Consensus Statement on Use of Ambulatory Glucose Profile in Patients with Type 2 Diabetes Mellitus Receiving Oral Antidiabetic Drugs

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Abstract
Glucose monitoring is an important aspect of diabetes care. The traditional methodologies of blood glucose monitoring such as fasting plasma glucose, post prandial glucose, glycosylated hemoglobin and self-monitoring of blood glucose do not adequately address hypoglycemia and glycemic variability, which are two important risk factors for diabetes-related complications. Ambulatory glucose profile (AGP) developed from a continuous glucose monitoring system is a simplified report, with standardized statistics and targets and visual representation of time in standardized glycemic ranges, glucose variability, and glycemic exposure over a single 24-h day. The role of AGP in T2DM patients who are on oral anti-diabetic drugs (OADs) is still not clearly defined. An expert group of endocrinologists and diabetologists met in Pune, India to discuss the role of AGP in T2DM patients on OADs. This article aims to discuss the consensus of the expert group on the role of AGP in T2DM patients on OADs and also reviews the various aspects of AGP and its interpretation; and the available evidences for disease management including treatment options based on AGP report.

Introduction
Diabetes mellitus (DM) is a growing global problem with nearly 693 million people expected to be affected by 2045;¹ Type 2 DM (T2DM) is the more prevalent type.² India is expected to have the largest number of people with diabetes by 2045 (134 million).³ DM contributed to nearly 1.37 million deaths in 2017, of which 1.02 million were due to T2DM; the mortality rate increased by 5.9% from 2007 to 2017.⁴

Uncontrolled diabetes increases the risk of micro and macrovascular complications.⁵ In T2DM patients, hyperglycemia is well-established as a major risk factor for the development of microvascular complications. Similarly, incidents of hypoglycemia are reported to be associated with an enhanced risk of adverse cardiovascular outcomes;⁶ individuals with an increased risk of severe hypoglycemia have a two-fold increased risk of all-cause mortality and cardiovascular deaths in contrast to those who never suffered from severe hypoglycaemia.⁷-⁹ Lowering serum glucose levels in order to reduce micro and macrovascular complications is the mainstay of T2DM treatment.¹⁰ The “glycemic pentad”, which includes fasting plasma glucose (FPG), postprandial glucose (PPG), glycosylated hemoglobin (HbA1c), glycemic variability (GV) and quality of life, plays an important role in diabetes management, especially in the Indian context.¹¹

GV refers to swings in blood glucose levels and includes both postprandial spikes in blood glucose as well as hypoglycemic events.¹² Numerous studies support association of long-term GV with an enhanced risk of micro and macrovascular complications, independent of HbA1c levels.¹³,¹⁴ Recent findings have also demonstrated the benefit of monitoring and controlling glycemic fluctuations in T2DM.¹⁵ PPG is a contributory factor for GV.¹⁶ In the San Luigi Gonzaga Diabetes Study, PPG was observed to be an independent risk factor for cardiovascular events in T2DM patients.¹⁷ Many other observational studies have also shown that elevated PPG, even in the high nondiabetic impaired glucose tolerance range, contributes to an approximately 3-fold increase in the risk of developing coronary heart disease or a cardiovascular event.¹⁸ Hypoglycemia is another limiting factor in the effective glycemic management of diabetes.¹⁹ GV can account for an estimated 40% to 50% of future hypoglycemic episodes.²⁰ A reanalysis of the Diabetes Control and Complications Trial showed that in the intensively treated group, if two patients had identical HbA1c and MBG values, but one patient had GV at the 97.5th rather than the 2.5th centile of the population, that patient would have a 35%–45% excess risk for one or more severe hypoglycemic episodes.²¹ The metrics for measurement of GV include the coefficient of variation (CV), standard deviation (SD), interquartile range (IQR), and mean amplitude of glycemic excursion (MAGE).²²,²³ A CV value <36% and a SD value less than the mean glucose (120–180 mg/dL) divided by 3 represents low GV and a relatively stable glucose profile.²²,²³

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Glucose monitoring is an important aspect of diabetes care that can help patients achieve and maintain glycemic targets. However, the traditional methods of monitoring glucose such as FPG, PPG or HbA1c do not adequately address hypoglycemia and GV and thus limit ability to achieve glycemic goals. Self-monitoring of blood glucose (SMBG), does show patterns of GV, but limit ability to achieve glycemic targets. However, the traditional approach of AGP, especially in Indian patients with T2DM treated with OADs, a group of AGP, especially in Indian patients with convenient ways of monitoring. As a result, SMBG is inconvenient and cumbersome for patients, especially for those who are on OADs.

Continuous glucose monitoring (CGM), which provides information on daily glucose fluctuations and shows how the values are affected by everyday activities and stress levels is a useful tool to assess GV. For example, in a study of 29 patients with T2DM well-controlled on metformin plus sulfonylureas, use of CGM demonstrated 18 patients (62%) to have experienced 65 episodes of silent, symptom-free hypoglycemia (interstitial glucose <70 mg/dL). Hence, use of CGM can enable patients to be more aware of these silent changes in blood glucose levels, providing them an opportunity to make the necessary adjustments to potentially avoid these hypoglycemic episodes. CGM also helps patients better understand their disease, impact of lifestyle on glycemic targets and their response to treatment, which may help with adherence. Although greater convenience and ease of use and improved sensor accuracy have increased CGM use, lack of standardized glycemic targets that can be referred to by both physicians and patients is a limiting factor. While many different CGM machines are available, most do not have a standardized method of reporting data, resulting in unwillingness of clinicians to invest the time necessary to learn and understand the diverse reporting options.

To address this issue, the Advanced Technologies and Treatments for Diabetes (ATTDD) Congress in February 2019 came up with consensus recommendations for relevant aspects of CGM data utilization and reporting among the various diabetes populations. The consensus was that time in ranges (within target range, below range, above range) are both appropriate and useful as clinical targets and outcome measurements that complement HbA1c for a wide range of people with diabetes. The panel of experts came up with guidance on glycemic targets considered “in range” “below range”, and “above range”, and the target percentage of readings and time per day in different categories of patients with diabetes. In addition, use of standardized and simplified reports such as the ambulatory glucose profile (AGP) can enhance patient and physician acceptance of CGM. Although use of AGP is well-accepted in patients on insulin therapy, there are no clear guidelines on its use as a monitoring tool in the management of T2DM patients on OADs. In India, especially, glucose monitoring is still insufficiently practiced. Some of the reasons for this noncompliance are pain and inconvenience related to monitoring techniques, low knowledge of diabetes and low rate of physician recommendation. Therefore, there is a need for educating patients on importance of routine blood glucose monitoring as well as enabling them with convenient ways of monitoring.

To derive a consensus towards use of AGP, especially in Indian patients with T2DM treated with OADs, a group of experts from India held a consensus meeting in Pune, India, on 28 June 2019.
**Ambulatory Glucose Profile**

The AGP is a report based on data obtained from a CGM. The first AGP graph was a graphical depiction of the 25th, 50th, and 75th percentiles of blood glucose values and was created by Dr Mazze in 1987. To create the graph, 440 glucose values obtained from 69 patients were organized into 14-day periods. The AGPs obtained were observed to be distinctive and related to the variability in metabolic control and the type of diabetes.  

Subsequent versions of AGP were developed at the International Diabetes Center (IDC), including the current version, v4.0 for CGM AGP report. The current AGP report is a single-page report based on SMBG or CGM data, with standardized statistics and targets and visual representation of time in standardized glycemic ranges, GV, and glycemic exposure over a single 24-h day. The AGP report also includes the daily glucose profiles in a calendar format. The AGP offers a report that is consistent regardless of device. A study of the AGP in patient clinics by Drs. Mullen and Bergenstal in 2014 showed that patients, families, and clinicians prefer the AGP over other reports, and its use could save 4-19 minutes per patient visit.

The AGP report based on CGM data includes the following: (i) Dates and number of days in report (ii) Percent time CGM active (iii) Glucose ranges and targets (iv) Average glucose (mean) (v) Glucose management indicator (vi) Glucose variability (vii) Time in Ranges (viii) Glucose profile (ix) Daily glucose profiles shown as a series of boxes, with each box indicating the date, day and showing a single day’s glucose pattern (Figure 1). In each box, readings above the grey shaded area highlighted in yellow indicates high readings which could make it harder to heal from infections and over time causes complications, and below the shaded area highlighted in red indicates low readings which could make a person feel shaky, weak or confused.

The advantages of an AGP report are that it effectively consolidates and displays CGM data, which can enable clinicians to quickly assess overall glycemia and identify patterns of concern, thereby facilitating more informed therapy decision-making, and also help patients to better manage their disease by understanding interactions between their medications, meals, and exercise. The IDC has also created a “9-step” interpretation plan to optimize interpretation of AGP data by clinicians and patients.

Most of the CGM device manufacturers have now adopted the AGP report, in slightly modified formats, in their download software. The FreeStyle Libre Pro (Abbott, Alameda, CA) was the first device with an AGP graph approved in Europe in 2014 and by the United States Food and Drug Administration in September 2016. Currently, many devices are available with AGP.

**Interpretation of AGP**

The daily glucose profiles collected over multiple days are combined to make a one-day (24-h) picture (Figure 2). The AGP shows the following:

1. **Median line**: The median (middle) line is shown in black where half of the glucose values are above, and half are below.

2. **Inter quartile range (IQR)**: The 25th and 75th percentile curves shaded in dark blue represent the interquartile range or 50% of all values. It is a good visual indicator of the degree of GV, and a narrow space indicates minimal GV.

3. **Inter decile range (IDR)**: The dashed outer lines (the 10th to 90th percentile curves) indicate that only 10% of glucose readings were above or below these values over the period assessed. In the latest AGP version (v4.0), the IDR has been changed to the 5th to 95th percentile curves indicating 5% of glucose readings that were above or below these values; this change was made to better identify infrequent, yet, significant hypoglycemia. In general, the closer the dotted blue lines and the light blue shaded area is to the dark blue shaded area, the better.

4. **Target range**: The green outlined area shows target range. At a glance, clinicians and patients can determine the extent to which values are within the target range (70–180 mg/dL) and the times of day that pose potentially...
The following aspects are to be assessed while interpreting AGP:

1. **Time in target range or time in range (TIR):** Generally, refers to the time spent in a patient’s target glucose range (usually 70–180 mg/dL). TIR measurements add valuable information to evaluate the glycemic control and were found to be correlated with HbA1c levels and diabetic complications in T2DM.28,36

2. **Patterns of hypoglycemia and/or hyperglycemia (including post-prandial hyperglycemia):** For hypoglycemia: The IDC 9-step interpretation plan states that if the 5% lower line is touching the 70mg/dL target line during a particular period of the day, or 5% of all glucose values are <70mg/dL on any given time, then physicians should consider taking some action. If the 25% line is touching or below the 70mg/dL target line or the 5% line reaches 54mg/dL, immediate action is required. The daily profiles can be viewed to double-check patterns of low glucose and see if they are clustered on weekends or special activity days.30

For hyperglycemia: The IDC 9-step interpretation plan states to discuss with the patient as to how many times per week a medication may have been forgotten or if meal-time insulin was actually taken before meals. The patient should be asked about mealtimes to check whether high values are usually before or after mealtimes. The patient should also be asked about any differences in weekend versus weekday times for waking, meals, and bedtime. The daily profiles should be viewed to double-check patterns of high glucose and see if they are clustered on weekends or special activity days.30

3. **Glucose fluctuations or GV:** Very wide interquartile ranges on the glucose profile correspond to high GV. The physician should discuss with the patient if the GV observed can be reduced by adjusting the timing or amount of food intake, carbohydrate counting, timing of medications, exercise times or amounts, and/or stress. If food and exercise log or electronic data are available, they should be matched with AGP.30

**Guideline recommendations on use of CGM and AGP in patients with T2DM**

All guidelines recommend CGM use in patients on intensive insulin therapy irrespective of the type of diabetes, for gestational diabetes and for diabetes during pregnancy.24,27,37,38 In T2DM patients on OADs, CGM is recommended under specific circumstances as described below:

- **The 2019 American Diabetes Association guidelines** recommends CGM use for all patients with diabetes who have hypoglycemia unawareness and/or frequent hypoglycemia. Guidelines suggest use of CGM as close to daily as possible for maximal benefit, and recommend robust diabetes education, training, and support for optimal CGM implementation and ongoing use.37 Use of standardized reports with visual cues, such as an AGP is recommended, to help the patient and the physician interpret the data and use it to guide treatment decisions.

- **The 2019 American Association of Clinical Endocrinologists and American College of Endocrinology consensus statement** suggest use of professional CGM in T2DM patients who have not reached their glycemic target after 3 months of the initial anti-hyperglycemic therapy and for those who require therapy that is associated with risks of hypoglycemia (i.e., sulfonylurea, glinide, or insulin), with frequency of use depending on stability of therapies. Use of personal CGM devices is suggested for T2DM patients with a history of hypoglycemia unawareness, or those with recurrent hypoglycemia, with frequency of use on a continual basis in most patients.27

The experts also anticipate SMBG to be replaced by more frequent use of both professional and personal CGM in T2DM patients. Availability of CGM for people with T2DM has provided greater clarity for the patient’s and clinician’s understanding of the glycemic pattern.

- In India, the consensus guidelines on CGM use published in 2019 recommends CGM in clinical practice for T2DM patients on hypoglycemic treatment under SMBG guidance who encounter one of the following situations: severe hypoglycemia or repeated hypoglycemia; asymptomatic hypoglycemia and nocturnal hypoglycemia; refractory hyperglycemia, especially when fasting; or large glucose excursions.24

The consensus also recommends CGM for diabetes education, as CGM can help patients to understand blood glucose fluctuations caused by diet, lifestyle and treatment, thereby instilling healthy lifestyle choices. Use of CGM is expected to help increase compliance and promote more effective communication between patients and doctors.

**Expert group recommendations: Indications for AGP in T2DM patients on OADs**

After reviewing literature evidences and collating clinical experiences of expert group members, all the members agreed unanimously that the traditional methods of monitoring diabetes maybe insufficient to prevent or delay the occurrence of complications. The expert group considered AGP to be beneficial in understanding the finer aspects of glucose control in T2DM patients, and recommended AGP in the following categories of T2DM patients on OADs (Table 1). The major components addressed are Glycaemic variability, hyperglycemia, hypoglycemia and patient education.

**Management of problems identified by AGP in T2DM patients on OADs**

There are various therapeutic options available to address concern areas identified by an AGP report. Physicians can tailor treatments to individual patients based on concern areas, resulting in better clinical outcomes. The section below focuses on the literature evidences supporting such management strategies.
Table 2: Glycemic control at baseline and after 8 weeks of adjunctive vildagliptin and sitagliptin treatment

<table>
<thead>
<tr>
<th></th>
<th>Vildagliptin</th>
<th>Sitagliptin</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Amplitude of Glycemic Excursion (MAGE) (mg/dL)</td>
<td>Mean ± SD</td>
<td>P value vs BL</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Baseline</td>
<td>67.0 ± 21.3</td>
<td>0.03</td>
<td>67.9 ± 17.3</td>
</tr>
<tr>
<td>Week 8</td>
<td>52.6 ± 16.4</td>
<td>0.00</td>
<td>51.4 ± 16.2</td>
</tr>
<tr>
<td>Mean 24 hr Blood Glucose reading (mg/dL)</td>
<td>Mean ± SD</td>
<td>P value vs BL</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Baseline</td>
<td>130.6 ± 12.0</td>
<td>0.01</td>
<td>131.0 ± 14.7</td>
</tr>
<tr>
<td>Week 8</td>
<td>118.5 ± 12.5</td>
<td>0.00</td>
<td>129.4 ± 18.2</td>
</tr>
</tbody>
</table>

Adapted from: B. Guerci et al., Diabetes and Metabolism 38 (2012) 359-366

Fig. 3: 24-h mean (SE) glucose, with Dapagliflozin therapy for 4 weeks compared with placebo with treatment difference for least-squares mean change from baseline (mg/dL) in the ITT population


A. Addressing glycemic variability:

Studies using CGM have shown that OADs such as dipeptidyl peptidase-4 (DPP4) inhibitors and sodium-glucose cotransporter-2 (SGLT2) inhibitors have a role in addressing GV. Hence, use of these drugs alone or in combination in T2DM patients would help in minimizing/delaying complications arising from GV.

DPP4 inhibitors: In a prospective open-label pilot study in Japanese patients with T2DM, sitagliptin 50 mg once-daily administered alone or with a concomitant drug decreased the average 24-h blood glucose level, SD of the 24-h blood glucose level, 24-h glycemic fluctuation range, MAGE, and hyperglycemic time. The improvement in 24-h blood glucose level was mainly due to improvement of postprandial hyperglycemia. A significant decrease in the time period of hyperglycemia (blood glucose level >180 mg/dL), and a tendency for decrease in hypoglycaemia was observed. The changes in the average 24-h glucose level and changes in HbA1c were related supporting the evaluation of drug efficacy with CGM in T2DM patients. The correlation between MAGE levels before and after sitagliptin administration suggests that larger glycemic fluctuation may result in a greater effect of sitagliptin in maintaining blood glucose levels.

In an open-label, randomized cross-over study in T2DM patients, vildagliptin 50 mg twice-daily showed lower glucose fluctuations than glimepiride 2 mg once-daily as measured by MAGE and SD of blood glucose rate of change. The postprandial glucose AUC data for both drugs were similar to those obtained by measuring post meal plasma glucose concentrations, suggesting that CGM can be utilized reliably to assess treatment effects of different glucose-lowering agents in T2DM patients. In another randomized, double-blind study in T2DM patients inadequately controlled on metformin, while both sitagliptin and glimeperide significantly reduced HbA1c, significant reductions in MAGE were seen only with sitagliptin.

SGLT2 inhibitors: In a randomized study in Japanese T2DM patients with baseline HbA1c of 7.9%, empagliflozin 10 mg or 25 mg resulted in a significant adjusted mean difference versus placebo at both day 1 and day 28 in change from baseline in AUC_{0-4h} for PPG and change from baseline in 24-h mean glucose. Percentage of time with glucose ≥70–<180 mg/dL increased from baseline to day 28 with both empagliflozin doses, without increasing time spent
with hypoglycemia. Improvement in MAGE was not significantly different with empagliflozin versus placebo. 45

In a randomized, double-blind trial in newly diagnosed Chinese T2DM patients with HbA1c levels of 7.5%–10.5%, treatment with dapagliflozin 5 mg or 10 mg once-daily or placebo for 24 weeks resulted in significant improvement of MAGE, reduction in 24-h mean blood glucose, and lower mean plasma glucose concentrations without increasing hypoglycemia. Dapagliflozin also resulted in notable decrease in plasma 8-iso PGF2α level. Results demonstrated the ability of dapagliflozin to improve glycemic variations and reduce oxidative stress in patients with T2DM, which may benefit the cardiovascular system. 46

In a retrospective study, use of SGLT2 inhibitors was demonstrated to significantly improve SD, MAGE, and largest amplitude of glycemic excursions by day 7. The percentage time at ≥140 mg/dL, max, and min significantly decreased on day 3 and further improved by day 7 while the percentage time at <70 mg/dL and mean postprandial glucose excursions remained unchanged. SGLT2 inhibitors induced an immediate decrease in glucose levels, reduced the variations in blood glucose levels, and regulated urinary glucose excretion to prevent hypoglycaemia. 47

In a randomized, double-blind study in adult patients with uncontrolled T2DM (HbA1c 7.5%–10.5%) on either stable doses of metformin monotherapy (≥1500mg/day) or insulin (≥30U/day with or without up to two OADs), the 24-h mean glucose decreased 18.2 mg/dL with dapagliflozin 10 mg/day and increased 5.8 mg/dL with placebo; the treatment difference was significant. The proportion of time spent in the target glucose range (70–180 mg/dL) increased significantly with dapagliflozin versus placebo. There was a notable downward shift in the mean 24-h CGM glucose profile across the overall 24-h profile from baseline to week 4 in the dapagliflozin group and there was an improvement in MAGE and glycemic parameters (Figure 3). 48

B. Addressing postprandial hyperglycemia: Studies using CGM have shown that α-glucosidase inhibitors minimize GV due to their ability to lower PPG levels. Hence in T2DM patients with postprandial hyperglycemia identified on AGP, a glucosidase inhibitor can be the preferred choice of therapy.

α-glucosidase inhibitors: In the MAJOR study in Japanese T2DM patients comparing miglitol 50 mg and acarbose 100 mg, both drugs were observed to have a similar effect on GV. However, PPG increases after a typical Japanese meal was significantly reduced with miglitol versus acarbose. 49

In a randomized study in Taiwanese T2DM patients inadequately controlled on one or two OADs (HbA1c 7.0%–11.0%), more effective reduction in both intraday and interday GV was observed with acarbose (50 mg thrice-daily for 4 weeks followed by 100 mg thrice-daily for 12 weeks) compared with glibenclamide (2.5 mg thrice-daily for 4 weeks followed by 5 mg thrice-daily for 12 weeks) as an add-on to metformin 500 mg thrice-daily; both combinations reduced the overall glucose level equally. 50

In another randomized parallel-group study, in Taiwanese T2DM patients inadequately controlled on one or two OADs (HbA1c 7.0%–11.0%), significant decrease in MAGE without significant change in oxidized LDL levels or 8-iso PGF2α excretion rates were observed only with acarbose (50 mg thrice-daily for 4 weeks followed by 100 mg thrice-daily for 12 weeks) but not glibenclamide (2.5 mg thrice-daily for 4 weeks followed by 5 mg thrice-daily for 12 weeks) as an add-on to metformin 500 mg thrice-daily. β-cell response to postprandial glucose increments improved significantly with acarbose. Also, treatment with glibenclamide significantly increased the duration of hypoglycaemia. 51

In a cross-over study, sitagliptin 50 mg/day was reported to significantly decrease the 24-h mean glucose level, mean glucose level during daytime, and preprandial glucose levels compared with voglibose 0.9 mg/day. However, the glucose curve after breakfast, and in particular after dinner, rose significantly rapidly with sitagliptin compared with voglibose. Results demonstrated voglibose to more significantly reduce PPG elevations compared with sitagliptin. 52

In a randomized trial in Indian patients with T2DM (HbA1c 7.0% to 10.0%), voglibose alone or in combination with high-fiber dietary intervention was observed to improve overall blood glucose levels and GV. Combination therapy was significantly more effective than monotherapy in reducing HbA1c and the mean of daily differences, whereas MAGE and largest amplitude of glycemic excursions were not significantly different between the two groups. 53

C. Addressing hypoglycemia: Studies using CGM have shown DPP4 inhibitors and SGLT2 inhibitors to be less associated with hypoglycemia. Hence, use of these drugs may help reduce hypoglycemia incidence and thereby GV in T2DM patients with increased risk of hypoglycemia. DPP4 inhibitors: DPP4 inhibitors are associated with fewer incidences of hypoglycemia, owing to their mechanism of action. The study by Mori et al. demonstrated that sitagliptin does not increase and actually reduces period of hypoglycemia (glucose <70 mg/dL) [39]. In the study by He et al., no incidences of severe hypoglycemia (defined as blood glucose <3.1 mmol/l) were reported with vildagliptin therapy. 42 Similarly, in the study by Scherbaum et al., no hypoglycemic episodes were reported with vildagliptin over a 2-year period in T2DM patients. 54

SGLT2 inhibitors: The SGLT2 inhibitors are also not expected to increase hypoglycemic episodes owing to their mechanism of action. In studies in T2DM patients using CGM, no increase in hypoglycemic episodes were observed with these drugs. In the study by Nishimura...
et al, empagliflozin increased the percentage of time with normoglycemia (glucose ≥70 to <180 mg/dL) without significantly increasing the percentage of time with hypoglycemia (glucose <70 mg/dL) in Japanese patients with T2DM [45]. In the study by Li et al, dapagliflozin did not increase hypoglycemia in Chinese patients with T2DM, and the incremental AUC less than 3.9mmol/L was almost the same in dapagliflozin and placebo groups after 24-week therapy. In the study by Henry et al., the mean percentage of time spent with glucose <54mg/dL was 0% at baseline and remained 0% at week 4 with dapagliflozin treatment in T2DM patients with uncontrolled diabetes.

**Sulfonylureas**: Although sulfonylureas in general are known to cause hypoglycemia, glimepiride is expected to cause less CV than glibenclamide owing to the extra pancreatic effect, rapid association, and dissociation binding properties with receptors and effect on both phases of insulin secretion. Also, the insulin-releasing activity is high with glibenclamide and lowest with glimeperide. Importantly, during hypoglycemia, protective mechanisms (inhibition of insulin secretion and promotion of glucagon secretion) are preserved in the presence of glimepiride but not in the presence of glibenclamide.

**Patient education**: Self-management and lifestyle interventions by patients plays an important role in the management of T2DM. Patients with T2DM who modified their diet and lifestyle were observed to experience a significant reduction in FPG and PPG after one year compared with those who did not, highlighting the value of lifestyle intervention in management.

Use of CGM and AGP can be a useful tool in counselling patients, because the visual displays in the report enables physicians to better educate the patients on the effect of medication and lifestyle on diabetes and enables patients to have a better control over their condition by understanding the interactions between medications, diet and physical activity. Lifestyle and behavioural counselling along with CGM is reported to promote higher treatment satisfaction and reduce disease-related distress. The AGP would enable patients and clinicians to agree on a personalized treatment plan aimed at improving the glucose profile while avoiding significant hypoglycaemia.

In an 8-week randomized study, it was observed that T2DM patients who received counselling feedback on their CGM graph along with role model CGM graph depicting glucose reductions in response to physical activity in addition to general diabetes education had significantly higher self-efficacy scores for sticking to activity/resisting relapse; significant increase in moderate activity minutes and a significant decrease in HbA1c and body mass index compared with those who only received general diabetes education.

In a 3 month study in poorly controlled T2DM patients (8.0 ≤ HbA1c ≤ 10%), use of CGM was reported to be useful in modifying patients’ diet and exercise habits and induce better glycemic control than SMBG. There was significant reduction in total calorie intake and a significant increase in exercise time per week in patients using CGM. In another 3-month study in women with suboptimal glycemic control advised CGM, problem-solving counselling resulted in significantly greater problem-solving skills, and greater dietary adherence, moderate activity minutes, weight loss, and higher intervention satisfaction than general diabetes education.

In another study, an increase in absolute step counts occurred after a 12-week lifestyle intervention combined with CGM.

A 6 month retrospective study in India evaluated glycemic control in 296 T2DM adults for 6 months following a 6-to 7-day study of their glycemic profile using masked Professional-CGM. The study showed that the frequency of performing self-monitoring of blood glucose (SMBG) was also found to be significantly increased in these patients from the baseline.

A brief informal survey conducted in India among 825 Freestyle LibrePro (FSLP) P-CGM deployed patients and clinicians to evaluate the user-friendliness and acceptability of this technology. The survey found that the patients were willing to repeat the procedure due to perceived simplicity, painless nature, increase in quality of life, lower cost, and so on achievable with the device.

**Conclusions**

Diabetes mellitus is growing at an alarming rate worldwide. As the prevalence of diabetes is increasing, there has been a surge in the complications caused by diabetes. The last decade has witnessed a tremendous improvement in the scientific knowledge about diabetes, bringing newer ways of management, newer antidiabetic agents, an increase in the awareness about the disease and the need to adopt lifestyle management strategies. Yet, there is no adequate control in the glycemic levels and no decline in incidence of complications of diabetes.

This necessitates a rethink into the various diabetes management strategies that is being followed currently and also emphasizes that there is something more than the traditional FPG, PPG and HbA1c levels which needs to be looked into. The AGP has been gaining traction as a tool for better management of diabetes by clinicians and patients with increasing evidence available on its role in better management of diabetes.

Clinicians need to adopt the newer technologies in the management of diabetes for better clinical outcome, explore the benefits and limitations of such technologies and share their experiences. Doing so would help build scientific evidence and encourage increased use of these technologies in clinical practice.

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**Conflict of Interest**

The expert group discussion was organized in association with Abbott Healthcare Pvt. Ltd. This article is based on the views expressed during the expert group discussion. The views
expressed in the discussion are solely of the panel members.

References