



The DAR Survey of Physicians' Use of GLP-1 Receptor Agonists and SGLT2 Inhibitors during Ramadan

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Abstract

Background While existing studies and guidelines have supported the safety of glucagon-like peptide-1 receptor agonists (GLP-1 RAs) and sodium-glucose cotransporter-2 (SGLT2) inhibitors during Ramadan, little is known about how these recommendations are applied by physicians in real-world settings.

Objectives This survey aimed to evaluate physicians' perceptions, practices, and use of GLP-1 RAs and SGLT2 inhibitors during Ramadan by assessing prescribing patterns, counseling approaches, and risk mitigation strategies.

Methods A cross-sectional online survey was conducted in December 2024. The survey was disseminated via targeted e-mails and professional networks, including participants of prior DAR Alliance activities.

Results A total of 939 physicians responded, with the majority from the Middle East and North Africa and South-East Asia regions. Endocrinologists accounted for over 40% of the sample. Most physicians reported treating over 50 patients with type 2 diabetes per month who fast during Ramadan. Endocrinologists were significantly more likely to initiate therapy earlier, adjust doses proactively, and provide structured counseling compared with non-endocrinologists, who exhibited more conservative and variable practices. Timing, dosing, and counseling practices varied, with some divergence between endocrinologists and non-endocrinologists. Nonetheless, both groups adhered to safety-focused strategies, including managing gastrointestinal side effects and reducing the risk of dehydration.

Conclusion Although access to GLP-1 RAs and SGLT2 inhibitors is generally not a barrier, hesitancy persists among physicians in initiating or adjusting these agents during Ramadan. This variation may lead to inconsistent patient care and missed opportunities for optimal metabolic and cardiorenal protection. Clear, evidence-based guidance and structured training initiatives are essential to unify clinical practice and enhance patient safety in this unique setting.

Keywords

- ▶ Ramadan fasting
- ▶ type 2 diabetes
- ▶ GLP-1 RA
- ▶ SGLT2 inhibitors
- ▶ hyperglycemia
- ▶ dehydration
- ▶ survey

Introduction

Fasting during Ramadan, observed by millions of Muslims worldwide, presents unique clinical challenges in the management of type 2 diabetes mellitus (T2D). Patients are exposed to prolonged periods without food or fluid intake, increasing the risk of hypoglycemia, hyperglycemia, dehydration, and other metabolic complications.¹⁻³

Among newer classes of glucose-lowering agents, glucagon-like peptide-1 receptor agonists (GLP-1 RAs) and sodium-glucose co-transporter 2 (SGLT2) inhibitors have garnered attention due to their glucose-dependent mechanisms of action and lower risk of hypoglycemia.⁴⁻¹⁰ These properties have made them particularly attractive options during fasting, when the risk of hypoglycemia must be carefully balanced against the need for effective glycemic and cardiorenal control.

Recent expert guidelines, including those from the International Diabetes Federation and the Diabetes and Ramadan (DAR) Alliance, endorse the use of GLP-1 RAs and SGLT2 inhibitors during Ramadan, highlighting their favorable safety profiles and benefits beyond glycemic control.¹¹⁻¹⁵ Several other groups produced literature reviews, consensus statements, and guidance specific to GLP-1 RAs and SGLT2 inhibitors.¹⁶⁻¹⁸ However, some physicians remain hesitant to initiate or adjust these therapies during Ramadan due to concerns about dehydration and the rare occurrence of euglycemic diabetic ketoacidosis with SGLT2 inhibitors, as well as gastrointestinal side effects with GLP-1 RAs.¹⁶⁻¹⁹ In particular, the timing of drug initiation, dose titration, and patient counseling strategies remain inconsistent and may differ between endocrinologists and nonspecialists.

This disconnect between evidence-based recommendations and real-world prescribing practices warrants further investigation. Earlier, smaller surveys revealed a gradual shift in physicians' comfort levels with these agents during Ramadan, especially SGLT2 inhibitors, but data remain limited in scope and regional representation.^{20,21}

Although clinical studies and expert recommendations support their safety during fasting, there are limited data on how these agents are used in real-world practice. The lag of real-world adoption behind guidelines is well-recognized. Both systemic or clinician-level barriers could be contributory. These may include limited access to updated training, uncertainty about fasting-related risks, or lack of structured decision-making tools for Ramadan-specific care.

To address these gaps, this study explores physicians' real-world perceptions, prescribing behavior, and clinical decision-making regarding GLP-1 RAs and SGLT2 inhibitors during Ramadan. Particular attention is given to the differences between endocrinologists and non-endocrinologists to identify practice variation, areas of hesitancy, and opportunities for targeted intervention.

Materials and Methods

Objective

The study aimed to (1) explore physicians' perceptions of the safety of these newer classes of antidiabetic drugs during

Ramadan, (2) document availability and access to these medications in their health care settings, (3) establish their initiation, titration, and dosing practices in relation to Ramadan, and (4) assess their counseling practices and patient support strategies in this context. A prespecified subgroup comparison between endocrinologists and non-endocrinologists was also conducted to evaluate differences in prescribing patterns, timing of initiation, and safety-related counseling approaches.

Target Population

The target population was identified from a list of electronic mail addresses, pooled from participants in various activities conducted by the DAR International Alliance. This included attendees of conferences, contributors to guideline initiatives, and participants in previous surveys or educational campaigns.

A few questions were added to the survey to delineate the demographic and professional profiles of the respondents and their practice settings. While the sample was diverse, it may reflect a population more engaged with diabetes care and Ramadan-specific education, which could introduce a degree of selection bias.

Survey Management

A Web-based commercial survey management service (SurveyMonkey Inc., San Mateo, California, United States; www.surveymonkey.com) was utilized. All participants received an initial e-mail or a link, which explained the rationale of the survey and what was required from consenting respondents, followed by two subsequent reminder e-mails during the study period. Each message included the principal investigator's affiliations and contact details, as well as a unique email-specific electronic link to the questionnaire. The survey Web site was open for 2 weeks, from December 19, 2024 to January 1, 2025. Survey responses were collected and stored electronically for anonymous analysis.

In addition to direct emails, the survey link was also distributed through professional WhatsApp groups, physician networks, and social media platforms affiliated with the DAR Alliance to increase geographic reach and physician engagement.

Survey Questionnaire

The first part captured the professional and demographic profiles of the respondents. The survey questions were constructed as multiple-choice questions covering knowledge, attitudes, and practices regarding the use of GLP-1 RAs and SGLT2 inhibitors before, during, and after Ramadan fasting (RF). It was based on the available literature, clinical practice, and available guidelines.¹¹⁻¹⁸ The survey was drafted by one author (B.A.) and developed further through several rounds of communications between the authors.

The content validity was ensured by expert review, iterative revisions, and alignment with guideline-recommended practices.

The questionnaire did not specifically capture patient-level clinical parameters such as baseline A1c, renal function, or comorbidities. Similarly, the survey did not explore detailed

strategies for co-managing other antidiabetic medications (e.g., insulin, sulfonylureas, diuretics), nor did it include structured questions on specific nutritional counseling content such as guidance on fatty liver meals. These are acknowledged limitations and discussed accordingly.

Data Analysis

The survey software tools were used to calculate summary statistics for responses to each question. As not all participants may have answered all the questions, the proportion of respondents providing a given answer was calculated individually, using the number of respondents for that question as the denominator. Subgroup analysis was performed between endocrinologists and non-endocrinologists using chi-square tests. Where appropriate, confidence intervals and effect sizes were calculated to assess the strength and clinical relevance of observed differences. We refrained from undertaking further subgroup analyses to avoid confounding factors resulting from differences in access and economic factors. All statistical tests were exploratory and intended to identify trends rather than establish causality.

Results

Demographic and Professional Profiles of Respondents

The total number of responses was 939, coming from diverse geographical areas, with the majority originating from the Middle East and North Africa (MENA) and South East Asia regions (►Fig. 1A). Most respondents represented endocrinology (40%), followed by internal medicine and general practice (►Fig. 1B). More respondents practiced in public health care facilities than in private practice (►Fig. 1C). The number of T2D patients likely to fast varied, but over 50% of respondents reported seeing more than 50 individuals with

diabetes, who are likely to fast (►Fig. 1D). This sample reflects a wide physician base across health care systems, though the predominance of endocrinologists and public-sector clinicians may introduce a degree of specialization bias that limits extrapolation to broader, less-specialized practice settings.

Drug Availability

There was less availability and access to GLP-1 RA (►Fig. 2A) than for SGLT2 inhibitors (►Fig. 2B). GLP-1 RA was readily available to 64.6% of respondents, compared with SGLT2 inhibitors, which were readily available to 78.59% of respondents (►Fig. 2B). Correspondingly, the limited availability of GLP-1 RA was greater than SGLT2 inhibitors (33.65% vs. 20.77%). Only an extreme minority reported a lack of either class.

Drug Initiation, Titration, and Dosing

Respondents' practices regarding initiation, titration, and typical dosing during RF are presented for GLP-1 RA in ►Fig. 3 and for SGLT2 inhibitors in ►Fig. 4.

For GLP-1 RA initiation, most physicians started GLP-1 RAs before Ramadan, often several weeks in advance. For instance, over 70% would not initiate GLP-1 RAs in the 4 weeks leading up to Ramadan, and approximately 50% follow the same titration protocol during Ramadan, while 70% do not change the dose of GLP-1 RAs during this period (►Fig. 3A, B). Adjustments were made to manage gastrointestinal side effects (►Fig. 3C).

Similarly, for SGLT2 inhibitors, three-quarters of respondents would not initiate SGLT2 inhibitors within 4 weeks before Ramadan. Almost 50% of respondents initiate during fasting if necessary (►Fig. 4A, B). The majority (72.1%) maintain the pre Ramadan dose (►Fig. 4C).

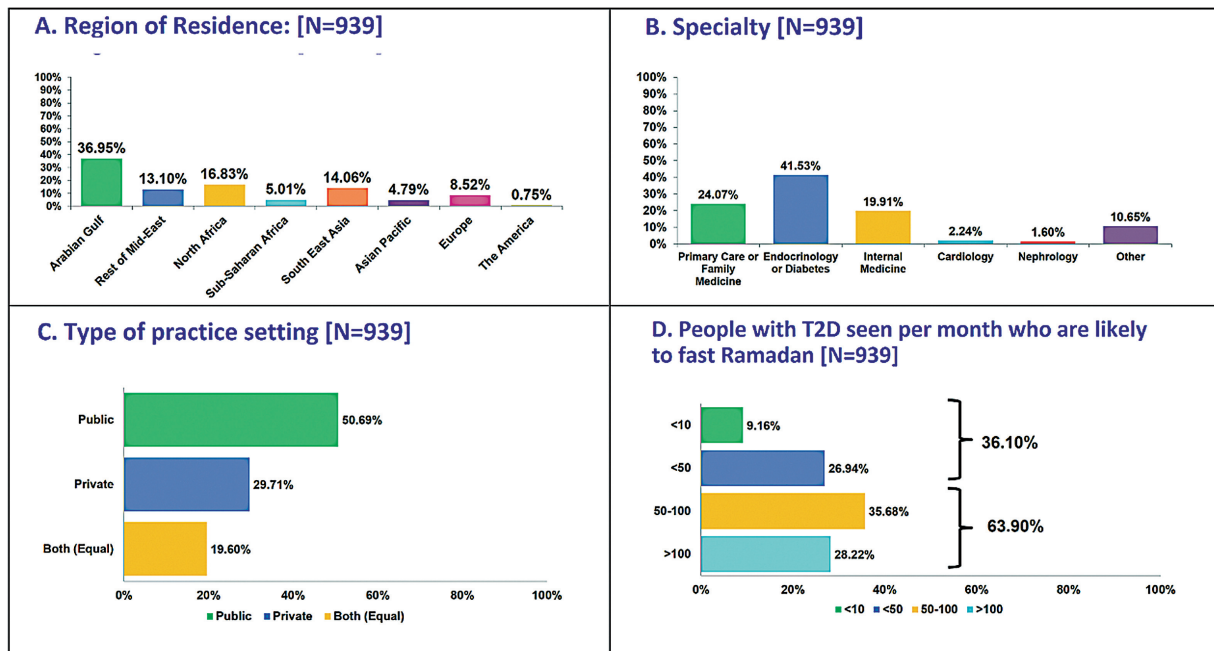


Fig. 1 (A–D) Respondents' geographical distribution, clinical specialty, practice setting, and number of people with diabetes who are likely to fast during Ramadan.

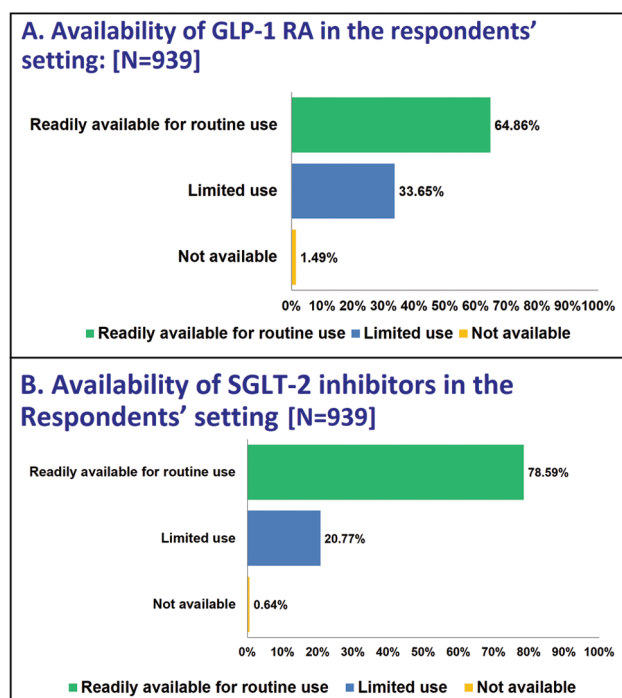


Fig. 2 (A, B) Reported availability and accessibility of GLP-1 RA and SGLT-2 inhibitors in the respondents' clinical practice settings.

Prevention and Management of Adverse Events

For GLP-1 RA, ► **Fig. 5** illustrates counseling strategies for the prevention and management of adverse events and complications before and during Ramadan. The preferred timing for GLP-1 RA injections during Ramadan was in the evening or after Iftar. The main counseling points for GLP-1 RAs during Ramadan were the management of worsening nausea or vomiting on GLP-1 RAs during Ramadan. Management approaches for nausea and/or vomiting, including symptomatic treatment or temporary dose adjustments, were common. The key counseling points included reassurance about safety, monitoring symptoms, hydration, and the timing of administration. Most physicians provided anticipatory guidance, emphasizing reassurance about medication safety, active symptom monitoring, adequate hydration during nonfasting hours, and timing administration with meals to reduce gastrointestinal intolerance.

For SGLT2 inhibitors, ► **Fig. 6** illustrates the counseling strategies for the prevention and management of adverse events and complications associated with SGLT-2 inhibitors before and during Ramadan. For the prevention of dehydration, respondents emphasized the importance of hydration during nonfasting hours and adjusting doses accordingly. Most respondents recommended administering the medication at Iftar or in the evening. Key counseling points included the importance of fluid intake, recognizing signs of urinary frequency or infection, understanding the symptoms of volume depletion, and being reassured of the overall safety profile when used appropriately. However, as noted in reviewer feedback, more detailed counseling—such as specific dietary modifications (e.g., avoiding excessively salty or caffeinated foods)—was not systematically assessed in the survey, representing an area for future research.

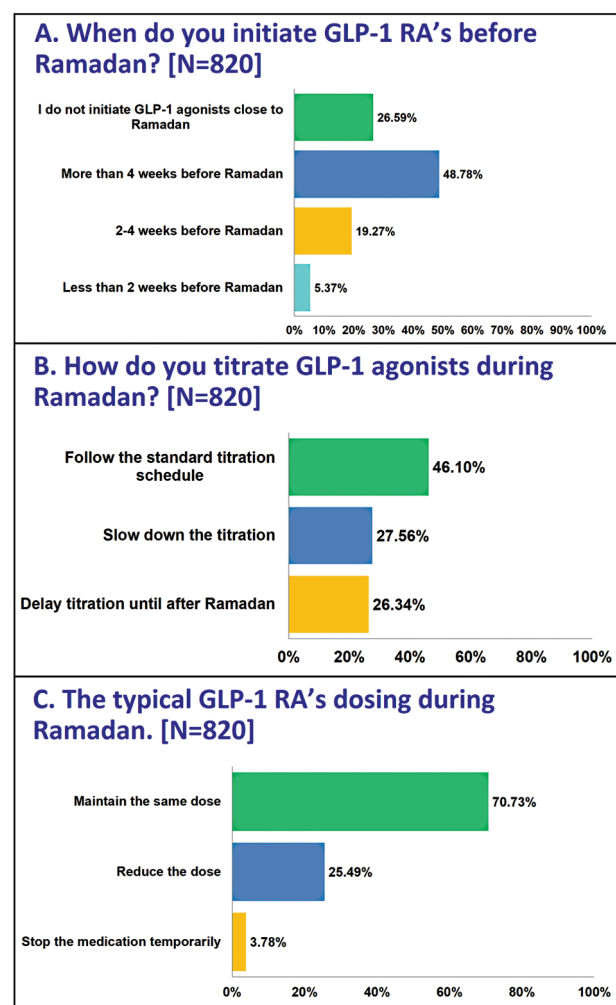


Fig. 3 Respondents' practices regarding GLP-1 RA use during Ramadan: initiation (A), titration protocols (B), and typical dosing adjustments (C).

Specialist Comparisons

Endocrinologists were more consistent in early initiation of both drug classes before Ramadan, making structured dose adjustments, and offering comprehensive counseling. On the other hand, non-endocrinologists showed more variation and a tendency toward cautious initiation or avoidance. Specifically, endocrinologists were significantly more likely to initiate treatment ≥ 4 weeks before Ramadan, adhere to titration protocols, and provide counseling tailored to side-effect profiles and fasting-related risks. In contrast, non-specialists often avoided initiating these agents near or during Ramadan and reported less structured counseling approaches. These differences underscore the potential impact of specialty training and familiarity with fasting-specific guidelines on real-world prescribing behavior.

Discussion

The findings of this survey revealed a high level of awareness and clinical responsibility among physicians managing patients with T2D during RF. Most respondents demonstrated an understanding of the unique metabolic challenges

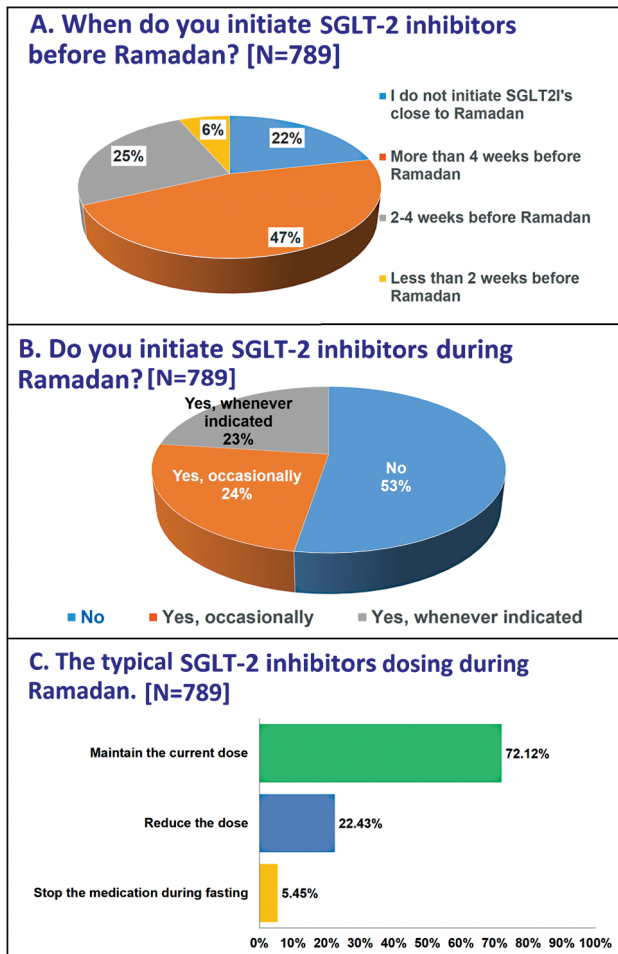


Fig. 4 Respondents' practices regarding SGLT-2 inhibitor use during Ramadan: initiation (A), titration protocols (B), and typical dosing adjustments (C).

posed by prolonged fasting and showed prudence in prescribing decisions related to GLP-1 RAs and SGLT2 inhibitors. Predictably, endocrinologists were more consistent in aligning their clinical practices with current evidence and expert recommendations, particularly in the early initiation of therapy and in delivering structured patient counseling. However, considerable variation in practice was noted, especially among nonspecialists and general practitioners. This variability may be due to differences in training, access to recent guidelines, or concerns about adverse events.

Importantly, such variation may have direct implications for patient safety, medication adherence, and fasting continuity—particularly if clinical inertia or hesitancy leads to underutilization of therapies known to be safe and effective.

These results support the ongoing need for targeted continuing medical education, cross-disciplinary engagement, and culturally sensitive decision-making tools to bridge the gap between evidence-based practice and real-world application.

A substantial body of evidence supports the use of GLP-1 RAs and SGLT2 inhibitors during RF in patients with T2D in various contexts.^{21–31} These agents are favored for their glucose-dependent mechanisms, which reduce the risk of

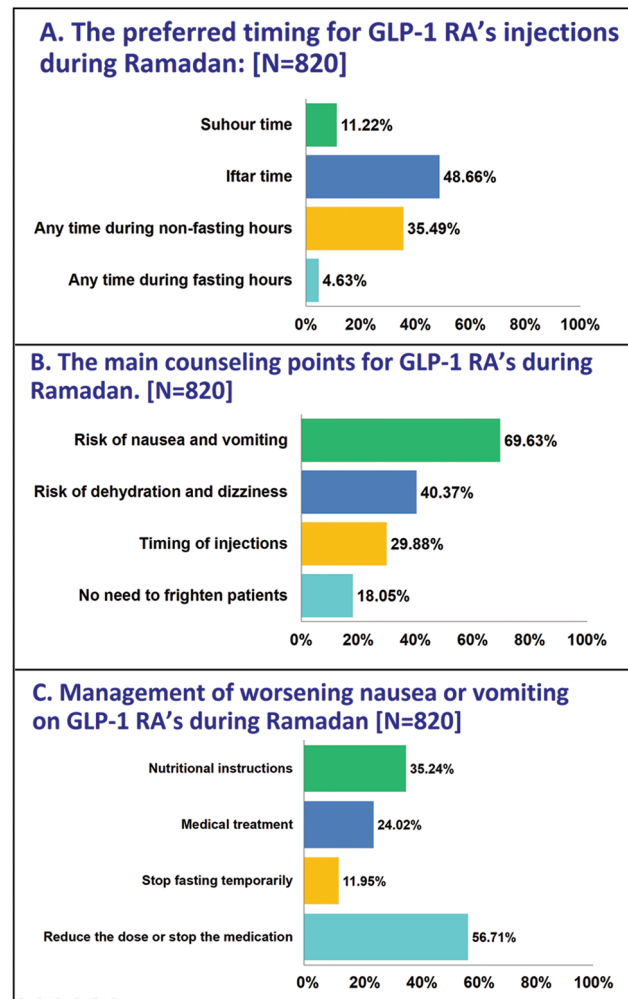


Fig. 5 (A–C) Counseling strategies for prevention and management of adverse events and complications related to GLP-1 RA therapy during Ramadan.

fasting-induced hypoglycemia—a central concern during prolonged periods of abstinence from food and fluid.

GLP-1 RAs, such as liraglutide, lixisenatide, and oral semaglutide, effectively lower HbA1c and weight with minimal risk of hypoglycemia when administered properly.^{21–24} Similarly, SGLT2 inhibitors, including dapagliflozin, empagliflozin, ertugliflozin, and canagliflozin, offer glycemic and weight benefits, as well as cardiovascular and renal protection in selected populations.^{25–31} These benefits make them ideal candidates for fasting patients, provided that therapy is introduced with appropriate monitoring and patient education.

Although concerns such as dehydration and rare events like euglycemic diabetic ketoacidosis persist, these can often be mitigated, through patient selection, adequate hydration during nonfasting hours, and appropriate monitoring. Both drug classes are now considered suitable for many patients observing Ramadan, as reflected in international guidelines.^{11–15}

Nevertheless, the survey findings confirm that real-world prescribing continues to vary significantly—often driven by physician caution rather than patient-specific contraindications. This highlights an ongoing disconnect between evidence-based safety profiles and practical decision-making,

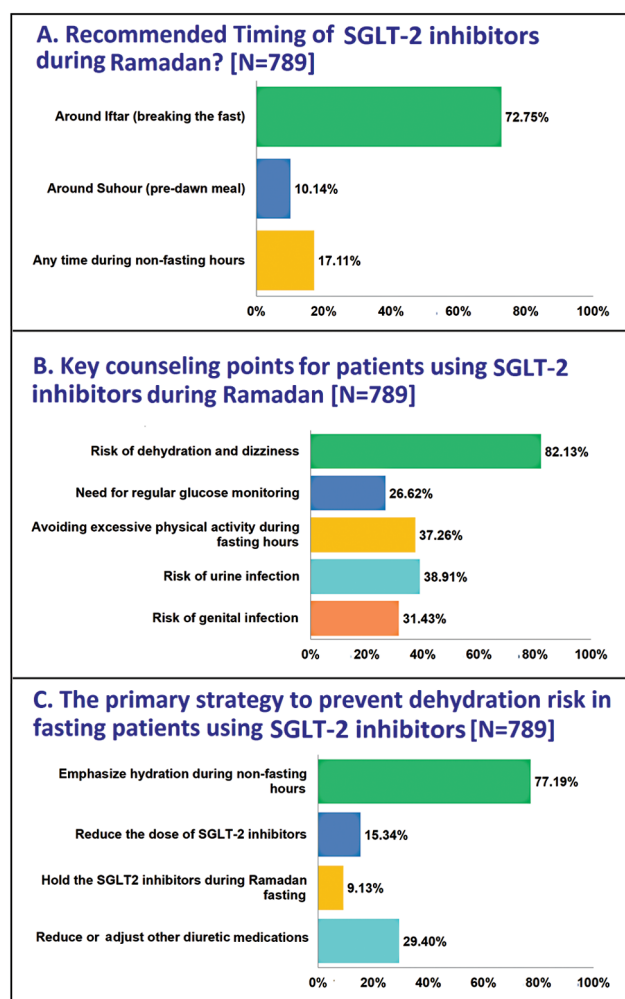


Fig. 6 (A–C) Counseling strategies for prevention and management of adverse events and complications related to SGLT-2 inhibitor therapy during Ramadan.

especially among nonspecialists who may be less familiar with fasting-focused management strategies.

The present survey revealed that GLP-1 RAs were readily available to 64.6% of respondents, compared with SGLT2 inhibitors, which were readily available to 78.59% of respondents; this corresponds to greater restricted access to GLP-1 RAs than SGLT2 inhibitors (33.65% vs. 20.77%). These findings reflect the cost difference between the two classes. Only a very small minority reported a complete lack of either class; yet, this likely reflects institutional or market-level access rather than individual patient affordability or prescribing feasibility.

Notably, the uptake of GLP-1 RAs in the real-world data from the DAR Global Survey 2022 remained limited despite their inclusion in recent guidelines, suggesting cost and logistical factors continue to constrain broader use.³²

The present survey revealed that over 75% of respondents avoided starting GLP-1 RAs in the 4 weeks leading up to Ramadan, reflecting concerns about gastrointestinal side effects and the time required for dose titration despite the reassuring recommendations.^{10–15} Similarly, most respondents initiated SGLT2 inhibitors well before Ramadan, with more than 70% maintaining the pre-Ramadan dose throughout the fasting

period, similar to earlier surveys.^{19,20} These findings suggest an overcautious prescribing behavior aiming at minimizing adverse events and allowing patients to adapt to therapy before initiating the fast. While this approach reflects clinical prudence, it may also limit timely access to these beneficial agents, particularly in patients newly diagnosed close to Ramadan. Nonetheless, there are adequate reassuring data on the minimal risk of dehydration and renal injury,^{29–31} ketonemia,^{27,31} and hypoglycemia,^{25,27} as well as overall tolerability.²⁸ Translating this growing body of evidence into confident prescribing remains an area for educational reinforcement.

Participating physicians could recognize and manage side effects associated with GLP-1 RA and SGLT2 inhibitors during Ramadan. Their strategies suggest a proactive and individualized approach, particularly in addressing gastrointestinal symptoms related to GLP-1 RAs and hydration concerns associated with SGLT2 inhibitors. Although rare, the risk of euglycemic diabetic ketoacidosis with SGLT2 inhibitors was acknowledged, with prevention centered on reinforcing hydration and symptom awareness.³³

This reflects a reassuring degree of clinical vigilance and alignment with best practices. These responses demonstrate consistency with current safety recommendations and underscore the importance of anticipatory guidance in mitigating risks associated with fasting.^{11–15} However, as noted by reviewers, counseling on other relevant aspects—such as meal composition or co-medication adjustments—was not captured in detail, signaling an opportunity for future structured assessment.

Effective patient counseling is a central component of safe prescribing during Ramadan.^{11–15} It is particularly crucial when involving medications that may carry a risk of side effects relevant to RF, where safety is the overriding principle for individualized risk assessment and personalized care.³⁴

A high consistency is observed in the responses. For example, concerning GLP-1 RA, a high proportion (85%) advised taking it at Iftar or during eating hours. Counseling is usually related to gastrointestinal side effects, and most physicians advise dose reduction for those with worsening nausea or vomiting.^{18,21} On the other hand, to mitigate the potential side effects of SGLT inhibitors, most respondents acknowledged the impact on fluid balance. They counseled patients appropriately on the timing of taking the medications and the importance of maintaining adequate hydration in line with the widely recommended expert consensus.^{16,17} These responses highlight physicians' attentiveness to fasting-specific risks and their adaptation of counseling strategies to the pharmacologic profiles of each agent. However, more structured guidance and training may be needed to ensure consistent delivery of advice on related factors such as dietary triggers and co-administered medications.

A few noteworthy factors limit the study. The self-reported perceptions and attitudes may not fully reflect actual clinical practice, as respondents might overestimate adherence to guidelines or best practices. This introduces the potential for reporting bias and underscores the need for complementary audit-based quality improvement initiatives that assess real prescribing behavior and patient outcomes.

Nonetheless, the survey provides valuable insight into clinician knowledge, practice variation, and areas of hesitancy. Although the total number of participants is remarkable for a cross-sectional survey, disproportionate representation is evident, with a predominance of respondents from the Gulf and MENA regions. This regional skew may limit generalizability, as economic disparities, medication availability, and health care infrastructure could differ significantly in other settings. Longer recruitment periods and the introduction of geographic quotas in future surveys may help mitigate this imbalance. Additionally, selection bias is likely, as the sample was drawn from a database of clinicians engaged in Ramadan-focused education and initiatives, potentially overrepresenting those who are guideline-aware and actively interested in this field.

Conclusion

GLP-1 RAs and SGLT2 inhibitors are widely considered safe for use during Ramadan by surveyed clinicians. However, notable variability exists in their clinical application, especially between endocrinologists and other providers. This variation, if unaddressed, may lead to inconsistent patient care and missed opportunities for optimal metabolic and cardiorenal protection during fasting.

Future efforts should focus on disseminating evidence-based guidelines and implementing practical training programs to unify care practices during Ramadan. Further research should focus on high-risk populations, such as those with advanced comorbidities or prior complications, and evaluate long-term outcomes of these agents in the fasting context. Additionally, research is warranted to assess optimal initiation timings and strategies for dose intensification while maintaining efficacy and safety. Institutional support for structured, Ramadan-specific education and broader inclusion of nonspecialist providers in guideline training initiatives may be critical to closing practice gaps. The current findings support the confident use of these agents during Ramadan, provided that prescribing is guided by patient assessment, careful timing, structured counseling, and culturally sensitive care models.

Author Contribution

M.H. proposed the study; B.A. drafted the questionnaire; S.A.B. and M.H. revised and further developed the questionnaire. S.A.B. drafted the manuscript, and all authors revised and contributed to its development. All authors approved the final manuscript.

Compliance with Ethical Principles

The study was deemed to carry no hazard to participants. No formal ethical approval was sought. However, consent for voluntary participation on an anonymous basis was secured electronically before participants could access the survey questions.

Data Availability Statement

All data supporting the study can be made available in a de-identified format upon reasonable request to the corresponding author.

Funding and Sponsorship

None.

Conflict of Interest

None declared.

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