 24-28 weeks, and at 32-34 weeks if required	91.3
As per the NCD program, when is postpartum follow-up testing advised for women diagnosed with GDM?	At 6 weeks after delivery to assess glycemic status	95.0
In women with GDM managed through lifestyle interventions, how can SMBG contribute to glycemic control?	By identifying postprandial spikes and guiding dietary adjustments	82.0
As per the RSSDI and DIPSI guidelines, what is the ideal SMBG pattern recommended for GDM patients on intensive insulin therapy?	7-point testing including pre-meal, 2-hour post-meal, and bedtime glucose levels	94.2
If seven daily SMBG tests are not feasible for GDM patients on insulin, what is an acceptable alternative on intensive insulin therapy?	One fasting test and three tests after breakfast, lunch, and dinner	84.1

DIPSI = Diabetes in Pregnancy Study Group India; NCD = Noncommunicable diseases; GDM = Gestational diabetes mellitus; SMBG = Self-monitoring of blood glucose; RSSDI = Research Society for the Study of Diabetes in India.

When daily 7-point SMBG was not feasible, 84.1% considered one fasting and three postprandial tests (after breakfast, lunch, and dinner) as an acceptable alternative, whereas 10.1% suggested one test in the morning and one before dinner, 3.3% one test every 2 days, and 2.5% two random tests per week (Table 2).

Attitudes

Endocrinologists/Diabetologists

Most endocrinologists/diabetologists acknowledged the clinical relevance of SMBG in GDM, although attitudes were mixed. The cumulative survey findings suggest a generally positive perception toward early SMBG use in GDM, with 52% of endocrinologists agreeing that it improves maternal and fetal outcomes. A similar cumulative proportion (55.4%) supported empowering gynecologists to initiate SMBG before endocrinology referral, indicating a generally positive perception toward early glucose monitoring.

Overall, 55.3% of endocrinologists were likely to recommend SMBG even for patients well-controlled on lifestyle modification alone, while 42.4% remained neutral. Most participants (68.8%) considered SMBG data along with glycated hemoglobin (HbA1c) for therapeutic adjustments, with very few preferring CGM system (CGMS) or rarely using SMBG results in practice (Table 3).

Table 3. Attitudes of Endocrinologists/Diabetologists Toward SMBG in the Management of Gestational Diabetes

Question	Response	Percentage (%)
Do you believe that SMBG can lead to better maternal and fetal outcomes when initiated early in the course of GDM?	Strongly agree	25
	Agree	27
	Neutral	48
	Disagree	0
	Strongly disagree	0
Would you support the idea of empowering gynecologists to initiate SMBG in GDM patients before referral to endocrinologists?	Strongly support	23.4
	Somewhat support	32
	Neutral	43
	Do not support	1.6
	Strongly oppose	0
How likely are you to recommend SMBG to a GDM patient who is well-controlled on lifestyle modification alone?	Very likely	20.9
	Likely	34.4
	Neutral	42.4
	Unlikely	2.3
	Very unlikely	0
How much do you rely on SMBG data (versus HbA1c or CGMS) to make therapeutic adjustments in your GDM patients?	Heavily rely on SMBG data	15.4
	Consider SMBG along with HbA1c	68.8
	Prefer CGMS over SMBG	13.8
	Rarely use SMBG for decision-making	1
	Do not use SMBG data in routine practice	1

SMBG = Self-monitoring of blood glucose; GDM = Gestational diabetes mellitus; HbA1c = Glycated hemoglobin; CGMS = Continuous glucose monitoring system.

Gynecologists

Gynecologists gave opinions on questions like influence of SMBG on patients, discomfort due to finger pricking, recommending SMBG as essential part of GDM management, patient engagement, and adherence in SMBG (Table 4). The cumulative responses indicated that 80% of clinicians felt SMBG improves patient awareness and engagement in managing GDM, while only 7% believed its impact is limited without counseling. Most respondents (61%) observed initial hesitation due to finger-prick discomfort, but noted that patients generally adapt over time; only 14% felt it significantly reduces willingness to perform SMBG.

Confidence in recommending SMBG was high, with 95% of clinicians being very or somewhat confident in its role in GDM management. In terms of patient engagement, the majority (95%) perceived patients as highly or somewhat engaged when SMBG is part of their treatment plan. To promote adherence, nearly 80% of clinicians reported proactively educating and guiding patients, whereas only a small fraction emphasized SMBG selectively or did not prioritize it.

Practices

Endocrinologists/Diabetologists

Over half (52.4%) of the endocrinologists/diabetologists reported managing an average of 26 to 50 GDM patients every month. For patients on lifestyle modifications only, majority (45.3%) recommended one fasting blood glucose (FBG) and one postprandial measurement per week.

For patients on insulin or oral antidiabetic drug (OAD) therapy, 51% recommended four SMBG measurements daily (FBG and three postprandial readings).

Commonly reported challenges with SMBG in GDM patients included the cost of devices and consumables (34.1%) and patient-related factors such as low motivation, limited acceptance, or difficulty sustaining routine monitoring (28.6%). Most clinicians reported that a substantial proportion of their GDM patients continued to have diabetes postpartum, with 42.8% estimating that 51%-75% had persistent diabetes, followed by 35.0% who reported 26%-50% (Table 5).

Responses from endocrinologists/diabetologists selecting "Other" have been provided in the supplementary file.

Table 4. Attitudes of Gynecologists Toward SMBG in Gestational Diabetes Management

Question	Response	Percentage (%)
In your opinion, how does SMBG influence patients with GDM in managing gestational diabetes?	Improves awareness and engagement	80
	Helps somewhat with support	9
	Limited impact without counseling	7
	Unsure of its influence	4
How does the discomfort from finger-pricking affect a pregnant woman's willingness to perform SMBG regularly?	Hesitation initially, adapts over time	61
	Discomfort is manageable, no effect on frequency	13
	Significantly reduces willingness	14
	No impact on SMBG adherence	12
How confident are you in recommending SMBG as an essential part of managing gestational diabetes in your patients?	Very confident	72
	Somewhat confident	23
	Not very confident	1
	I do not routinely recommend SMBG in GDM management	4
How do you feel about the level of patient engagement in SMBG for GDM when it is part of the treatment plan?	Patients are highly engaged and motivated	37
	Somewhat engaged, need support	58
	Low engagement due to inconvenience	4
	Poor engagement and adherence	1
How do you encourage SMBG adherence in GDM patients?	Educate and guide proactively	79.8
	Inform benefits, let them decide	10.5
	Emphasize only if control is poor	7.2
	Do not prioritize SMBG for most	2.5

SMBG = Self-monitoring of blood glucose; GDM = Gestational diabetes mellitus.

Responses to the final question on recommended postpartum blood glucose monitoring in GDM patients are detailed in the supplementary table. Among the 311 respondents, 21% favored individualized follow-up, 11% recommended testing at 6 weeks postpartum, and the remaining participants either suggested other intervals or did not respond, highlighting notable variability in clinical practice.

Gynecologists

Nearly half of the gynecologists (47.7%) reported managing fewer than 10 GDM patients per month (Table 6).

The responses showed varying referral practices for GDM patients. About 30.3% referred at the time of diagnosis, 31.4% referred after failure of MNT and lifestyle modifications, 20.2% referred once insulin therapy was required, while 18.1% managed patients independently without referral.

SMBG frequency recommendations mirrored guideline-concordant practices (RSSDI and DIPSI[7,14]): 53.1% advised one FBG and three postprandial readings at least once weekly for lifestyle-managed patients, and 43.7% recommended four daily SMBG measurements for patients on insulin or OADs.

Major barriers to SMBG were patient noncompliance or lack of motivation (34.3%) and psychological resistance or anxiety (20.9%).

Most gynecologists (66.1%) observed that ≤25% of their GDM patients progressed to T2DM postpartum, while 30.3% reported progression in 26%-50% of cases.

Responses from gynecologists selecting "Other" and to the final question on recommended frequency and method for postpartum glucose monitoring in prior GDM patients have been provided in the supplementary file.

Among the 277 respondents, 42% recommended an oral glucose tolerance test (OGTT) at 6 to 12 weeks postpartum, 15% suggested HbA1c every 6 months, 6% chose OGTT at 6 weeks, 3% preferred HbA1c every 3 months, 3% recommended non-specific testing at 6 weeks postpartum, and smaller proportions suggested yearly (1%) or a single 12-week test (<1%), reflecting variation in postpartum monitoring practices.

Table 5. Practices and Perceived Challenges of Endocrinologists/Diabetologists in Managing GDM and Implementing SMBG

Question	Response	Percentage (%)
Approximately how many GDM patients do you manage in your outpatient department on a monthly basis?	Less than 10	12.9
	10-25	33
	26-50	52.4
	More than 50	1.9
For GDM patients managed with lifestyle modifications only, how frequently do you recommend SMBG?	One FBG and three postprandial values at least once a week	38.3
	One FBG and one postprandial value per week	45.3
	One FBG per week	13.8
	Other	2.6
For GDM patients on insulin therapy or OADs, how frequently do you recommend SMBG?	Four times per day (FBG and three postprandial values)	51
	Paired testing daily (e.g., pre- and post-breakfast on day 1, pre- and post-lunch on day 2, pre- and post-dinner on day 3, repeating the cycle)	36
	One FBG and one postprandial value per day	9
	Other	4
Challenges in SMBG: What challenges do you encounter with SMBG in GDM patients?	Cost associated with blood glucose monitoring devices and strips	34.1
	Patient noncompliance or lack of motivation/acceptance	28.6
	Limited patient education on self-monitoring techniques	19
	Pain associated with finger pricking	4.8
	Lack of follow-up	1.3
	Limited access to CGM technology	1.9
	Other	10.3
Approximately what percentage of your GDM patients continue to have diabetes postpartum?	0%-25%	21.9
	26%-50%	35
	51%-75%	42.8
	76%-100%	0.3

GDM = Gestational diabetes mellitus; SMBG = Self-monitoring of blood glucose; FBG = Fasting blood glucose; OAD = Oral antidiabetic drug; CGM = Continuous glucose monitoring.

Table 6. Practices and Perceived Challenges of Gynecologists in Managing GDM and Implementing SMBG

Question	Response	Percentage (%)
Approximately how many GDM patients do you manage in your outpatient department monthly?	Less than 10	47.7
	10-25	43.3
	26-50	8.7
	More than 50	0.3
At what stage do you typically refer GDM patients to an endocrinologist or diabetologist?	At the time of diagnosis	30.3
	After MNT and lifestyle modifications prove ineffective	31.4
	Once the patient requires insulin therapy	20.2
	I manage GDM patients independently without referral	18.1
Approximately what percentage of your GDM patients do you refer for co-management with an endocrinologist/diabetologist?	0%-25%	51.3
	26%-50%	28.5
	51%-75%	7.9
	>75%	12.3

Table 6. Practices and Perceived Challenges of Gynecologists in Managing GDM and Implementing SMBG

Question	Response	Percentage (%)
For GDM patients managed with lifestyle modification only, how frequently do you recommend SMBG?	One FBG and three postprandial readings at least once a week	53.1
	One FBG and one postprandial value per week	28.2
	One FBG per week	7.9
	Others	10.8
For GDM patients on insulin or OADs, how frequently do you recommend SMBG?	Four times daily (FBG and three postprandial values)	43.7
	Paired testing (e.g., pre- and postprandial testing in a rotational meal pattern)	24.9
	One FBG and one postprandial value per day	20.9
	Other	10.5
Challenges in implementing SMBG: What are the major barriers to regular SMBG in your GDM patients?	Patient noncompliance or lack of motivation	34.3
	Psychological resistance or anxiety towards monitoring	20.9
	Pain or discomfort from repeated finger pricks	17.3
	Insufficient patient education on testing technique	13.7
	Cost of monitoring devices and consumables	6.9
	Other (please specify)	5.4
	None	1.5
Approximately what percentage of your GDM patients show persistence or progression to type 2 diabetes postpartum?	0%-25%	66.1
	26%-50%	30.3
	51%-75%	3.3
	76%-100%	0.3

GDM = Gestational diabetes mellitus; MNT = Medical nutrition therapy; SMBG = Self-monitoring of blood glucose; FBG = Fasting blood glucose; OAD = Oral antidiabetic drugs.

DISCUSSION

This survey showed different levels of awareness about specific GDM guidelines, such as RSSDI and DIPSI, among the respondents. The demographic profile of the participants, mainly urban practitioners, reflected the distribution of specialized diabetes and obstetric care services in India.

Urban centers usually have better diagnostic infrastructure, easier access to SMBG devices, and more organized diabetes care programs. Because of this, endocrinologists/diabetologists and gynecologists in these areas are more involved in managing GDM and more likely to teach patients about self-care practices. It was important to include strong urban representation to capture informed perspectives on SMBG awareness, use, and attitudes. At the same time, having practitioners from semi-urban and rural areas helped provide a fuller understanding of regional differences, resource limitations, and real-world challenges in implementation. This balanced inclusion improved the representativeness of the KAP findings and their relevance to everyday clinical settings across different levels of the health care system.

About 33% endocrinologists/diabetologists felt that limited knowledge and insufficient community-based education was the reason for nonadherence to SMBG among rural Indian GDM patients. They also pointed to cultural barriers as another reason for nonadherence among the rural GDM patients. This accounted for 38.3% of their responses. Health literacy is shaped by cultural, social, and family factors, which influence how people view and approach health[16]. An Indian survey by Gupta et al found that while patients understood the importance of lifestyle modifications and taking medication as prescribed, they lacked knowledge about regular glucose monitoring, foot care, and managing stress. Many believed in herbal treatments and followed unhealthy eating habits, while also holding onto myths about T2DM[17].

For postpartum follow-up, the Indian NCD program specifies 6 weeks[14]. However, responses from endocrinologists/diabetologists showed a different pattern. A common response among these specialists was 3 months. This timing closely matches the 4- to 12-week window recommended by major international bodies. These include the International Federation

of Gynecology and Obstetrics (FIGO), the American Diabetes Association (ADA), and the American College of Obstetricians and Gynecologists (ACOG)[18-20]. This deviation from the national protocol may stem from a stronger emphasis on broader international standards among endocrinologists/diabetologists. Meanwhile, 94.9% gynecologists knew about the recommendation of the NCD program for postpartum follow-up at 6 weeks[14].

For antenatal screening, many endocrinologists/diabetologists chose only the 24- to 28-week window. While the comprehensive DIPSI protocol recommends a multistep approach (before 12 weeks, at 24-28 weeks, and if needed, at 32-34 weeks)[14], focusing on the 24 to 28 weeks aligns with the most widely recognized screening period in global guidelines[19-21]. These response patterns imply that the differences observed are likely affected by the unique characteristics of the clinical roles and possibly the main guidelines each specialty follows.

Gynecologists play a key role in routine antenatal screening. They encourage strong adherence to national protocols, like DIPSI. In contrast, endocrinologists/diabetologists, who focus on managing T2DM, often base their decisions on broader international guidelines, rather than Indian recommendations. Their approach tends to emphasize personalized, case-based management suited to complicated metabolic conditions. Therefore, we need to improve coordination between these specialties through better collaboration and wider sharing of national guidelines. It is important to reinforce the importance of India-specific protocols, even when they differ from global recommendations, to ensure consistent care.

The survey showed varied views among endocrinologists/diabetologists on the role of SMBG in GDM. A majority of respondents (52%) agreed that early SMBG leads to better outcomes. However, a significant number of neutral responses (48%) indicate that this belief is tempered by practical challenges. This neutrality likely does not stem from a lack of belief, but from recognition of serious implementation barriers. These barriers can include systemic issues like limited access to glucometers and test strips, especially in rural areas, as well as patient-specific challenges such as financial limitations and varying levels of health literacy[22].

A strong agreement with national recommendations for GDM was seen among gynecologists. Most respondents, 91.3%, correctly identified the DIPSI antenatal glucose testing schedule[14]. Their knowledge of SMBG monitoring protocols was also impressive, with 94.3% recognizing the ideal 7-point testing pattern as recommended by DIPSI, particularly for GDM patients on intensive insulin therapy[14].

For the opinion on empowering gynecologists to initiate SMBG, though a majority (55.4%) supported the idea, the substantial neutral cohort (43%) may have harbored concerns about the lack of standardized training and protocols and limited role of gynecologists in monitoring blood glucose levels in early pregnancy[23]. However, this perception may not align with the current realities of antenatal care, which actually strengthen the case for gynecologist-led SMBG. This was shown by Bhavadharini et al, where obstetricians conducted most screenings at 12 weeks. Endocrinologists/diabetologists typically have limited access to women in the early stages of pregnancy and understandably reported minimal involvement in screening at 12 weeks. In contrast, obstetricians were primarily responsible for early screening, employing a range of methods such as fasting plasma glucose (FPG), HbA1c, random blood glucose, and OGTTs[24]. Therefore, the premise that gynecologists/obstetricians are well-positioned to initiate SMBG is strongly supported.

A similar split was seen in the recommendation of SMBG for GDM patients who maintain control through lifestyle changes alone. About 55.3% were likely or very likely to recommend it, while 42.4% were neutral. This division shows an ongoing debate in the clinical community. Supporters argue that SMBG empowers patients and offers an early warning for worsening glycemic control. On the other hand, those who are neutral may base their position on a lack of clear evidence proving SMBG's benefits in this low-risk group. Some studies on SMBG have not demonstrated a clear clinical benefit[11,25]. Among gynecologists a clear majority (53.1%) recommend a comprehensive weekly schedule of one FBG and three postprandial readings, which emphasizes the importance of postprandial glucose levels, a key target for MNT in GDM management[26,27].

For patients on insulin or OADs, the majority of endocrinologists/diabetologists recommended a frequency of 4 times daily, while many favored daily paired testing (preprandial and 2-hour postprandial)[28]. International guidelines recommend both; ACOG[20] recommends 4 times/day testing, and the National Institute for Health and Care Excellence United Kingdom (NICE UK)[29] guideline recommends daily testing, both fasting and after meals, and the 4-point glucose monitoring is recommended by World Health Organization (WHO)[30]. Gynecologists (43.7%) supported the guideline-recommended schedule of four tests daily, which includes one

FBG and three postprandial values[7,15]. This intensive monitoring is crucial for precise medication adjustment and maintaining tight glycemic control. Around 24.9% gynecologists used paired testing (rotating pre- and post-meal testing) as an alternative method for gathering glycemic data.

Regarding the clinical use of glycemic data, the findings show a clear preference for an integrated assessment model that combines SMBG and HbA1c measurement. The majority of endocrinologists/diabetologists (68.8%) use SMBG data alongside HbA1c, relying on SMBG for real-time insights into glycemic fluctuations and using HbA1c for a long-term view. A smaller but significant group (15.4%) depended heavily on SMBG alone. This is a valid approach due to the known limitations of HbA1c during pregnancy, such as changes in red blood cell turnover[31], which can affect its accuracy.

On the other hand, 13.8% preferred CGMS, recognizing its advantage in providing detailed glycemic profiles. However, its wider use is hindered by practical issues, mainly cost and accessibility[7], along with a lack of data[19] that prevents it from becoming the standard of care in routine clinical practice. While several clinical trials have shown that CGMS during pregnancy improves metabolic control and reduces the risk of macrosomia compared to SMBG alone, other studies have found no significant differences in glucose levels or adverse pregnancy outcomes between the two monitoring methods. As a result, there is no consensus on the best use, timing, and frequency of CGM in managing GDM[32].

Among practice questions, endocrinologists/diabetologists reported managing a large number of GDM cases. Most of them see 26 to 50 patients each month. The next largest group handles 10 to 25 patients per month. This situation shows the high prevalence of GDM in India[33]. India is facing a growing burden of GDM, with prevalence estimates between 7.7% and 21.6%. Factors like rapid urbanization, changing lifestyles, and rising obesity among women of reproductive age contribute to this trend[34].

For women treated with lifestyle changes, the most common recommendation for SMBG was one fasting and one post-meal reading per week. This method, along with the next most common advice of one fasting and three post-meal readings weekly, seems to balance the need for good monitoring with patient concerns like cost and practicality. This matches the Indian Council of Medical Research (ICMR) guidelines, which suggest that SMBG frequency should be tailored to the individual, recommending more frequent monitoring during pregnancy[35].

For those on insulin or OADs, most endocrinologists/diabetologists recommended guideline-consistent 4-point daily SMBG, while a substantial proportion recommended paired or alternate-day testing as practical adaptations. These recommendations are consistent with the Federation of Obstetric and Gynecological Societies of India (FOGSI) guideline, which advises SMBG in women with GDM either 7 times daily, 3 to 4 times daily or, at a minimum, through paired pre- and post-meal testing each day[36].

More than half of the GDM patients managed by the endocrinologists/gynecologists continued to have diabetes after giving birth. A study by Jayapal et al, showed that at a median 3-year follow-up, 25.6% of women developed prediabetes and 16.9% progressed to T2DM, with ~1 in 6 women transitioning within 2 to 4 years[37]. About 30.3% of gynecologists reported a higher progression rate of 26%-50%, whereas 66.1% estimated that 0%-25% of patients developed T2DM.

While the estimates of gynecologists reflect their practice timelines, longitudinal Indian studies show a more pronounced risk. Mahalakshmi et al reported that among 174 of 898 women (19.3%) with follow-up OGTT, 58% developed T2DM and 5% impaired glucose tolerance postpartum, while 37% returned to normal. Of those progressing to T2DM, 56.3% did so within 5 years, 33.9% within 5 to 10 years, and 9% after 10 years, with over 90% converting within the first decade[38]. This highlights the need for ongoing postpartum screening and lifestyle management.

The understanding of the practical application of SMBG among gynecologists was robust. Majority (82.0%) correctly identified its role in detecting postprandial spikes to guide dietary adjustments in lifestyle-managed patients, which is a fundamental aspect of effective GDM care[39].

Furthermore, their knowledge extended to intensive management protocols, with 94.2% correctly identifying the ideal 7-point SMBG pattern for patients on insulin. Crucially, 84.1% also recognized the appropriate 4-point testing alternative when the intensive schedule is not feasible, demonstrating a clear understanding of adapting RSSDI and DIPSI guidelines to practical clinical scenarios[7,14].

An overwhelming majority (80%) of respondents believed that SMBG increases patient awareness and involvement in managing their GDM. This view matches findings from previous research. For example, studies have shown that SMBG helps women understand their blood glucose patterns, which encourages them to

take charge of their care and boosts their confidence in daily decisions. It may also lower health care costs[9]. A study in India noted that initial adherence might be low. However, it emphasized that educating and empowering patients can lead to better maternal and fetal outcomes[40]. Another study in India supports this, finding that education is essential for improving low SMBG adherence rates in this group[11].

When questioned about the impact of discomfort from finger-pricking, the predominant view (61%) was that while patients may show initial hesitation, they generally adapt over time. This finding is consistent with an Indian study, which identified pain and discomfort as common initial barriers, but noted that adherence improves significantly with proper education[11].

Confidence in recommending SMBG was notably high, with a significant majority (73%) of gynecologists reporting they were "very confident" in its role as an essential component of GDM management. This high level of confidence is likely underpinned by strong endorsements from national and international guidelines, including the RSSDI Expert Consensus (2024), and the ADA Standards of Care (2025), which clearly advocate for SMBG in GDM management[7,19].

Regarding patient engagement, the responses were divided. A majority (58%) felt patients were "somewhat engaged" and required support, while a substantial proportion (37%) observed that patients were "highly engaged and motivated". This variability may reflect the well-documented sociodemographic differences in health literacy, particularly between urban and rural patients. It is plausible that urban and semi-urban women, who may have greater access to information, access to glucometers and a higher level of education regarding GDM risks, are generally more proactive.

For example, one Indian study highlighted this disparity, finding that rural women had significantly lower awareness of the long-term risks of GDM such as progression to T2DM and effects on their children, with only 21% aware that untreated GDM increases risks for the baby and just 15% recognized the susceptibility of the mother to developing overt diabetes[41]. In terms of strategies to encourage adherence, a heartening response was observed with an overwhelming 80% of gynecologists reporting that they "educate and guide patients proactively". For a subset of gynecologists, practical barriers likely hinder the routine implementation of SMBG. These barriers can include limited resources and costs for both patients and clinics, making frequent monitoring difficult, especially in rural or lower-income areas.

High patient volumes and time constraints in busy outpatient settings, along with a shortage of supporting staff in public hospitals, create significant challenges for health care providers. This situation limits their ability to offer thorough counseling and effective communication with pregnant women about GDM and SMBG[42].

Managing GDM effectively requires a teamwork approach that includes regular diabetes and obstetric assessments, along with patient education, lifestyle changes, and ongoing support[43]. While it is not practical to hospitalize every woman with GDM in areas with limited resources, successful management relies on coordinated care from a team.

Trained health care professionals are vital for accurate screening, diagnosis, and treatment. An ideal care team typically includes an obstetrician or endocrinologist/diabetologist, a health educator, a dietitian, and a neonatologist or pediatrician[44].

The data on referrals to endocrinologists/diabetologists shows two different clinical management approaches. Gynecologists are nearly equally divided between those who refer at the time of diagnosis (30.3%) and those who refer only after MNT and lifestyle changes do not work (31.4%).

- Proactive referral: The group that refers immediately upon diagnosis likely takes a proactive, risk-based approach. This strategy ensures early specialist intervention, which is crucial for achieving good glycemic control and preventing negative outcomes, especially in patients with high-risk factors or multiple health issues.
- Stepwise referral: Those who delay referrals until initial interventions fail are following a conventional stepwise management protocol. This approach, which is common in Indian practice, positions MNT and lifestyle changes as the first-line therapy[44], with specialist consultation reserved for cases requiring pharmacological intervention.

This dual approach is further clarified by the finding that the majority of gynecologists (51.3%) refer 25% or fewer GDM patients. This suggests a high degree of confidence in managing uncomplicated GDM independently, escalating care to a specialist only when necessary.

Endocrinologists/diabetologists identified major SMBG barriers as strip costs, patient noncompliance, and limited education[7]. Gynecologists highlighted patient-related factors over logistical or financial issues: noncompliance or lack of motivation (34.3%), psychological resistance or anxiety (20.9%), and pain or discomfort from finger pricks (17.3%). These align with broader SMBG

adherence literature, noting motivation, health literacy, and fear as primary obstacles. Other barriers included fear of needles, frustration over high readings, cost of strips/needles, and perception that SMBG is mainly for insulin titration[6,26,45]. Only 6.9% cited device/consumable costs, suggesting lesser impact.

STUDY LIMITATIONS

The use of a digital questionnaire may have introduced selection bias, favoring participation by clinicians who are more technologically engaged.

Reporting bias cannot be ruled out, with respondents providing answers that reflect guideline recommendations rather than their routine clinical practices. As the findings are based on self-reported data, they may be subject to recall and social desirability biases. Additionally, the sample may not fully represent regional variations or include perspectives from all health care provider groups beyond consulting gynecologists and endocrinologists/diabetologists.

The study did not stratify clinicians by urban, semi-urban, and rural practice settings, which may have limited the ability to identify context-specific differences in SMBG awareness, attitudes, and implementation challenges. Despite these limitations, the study offers an important initial understanding of health care professionals' perceptions of SMBG and self-care for GDM in India, highlighting the need for further research and focused interventions.

CONCLUSION

The survey revealed two specialty-specific approaches to GDM management in India. Gynecologists generally showed strong adherence to national guidelines (DIPSI, RSSDI), displayed confidence in SMBG, and reported patient noncompliance as a barrier. Endocrinologists/diabetologists followed international recommendations, leading to variations in SMBG frequency and follow-up, with decisions influenced by treatment costs and patient education gaps. Both groups, however, agreed on the importance of intensive SMBG for women with GDM needing pharmacological management.

Gynecologists are in a good position to initiate SMBG for pregnant women diagnosed with GDM because they are their first point of contact. At this level, patients who need advanced care can be referred to endocrinologists for comprehensive diabetes education and management. Empowering them can reduce missed windows of hyperglycemia, enabling earlier detection and timely intervention.

To support this shift, a combined national guideline jointly developed by DIPSI, RSSDI, Endocrinology Society of India (ESI), and related bodies is needed for uniform application across India.

Summary

This survey examined the knowledge, attitudes, and practices of Indian gynecologists and endocrinologists/diabetologists with regard to self-monitoring of blood glucose (SMBG). A total of 588 clinicians took part, offering insights on clinical management of gestational diabetes (GDM), patient engagement, SMBG adoption, and guideline awareness. Gynecologists showed confidence in the use of SMBG and identified patient noncompliance as the primary obstacle by largely following national recommendations. Due to treatment costs and gaps in patient education, endocrinologists/diabetologists adhered to more general international guidelines, which resulted in differences in SMBG frequency, follow-up, and therapy modifications. The significance of intensive SMBG in GDM patients in need of pharmaceutical interventions was stressed by both groups. Referral patterns differed; endocrinologists/diabetologists concentrated on complex management, while gynecologists frequently handled simple cases on their own. Access to monitoring tools, cultural beliefs, and patient motivation were identified as major obstacles. The results show that gynecologists can start SMBG early in pregnancy and refer patients to specialists for more advanced care, which would support prompt intervention and better outcomes for mothers and newborns. To maximize SMBG implementation and improve GDM care across various health care settings in India, the study emphasizes the necessity of unified national guidelines and focused educational initiatives.

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