




## Editorial

# Abstracts of the Diabetes and Ramadan International Alliance (Virtual) Conference 2024, 12 to 13 January 2024

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- ▶ glycemic metrics

The Diabetes and Ramadan (DAR) International Alliance was created to coordinate the research work and align the expert opinion on the subject worldwide. DAR holds an annual conference for the early presentation of new studies, consensus statements, and clinical practice guidelines. This year's conference was held virtually to attract a larger audience. The conference was held on the 12th and 13th of January 2024. This article presents the advance abstracts of the conference's communications. The abstracts are grouped under themes to facilitate reading. In conclusion, diabetes remains the most extensively studied health impact of Ramadan fasting. Continued interest is evolving around the newer therapeutic agents and technologies.

**Introduction**

Diabetes is the most extensively studied health impact of Ramadan fasting (RF). The Diabetes and Ramadan (DAR) International Alliance was created to coordinate the research work and align the expert opinion on the subject worldwide. DAR holds an annual conference for the early presentation of new studies, consensus statements, and clinical practice guidelines. This year's conference was held virtually to attract a larger audience. The conference was held on the 12th and 13th of January 2024. This article presents the advance abstracts of the conference's communications. The abstracts are grouped under themes.

**Authors' Contributions**

The conference abstracts were compiled by the scientific committee, which acted as the guest editors. The DAR

International Alliance mandates that all named authors on submitted abstracts comply with the four ICMJE authorship criteria.

**Compliance with Ethical Principles**

The abstracts are accepted on the proviso that all human research was conducted according to the appropriate ethical principles, with prior ethical approvals and patient-informed consent.

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**Conflict of Interest**

None declared.

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## Abstracts of Presentations

### 1. Pre-Ramadan Management in the Digital Era

#### 1.1 Current Status of Ramadan-Focused Diabetes Education: Results of Diabetes and Ramadan Global Survey 2022

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**Aims and Objectives:** Ramadan-focused structured diabetes education has improved glycemia for safer fasting. We describe the characteristics of Ramadan-focused education for Muslims with diabetes.

**Methods and Results:** A multinational study surveyed Muslims with diabetes during routine clinic consultation. Data on demographics, fasting characteristics, and complications were collected. Descriptive statistics, a chi-square test, and multiple tests were performed. Of 14,144 participants, 59.9% received Ramadan-focused education; the mean age was  $50 \pm 15.1$  years, with 52.9% females. The mean duration of diabetes was  $9.9 \pm 7.2$  years with mean hemoglobin A1C (HbA1c)  $8.2 \pm 1.7\%$ ; 15.5% had Type 1 diabetes (T1D), 83.8% Type 2 diabetes (T2D), and 0.6% gestational diabetes. Apart from a trend toward significance in those on sodium-glucose co-transporter 2 inhibitors (SGLT2i; 17.8 vs. 12.6%,  $p = 0.059$ ) and GLP1 receptor agonist (2.9 vs. 2.1%,  $p = 0.06$ ) between those with and without education, no difference for other treatment was observed. With regard to preexisting complications, more had microalbuminuria (4.8 vs. 2.1%,  $p = 0.005$ ) and no complications (22.1 vs. 8.5%,  $p < 0.0001$ ) between those with and without education. The majority (87.5%) received education during routine consultation, 10.7% within a group, 7.0% via online or mobile application, and 25.6% received a leaflet. The duration was 15 minutes or less for 70.7%, 15 to 30 minutes for 21.9%, and more than 30 minutes for 5.8%. More participants with T1D received education compared with T2D (60.6 vs. 59.2%). However, for those with chronic kidney disease (CKD), more of those with two diabetes (67.8%) received education compared with T1D (60.3%), the latter alike in proportion to T2D on insulin therapy (60.3%) but more than that for Type 2 with cardiovascular disease (57.7%). Of note, for T2D, there was less incidence of hypoglycemia among those who received education than those without (10.2% vs. 14.8%).

**Conclusion:** Ramadan-focused structured education needs to be provided to all, especially those with preexisting complications, to reduce hypoglycemia risk.

#### 1.2 Nutrition Education in the Digital Era

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**Aims:** This review investigates the transformative role of digital technologies in nutrition education and how they impact nutrition knowledge and eating habits. With a focus on RF and diabetes, we identify the role of digital nutrition intervention in promoting healthier diets to improve glycaemic control.

**Method and Results:** We identified studies on digital nutrition education facilitated through mobile applications,

online platforms, and other technological tools in the context of providing tailored nutrition guidance, especially during Ramadan. During the non-Ramadan period, various studies have observed the benefits of digital nutrition intervention on glycaemic control, revealing a significant reduction between 0.4 and 0.6% of HbA1c, ranging from 12 to 24 weeks of intervention. During Ramadan, telemonitoring intervention was able to reduce the risk of hypoglycemia with no deterioration in glycaemic control.

**Conclusion:** Technology integration in nutrition education, especially during Ramadan, can support the improvement in glycaemic control and safe fasting practices. Future studies should also include strategies for personalized dietary recommendations and culturally sensitive considering digital literacy and access to technology among low-income and older populations. RF is associated with an increased incidence of hypoglycemia and hospital admission in type-2 diabetes mellitus (T2DM) patients with diabetic peripheral neuropathy (DPN) and diabetic foot ulceration (DFU): a multinational study.

#### 1.3 Ramadan Education and Digital Technology

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**Background:** Ramadan-focused diabetes education is critical to facilitate safer fasting among Muslim people living with diabetes. However, access to and engagement with education is variable, and many health care professionals (HCPs) are inadequately equipped to deliver it. Digitization can democratize high-quality diabetes education at low cost. We present the design, delivery, and evaluation of two parallel massive open online courses (MOOCs) in Ramadan-focused diabetes education for people with diabetes (PwD) and HCPs.

**Methods:** MOOCs were developed and delivered by a multidisciplinary group of clinicians, academics, and technologists in association with Diabetes and Ramadan (DAR) Alliance: one for HCPs in English, and another for PwD in English, Arabic, and Malay. A user-centered iterative design process was adopted, informed by feedback from a 2022 pilot MOOC. The MOOCs (7th March–24th April 2023) featured interactive elements, videos, patient stories, and live multilingual Q&A sessions. Promotion occurred through diabetes organizations, health authorities, and media outlets. The evaluation comprised a mixed-methods evaluation of pre- and postcourse user surveys.

**Results:** The platform was utilized by PwD and their family, friends, and HCPs. Overall, 1,531 users registered from 50 countries, 809 started a course with a 48% subsequent completion rate among course starters. HCPs worked in varied roles; most (60%) were nondiabetic specialist roles, 55% identified as Muslim, and most self-reported high baseline levels of diabetes and Ramadan awareness. Most found the course user-friendly and authoritative, and users reported improved post-MOOC Ramadan awareness, associated diabetes knowledge, and ability to assess and advise patients in relation to their diabetes during Ramadan ( $p < 0.01$ ). Patients self-reported Ramadan-related diabetes management knowledge and confidence improved after the course (paired responses,  $p < 0.01$ ).

**Discussion:** MOOCs can deliver useful, educational, culturally tailored, high-quality, scalable, low-cost, multilingual Ramadan-focused diabetes education to HCPs and PwD, among a diverse cohort of worldwide learners.

#### 1.4 Blood Glucose Monitoring in Ramadan: How Frequently Should We Check?

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Blood glucose monitoring during Ramadan is essential and depends on the type of diabetes (Type 1 diabetes mellitus [T1DM], type 2 diabetes [T2DM] and gestational diabetes [GD]), stratification scores, risk of hyperglycemia and hypoglycemia, the type of medication (oral antidiabetic agents, insulin therapy regimens), comorbidities, and patient's profile. BG monitoring is a key component of Ramadan-focused education. Individuals who wish to fast should increase the frequency of self-monitoring of blood glucose (SMBG) to reduce the risk of hypoglycemia and hyperglycemia. Many individuals on multiple antidiabetic agents (sulphonylureas (SU) ± insulin) have a long duration of diabetes, multiple comorbidities, and renal impairment. Hence, they are at higher risk of hypoglycemia when fasting during Ramadan. In general, patients who are fasting are advised to self-monitor using a 7-point glucose monitoring (predawn meal Suhoor, sunset, morning, midday, mid-afternoon, pre-sunset Iftar, 2 hours postiftar, and any time where there are symptoms of hypoglycemia/hyperglycemia or feeling of being unwell). It is documented that SMBG is of vital importance for patients with T1DM who fast, and the advantages of continuous glucose monitor (CGM) or FGM techniques should be highlighted. International Diabetes Federation (IDF)-DAR guidelines recommend the use of CGM as the method of choice if available for patients with diabetes who observe RF. Studies have indicated that CGM and flash or intermittently scanned glucose monitoring (FGM or iCGM) provide the benefit of predicting hypoglycemia and assessing glycemic excursions during RF. We have several categories of patient behavior: those whose SMBG is part of their routine and who apply it regularly before Ramadan and will continue to do so according to their doctors' suggestions, those who do not apply SMBG and know that during Ramadan they will be more likely to deviate from their diet, those who are limited by lack of means (insufficient strips) and those who have not received sufficient and appropriate therapeutic education on SMBG in general and before Ramadan in particular. In a recent study conducted in Algeria on a population of 1647 patients, the main findings concerning BG monitoring were the impact of pre-Ramadan education since both practitioners and patients chose to prioritize glycemic control during the fasting period. We need to promote therapeutic education before Ramadan and reinforce follow-up during Ramadan. Ramadan seems to be a condition and an indication for this tool for better patient safety during Ramadan and to alleviate their burden.

#### 1.5 Reality Check: BG monitoring in T1 versus T2 versus High-Risk Group

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**Introduction:** Optimal blood glucose monitoring is crucial for diabetic patients planning to fast during Ramadan. It is emphasized in all the guidelines, including IDF DAR, as an antecedent to safe fasting and is one of the important components of pre-Ramadan education.

**Aim and Objectives:** We aimed to review literature—(1) real-world evidence regarding the incidence of blood glucose monitoring, (2) evidence regarding the role of SMBG in preventing and treating complications related to

fasting in Ramadan, and (3) differential monitoring in T1/T2/high-risk group.

**Method and Results:** The incidence of blood glucose monitoring (BGM) varies globally and is a direct variable of pre-Ramadan education and preconceptions regarding the invalidity of the fast on pricking. In the global DAR 2020 survey, the percentage of T2D participants who performed SMBG was 73.8%, whereas the DAR global 2022 showed that 93.2% T1D, 74.2% T2D, 97.2% CKD T1D, 74% CKD T2D, 74.7% cardiovascular diseases (CVD) T2D, and 77.9% T2D on insulin did SMBG but the frequency is inadequate. An important observation is that most patients performed SMBG at the same frequency as before Ramadan. Also, monitoring is most frequently done before iftar and in case of hypoglycemia. Frequent monitoring (more than five times) in stable, well-controlled T1D patients allows them to fast safely under strict supervision. Monitoring in Type 2 and high-risk groups reduces the incidence of both hypoglycemia and hyperglycemia in various studies.

**Conclusion:** Although BGM is extensively advocated and emphasized in pre-Ramadan education, patients do not monitor as advised. The observation that the majority performed SMBG as before Ramadan means that patients have to be educated regarding the importance of SMBG at every point-of-care (POC). BGM is useful in reducing the risk of complications in T1 and high-risk patients and is used as an advantage in these situations. The education of both physician and patient is the key to more intensive BGM and a safer Ramadan experience.

#### 1.6 The Position of Continuous Glucose Monitoring in Ramadan

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**Introduction:** According to DAR guidelines, 2021, many adults and adolescents with T1D can have safe fasting during Ramadan with no worse outcome compared with pre-Ramadan. However, hypoglycemia and fear of DKA have been listed as major complications of RF, especially in patients with poorly controlled T1D.

**Objectives:** Our objective was to promote CGM in patients with T1D who plan for RF to minimize the risk of fasting complications.

**Results:** The use of CGM, in general, has been associated with a better control of diabetes, lower risk of hypoglycemia, and less glucose fluctuation. Additionally, the early use of CGM reduced diabetes-related ER visits for more than 2 years, and other studies linked CGM to improving the quality of life. While there are no randomized controlled trials on the impact of using CGM in patients with T1D during RF, it has been reported that CGM detected more hypoglycemia than SMBG during RF in pregnant women with gestational diabetes and that relying on intermittent SMBG in the management of GDM in patients during RF might be misleading. In another study, flash glucose monitoring (FGM) during RF was found to aid in empowering patients with T1D to fast safely and maintain glycemic control with fewer complications.

**Conclusion:** DAR Practice Guidelines emphasize that frequent glucose testing is fundamental to ensure safe fasting. CGM or FGM is superior to SMBG monitoring and should be the method of choice.

## 2. Therapy in Type 2 Diabetes in Ramadan—New Studies

### 2.1 Glycemic Control and Treatment Patterns Associated with the Use of Oral Semaglutide in Type 2 Diabetes Patients Fasting during Ramadan

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**Introduction and Objective:** Managing T2DM during periods of fasting, including Ramadan, is challenging. The Oral Semaglutide in T2D Patients Fasting study evaluated glycemic and body weight control, treatment patterns, compliance, and safety of oral semaglutide in T2DM patients fasting during Ramadan.

**Methods:** This prospective, noninterventional study was conducted in UAE, Saudi Arabia, and Kuwait with up to 20 weeks of follow-up and enrolled adult T2DM patients intending to fast during Ramadan and on oral semaglutide maintenance dose for  $\geq 4$  weeks. Data were collected pre-, during, and post-Ramadan. They included HbA1c, body weight, treatment patterns, adverse events sourced from medical records, and self-reported dosing compliance and hypoglycemic events (HEs) via patient diary.

**Results:** Among 257 enrolled patients, 56% were on 14 mg oral semaglutide. Significant reductions in HbA1c ( $-2.05\%$ ) and body weight ( $-5.13$  kg) occurred from enrollment to week 20. Adherence to dosing instructions was  $\geq 80\%$  during Ramadan. There were 249 self-reported HEs. Self-reported HEs increased during Ramadan compared with pre-Ramadan (incidence rate ratio [IRR]: 4.08, 95% confidence interval [CI]: 1.76–9.49) and post-Ramadan (IRR: 3.95, 95% CI: 1.71–9.14). No level 2/3 HEs were reported. Thirty percent of the patients used sulfonylureas as accompanying antidiabetic medication at baseline. The discontinuation rate was 7.4%, with minimal discontinuations due to safety (0.4%) or gastrointestinal intolerance (3.1%).

**Conclusions:** The findings suggest that oral semaglutide is suitable for glycemic and weight control in T2DM during fasting, demonstrating significant benefits irrespective of a 20% nonadherence rate.

### 2.2 Basal versus Mixed Insulin and Safety of Fasting in Ramadan

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**Introduction:** RF poses a particular challenge for PwD on insulin therapy. Although divine exemptions exist for people with medical conditions, many living with diabetes often choose to fast against the advice of their health care providers.

**Methods:** This is a subanalysis of the DAR global study conducted in 2020 and 2022 as a cross-sectional, questionnaire-based survey that included Muslim patients with diabetes who were invited to participate during the 10-week post-Ramadan period during their regular clinic visits. The subanalysis aims to evaluate the characteristics of patients on basal and mixed insulin therapies.

**Results:** The number of patients on either basal or mixed insulin therapy totaled 2,349 with a mean age of 56 years and an equal gender distribution. The mean body mass index (BMI) for both cohorts was 27, and the mean duration of diabetes was 12 years for both groups. They both had suboptimal glycemic control with an average HbA1c of 8.6%. Most patients in both groups could fast for an average of 27 days.

**Discussion:** The baseline characteristics were similar for patients on basal and mixed insulin regarding age, BMI, diabetes duration, average HbA1c, and comorbidities. Slightly more HEs were seen in patients on mixed insulin; however, hypoglycemic episodes that led to breaking the fast or emergency room (ER) visits were similar between both groups. Hyperglycemia emerged as a bigger problem than hypoglycemia in both groups. It is evident that both groups have infrequent SMBG and structured Ramadan-focused education is lacking in both cohorts.

**Conclusions:** Patients on insulin therapy are categorized as having a high risk of fasting and should be prioritized for structured Ramadan-focused education. Mixed insulin scores are higher than basal insulin on the current risk calculator. In lieu of the data from the global survey, which did not show a significant difference between those on basal insulin in terms of severe hypoglycemia events, it is reasonable to reconsider the scoring value for mixed insulin therapies. Further studies will be required to validate the findings of this subanalysis.

### 2.3 Sodium–Glucose Cotransporters 2 Inhibitors in Ramadan

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**Introduction:** Clinical and epidemiologic studies have linked fasting during Ramadan and a higher risk of hypoglycemia, hyperglycemia, diabetic ketoacidosis, and dehydration. Various studies assessed the safety of SGLT2i during Ramadan from low-risk PwD to people at high risk of complications during fasting. This global survey from various regions representation is expected to fill further gaps in the safety of SGLT2i during RF.

**Methods:** This is a survey-based real-world evidence where all participating physicians interviewed PwD who intended to fast Ramadan. The biometric and biochemical data were extracted from the electronic medical files.

**Results:** The overall survey population was 5,865 people with T2D on oral injectables. Out of those patients, 2,379 were on SGLT2i plus other hypoglycemic agents. Fifty-seven percent of them were males. Duration of diabetes was shorter in the SGLT2i group alone and longer in the SGLT2i group with sulfonylurea and insulin. Similarly, diabetes complications were more prevalent as the duration of diabetes became longer with a more complex hypoglycemic agents' regimen. The duration of days fasted across the groups was similar, but the days with broken fasting in the group on SGLT2i alone were 50.4% compared with 13.6% in that on SGLT2i plus sulfonylurea and insulin. In this study, SGLT2i without sulfonylurea is associated with less hypoglycemia and fewer days with broken fasting due to diabetes-related complications compared with when sulfonylurea and insulin were added to the baseline SGLT2i.

### 2.4 Multiple Oral Therapy for Diabetes during Ramadan: Characteristics of Ramadan Fasting in Complication-Free Patients with Type 2 Diabetes in Diabetes and Ramadan Global Surveys of 2020 and 2022

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This analysis' main goal is to illuminate the characteristics and maintenance routines of complication-free people living with diabetes. Our data were obtained from a population that fasted during and after Ramadan in 2020 and 2022. In this group, medications did not include insulin or sulphonylureas and patients were free from complications including

microalbuminuria, macrovascular disease (CAD, heart failure, stroke or transient ischemic attack, and peripheral vascular disease), diabetic foot complications, or nephropathy/CKD (abnormal estimated glomerular filtration rate [eGFR] or serum creatinine). The study cohort included 2,917 people living with diabetes, 25% of them were above 60 years of age and 20% of them had a long history of diabetes above 10 years. Almost 40% of them were not controlled with HbA1c above 7.5%. Medications used included all antidiabetic medications excluding insulin and sulphonylureas. Twenty-six percent of patients had hypertension and another 26% had dyslipidemia. Eighty-seven percent of the study cohort fasted during Ramadan and the remaining percentage did not, and 97% of the fasting group broke the fasting for 7 or less days. Eight percent of those who fasted experienced hypoglycemia and 50% of them broke the fasting and 0.23% of them were admitted to a hospital or emergency room.

### 2.5 Basal Insulin Therapy in Type 2 Diabetes during Ramadan Fasting

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During RF, hypoglycemia risk is elevated among insulin-treated persons. This risk depends on the type, dose, timing, and regimen of insulin prescribed. Specific patient education, structured blood glucose monitoring, and appropriate adjustment to insulin therapy will minimize the risk of hypoglycemia. Basal insulin therapy represents the most frequent insulin regimen initiated for persons with T2D requiring injectable therapy in combination with oral glucose-lowering medication. The current IDF–DAR (2021) risk calculator places a risk score of 1.5 for basal insulin therapy, higher than sulphonylureas (score 0.5–1) and lower than other insulin regimens (score 2–3). In the most recent DAR global survey 2022 T2D cohort, there were 1,207 participants treated with basal insulin-only regimen, combined most frequently with metformin (82%), sulphonylurea (49%), and SGLT2i (25%). Incretin therapy combination with basal insulin was 38% for DPP4 inhibitors and 8.3% for GLP1RA. Among those on basal insulin therapy, fasting rates were 83% ( $n = 1009$ ), with 62% able to complete 30 days of fasting. Of those fasting while on basal insulin-only regimen, 21.7% experienced hypoglycemia, and similarly, 21% experienced hyperglycemia. The majority (63.6%) experiencing hypoglycemia broke their fast, as compared with 23.1% with hyperglycemia. Comparatively, 11.4 and 10.9% of hypoglycemia and hyperglycemia were substantially lower in the noninsulin-treated cohort ( $n = 7,602$ ). Diabetes-related complication rates were higher in those treated with basal insulin as compared with those on noninsulin glucose-lowering therapy, notably nephropathy (11.3 vs. 5.3%) and macrovascular disease (13.8 vs. 7.8%). Nephropathy increases the risk of hypoglycemia, and hypoglycemia negatively impacts adversely on outcomes of macrovascular disease. Fasting with basal insulin therapy demonstrated a doubling of the risk of both hypoglycemia and hyperglycemia among those performing RF. Concomitant use of basal insulin with sulphonylurea in almost 50% of the participants would contribute to a higher risk score (2–2.5) on the risk calculator. Combined with the other elements on the risk score, this would likely categorize the majority of participants on basal insulin into the moderate–high-risk category for RF. Addressing this in the pre-Ramadan period with therapy adjustments improved glucose monitoring and reduced hypoglycemia occurrence will lower risk scores and promote safer fasting among those receiving basal insulin therapy.

## 3. State-of-the-Art Lectures

### 3.1 Unlocking the Hidden Secrets of Non-Ramadan Fasting

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As early humans evolved, food supplies were alternately abundant and scarce. We also evolved in sync with the natural day–night cycle. So our metabolism adapted to function best with periods of hunger and eating during the day and sleeping at night. The health benefits of intermittent fasting go beyond just weight loss and reduced free-radical production and involve a complex system of adaptive cellular responses. During fasting, cells activate pathways that improve glucose regulation, increase stress resistance, and suppress inflammation by enhancing intrinsic defenses against oxidative and metabolic stress. And, during feeding periods, cells engage in tissue-specific processes of growth and plasticity. However, since most people consume three meals a day plus snacks, they are not practicing intermittent fasting as it's meant to be done. During this session, we will review 10 potential benefits of non-RF and we need to assess why despite fasting for 30 days, the majority of people do not get these benefits years over years. It's understandable that there are obstacles to widespread adoption of intermittent fasting, as our culture and marketing heavily promote a diet of three meals with snacks every day. Additionally, some people may experience initial side effects such as hunger, irritability, and reduced concentration when switching to intermittent fasting. However, these typically disappear within a month and patients should be advised accordingly. Moreover, many physicians are not trained in prescribing specific intermittent fasting interventions for their patients. It might be helpful for physicians to advise their patients on the gradual transition toward incorporating intermittent fasting into their diet over several months.

### 3.2 Nonreligious Fasting and Health

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**Introduction:** The pathomechanisms why diabetes is a progressive disease is only mildly understood. The natural progression of diabetes is a continuous challenge in establishing a successful therapy as well as adequate lifestyle intervention. Ultimately understanding nonresponse and response to intervention becomes a hot topic in preventing and treating T2D.

**Methods and Results:** Recent studies showed that the pure presence of liver fat is related to nonresponse in lifestyle intervention. In some cases, less than 100 g of fat in the liver inhibits an adequate response to pharmacotherapy and lifestyle intervention. For example, exceeding a threshold of consumption of daily artificial sweeteners has an impact on the microbiome, and the production of the detrimental metabolites in the bacteria supports the development of liver fat accumulation and fatty liver disease—furthermore, making the patient become a nonresponder to physical activity. Based on recent data, the only way to achieve a significant reduction and remission of liver fat content is related to 2 weeks of total fasting. Due to the ideal metabolic environment in hepatic cells in conjunction with insulin secretion, glucagon release, and somatostatin in the period of ketosis, the  $\beta$ -oxidation of fatty acids is significantly enhanced in the liver, leading to a fast reduction of liver fat in an environment of ketosis, hypoglycemia, and hyperinsulinemia. Fasting for

14 days without taking any kilocalories, therefore, can lead to a reduction of liver fat and, by this, to a significant improvement of insulin resistance and dysglycemia and, in many cases, to remission of diabetes.

**Conclusion:** Total fasting is an attractive strategy for T2D remission and diabetes prevention. The metabolic environment in pancreatic and liver cells helps to initiate  $\beta$ -oxidation of fatty acids and preferably reduce liver fat. Two weeks of total fasting can become a priming therapy for patients newly diagnosed with T2D, leading to diabetes remission.

## 4. Ramadan Fasting and the Kidney

### 4.1 Impact of Microalbuminuria on Ramadan Fasting: A Subanalysis of DAR Survey 2020 to 2022

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**Background:** Early detection of diabetic nephropathy often involves identifying microalbuminuria recognized as an independent cardiovascular (CV) disease risk factor. Despite this, there is a lack of research examining the predictive role of urinary albumin-to-creatinine ratio (UACR) with normal eGFR to adverse glycemic and renal outcomes during Ramadan. Additionally, there needs to be more studies investigating the impact of RF on microalbuminuria.

**Methodology:** This study constitutes a subanalysis of the DAR survey conducted between 2020 and 2022. Subjects exhibiting elevated UACR alongside normal creatinine and eGFR were compared with individuals with negative UACR and no comorbidities or diabetes complications. Parameters such as the frequency of hypoglycemia, hyperglycemia events, ER visits, and hospital admissions related to diabetes complications were assessed.

**Results:** In total, 459 individuals with T2D and microalbuminuria (MAU) having normal eGFR were contrasted with 9,216 subjects devoid of MAU and diabetes-related complications or comorbidities. Those without MAU observed a significantly higher frequency of fasting days during Ramadan compared with the MAU group. Notably, the MAU cohort exhibited a notable increase in HEs and admissions related to hypoglycemia ( $p = 0.012$  and  $0.04$ , respectively). Similarly, the MAU group showed elevated frequencies of hyperglycemic events and admissions due to hyperglycemia ( $p \leq 0.0001$  and  $0.02$ , respectively).

**Conclusion:** The available data do not permit a definitive conclusion regarding whether MAU with normal kidney function independently poses a risk during RF. Our findings suggest a potential correlation between MAU and CV risk factors within the MAU group. Further studies are imperative to explore the relationship between MAU and fasting during Ramadan comprehensively.

### 4.2 Fasting and diabetic kidney disease

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Regarding fasting and diabetic kidney disease, most of the studies are observational and noninterventional. Fasting has shown to cause transient and reversible rise in creatinine levels in PwD and is avoidable with proper fluid intake. People with CKD are at more risk of hypoglycemia and hyperglycemia as well as requiring emergency visits and

hospital admission compared with people without CKD. People with diabetic kidney disease should be counseled and the risk of fasting must be discussed.

### 4.3 New and Ramadan Consensus Recommendations

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The Ramadan and Kidney Disease (RaK initiative) working group, comprising expert physicians, aims to consolidate existing evidence and insights in collaboration with the DAR alliance to provide empirical recommendations. The group established consensus recommendations through an extensive review of the literature concerning RF in the context of kidney diseases, both with and without associated risk factors. The working group categorized risk factors for fasting during Ramadan as low, moderate, or high. Each kidney disease patient undergoes a personalized assessment to identify their risk factors (Assess). This assessment enables categorizing the fasting risk level as low, moderate, or high. Subsequently, based on this evaluation, patients are advised whether fasting is advisable. Our role for those opting to fast involves providing comprehensive assistance to ensure that their fasting experience is as safe as possible (assist), utilizing recommendations developed by the RaK initiative task force.

### 4.4 Chronic Kidney Disease and Ramadan Fasting: A Literature Review

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**Introduction:** RF is an obligation for every adult Muslim. Due to complete abstinence from food and drink during the fasting hours—which can extend more than 16 hours in hot weather—theoretically, kidney function might get worse.

**Method:** A literature review was conducted for research articles that studied the effect of RF on kidney function in patients with CKD, including renal transplant and dialysis.

**Discussion/Conclusion:** Several studies were found for patients with CKD or renal transplant but all were observational and had small sample sizes with possible selection bias and great heterogeneity. In general, there is no evidence that RF is harmful to patients with CKD Stages 1 to 3 or renal transplant with stable graft function after 1 year posttransplant surgery. However, RF is potentially harmful for patients with CKD Stages 4 to 5. Few studies were conducted for patients on hemodialysis, and in general, they did not show significant risks. One very small study was conducted on patients on peritoneal dialysis, showing no major harmful effect of RF. Further high-quality and large research studies are much needed.

## 5. Type 1 Diabetes and Ramadan Fasting, The Present and the Future

### 5.1 Type 1 Diabetes and Conventional Therapy in Ramadan

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Conventional/multidose insulin therapy is the mainstay of therapy for people with T1DM worldwide.

Epidemiological studies have shown that most T1DM in many countries choose to fast during Ramadan. Considering the high risk involved, this challenges their treating physicians. Under proper preparation and education, the safety of fasting in this population has been proven. However, well-designed randomized controlled clinical trials about specific dosing and timing are still lacking. Several observational studies have tested specified insulin dose reductions during RF, but evidence on using different insulin types, dosing, and timing adjustment comparisons is extremely limited. High-quality clinical research is needed to allow evidence-based guidance for the best-required insulin regimen adjustments during fasting for people with T1DM who choose to fast during Ramadan.

## 5.2 Does Technology Reduce the Risk of Fasting in Type 1 Diabetes?

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**Background:** Recent advances in therapies and technology had a major impact on the T1DM management approach and enabled a range of physical and metabolically challenging circumstances to be undertaken safely. Advanced hybrid closed loop (AHCL) is the most advanced insulin pump system approved for treating T1D. Hypoglycemic events are a serious complication associated with T1D management during RF.

**Objectives:** This prospective study assessed the safety, effectiveness, and optimization of the AHCL system on glycemic metrics and the level of hypoglycemia in T1DM patients who wished to fast in Ramadan.

**Methods:** Forty-two T1 patients (mean age  $15.2 \pm 3.4$  years) using the AHCL system were divided into two groups (each  $n=21$ ): the intervention group who adjusted AHCL settings and the control group who kept the same settings as before Ramadan.

**Results:** The most aggressive system settings among the control group consisting of a 100 mg/dL glucose target, active insulin time of 2 hours, and bolus increment maintained exceptional glycemia with time in range (TIR) reaching  $82.0 \pm 10.2\%$ , time above range  $>180$  mg/dL of  $12.1 \pm 3.5\%$  without an increase in hypoglycemia (time below range, TBR,  $3.0 \pm 0.3\%$ ). All of which were nonsignificant in comparison to the intervention group. Overall time spent in closed loop (SmartGuard) by users averaged  $98.7 \pm 2.1\%$  in auto mode and involved only  $1.0 \pm 0.7$  exits per week, indicating confidence in the system's performance. There were no severe hypoglycemic or diabetic ketoacidosis events during the study.

**Conclusions:** RF is feasible in PwD using an automated insulin delivery system with customizable targets, which is safe and achieves significant optimization in glycemic parameters even in the most aggressive system settings while minimizing hypoglycemia in a real-world environment with no serious adverse effects. The AHCL system assists in safe fasting with minimal user input. It allows for the achievement of recommended glycemic targets in people with T1DM during RF, which we believe would not have been achieved using multiple daily insulin regimens or open-loop insulin pump therapy.

## 5.3 Suhoor Timing in Type1 Diabetes Patients Fasting Ramadan: A Randomized Cross-Over Trial

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**Introduction:** Despite the risk of complications, many patients with T1DM fast during Ramadan. Local studies have shown that breaking the fast due to hypoglycemia is common during the morning hours; however, the optimal timing of Suhoor (predawn meal) has yet to be investigated. Current guidelines recommend late Suhoor; however, this does not provide sufficient time for correction in case of insulin overdosing and can lead to breaking of the fast in the early hours.

**Objective:** Our objective was to estimate hypoglycemia risk in T1D fasting Ramadan when eating Suhoor 90 to 120 minutes before dawn versus 30 minutes before dawn.

**Methods:** This study was a prospective randomized crossover design. T1D insists on fast recruiting. Data were collected using pre/post-Ramadan questionnaires and FCGM—Freestyle Libre.

**Results:** In total, 44 T1D patients were randomized to early versus late Suhoor regimens for a week, and then crossed to the other regimen the 2nd week. Forty-two MDI and two CSII. The mean age was  $25 \pm 5.9$  years (range 15–39), DM duration was  $13.7 \pm 6.6$  years, and 73.5% were female. Pre-Ramadan  $A1c \leq 7$  (30.2%), and  $>9$  20.9% (22.7%) reported frequent hypoglycemia ( $\geq 3$ /week), and 4 (9.1%) reported hypoglycemia unawareness. During the early versus late regimen, self-reported hypoglycemia leading to breaking of fast 64.5% versus 58.1%,  $p=0.18$ , occurring most commonly in the morning (38.5%) versus 14 (60.9%), and noon 11 (42.3%) versus 5 (21.7%)  $p=0.09$ . Mean days when the fast was broken  $2.5 \pm 1.6$  versus  $2.05 \pm 1.4$ ,  $p=0.7$ . One severe hypoglycemia and one admission were reported with the late regimen. There was no DKA admission during either regimen. FCGM-detected mean hypoglycemia events per patient per week of early versus late regimen was 5.5 versus 5.4,  $p=0.65$ ; for post-Suhoor (6–11 AM) 0.94 versus 1.07,  $p=0.25$ . Hypoglycemic events were significantly higher during morning/noon than presunset 1.9 versus 0.43,  $p < 0.001$ . AGP report was as follows: GMI  $7.58 \pm 1$  versus  $7.49 \pm 0.9$ ,  $p=0.36$ , TIR (70–180 mg/dL)  $46.9 \pm 17.3\%$  versus  $47.9 \pm 17.3\%$ ,  $p=0.99$ , TBR ( $<70$  mg/dL)  $8.6 \pm 14.3\%$  versus  $7.8 \pm 7.6\%$ ,  $p=0.15$ , time above range ( $>180$  mg/dL)  $45.8 \pm 22.03\%$  versus  $44.5 \pm 20.1\%$ ,  $p=0.6$ , and glucose variability  $39.3 \pm 10.5\%$  versus  $40.6 \pm 6.5\%$ ,  $p=0.005$ .

**Conclusion:** Managing T1D who fast during Ramadan is challenging. Adjusting Suhoor meal and insulin dose time to allow postmeal correction provides flexibility—larger studies are needed to demonstrate the effectiveness of this approach.

## 5.4 Can Advanced Insulin Pump Technology Help Exercise in Ramadan? (Active Fast Study)

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**Background and Aims:** Evidence on exercise's effect on glycemic outcomes in T1D during RF is lacking. We aimed to assess the safety of moderate-intensity exercise (MIE) in Ramadan in individuals with T1D using MiniMed 780G.

**Methods:** In this prospective, single-arm study, we recruited adults with T1D using MiniMed 780G. We compared TBR and TIR between Ramadan (fasting) and Shawal, the month after Ramadan (nonfasting). Patients performed MIE (brisk walking >100 steps/minute; Tudor-Locke et al., 2018) for 30 minutes/day, five days/week, during eating hours in Ramadan and at any time in Shawal, with activation of the 780G's "Temp target" feature. Patients wore an activity-detecting device for step counting and monitoring compliance through an online platform. A Diabetes Treatment Satisfaction Questionnaire (DTSQ-status) was conducted.

**Results:** We enrolled 35 individuals (19 females), aged  $27.9 \pm 8.4$  years, with the T1D duration of  $15.5 \pm 7.3$  years. HbA1C, TIR, and TBR were  $7.7 \pm 1.4\%$ ,  $64 \pm 15\%$ , and  $1.8 \pm 1.6\%$ , respectively. The compliance to fasting was 90.5% and to exercise in Ramadan and Shawal was 84.4 and 88%, respectively. TIR (mean [SD] of  $66.9 \pm 12.3\%$  vs.  $63.2 \pm 14.8\%$ ,  $p = 0.0134$ ) and time above range (mean [SD] of  $31.2 \pm 12.7\%$  vs.  $35.4 \pm 15\%$ ,  $p = 0.0088$ ) were better in Ramadan versus Shawal. TBR (Mean [SD] of  $1.82 \pm 1.89\%$  vs.  $1.47 \pm 1.46\%$ ,  $p = 0.2107$ ), HbA1c (Mean [SD] of  $7.6 \pm 1.2\%$  vs.  $7.6 \pm 1.4\%$ ,  $p = 0.98$ ), and DTSQ satisfaction score [Mean (SD) of  $31.8 \pm 3.9$  vs.  $32.7 \pm 3.6$ ,  $p = 0.30$ ] had no significant differences. No severe hypoglycemia or DKA was reported.

**Conclusions:** Adults with T1D using Minimed 780G and fasting in Ramadan can safely do MIE during eating hours.

## 6. Risk Calculation in Ramadan

### 6.1 (Ramadan Plus) Diabetes-Fasting Study: Extended Fasting More than 60 Days: A Cross-Sectional Study Samih Abed Odhaib<sup>1</sup>

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**Background:** PwD may fast more than Ramadan. The study aims to evaluate PwD fasting experience in different risk categories using the DAR Fasting Ramadan Risk Calculator and evaluate the specific fasting experience for PwD who chose to extend their fast > 60 days, including Ramadan.

**Methods:** 4,541 PwD was reviewed, and their (Fasting Risk Calculator) was measured during Jumada Althani and Rajab 1,444 and followed until Dhul-Qidah 1,444. The study was performed in one governmental center and three private endocrine and diabetes centers to enroll any type of DM > 14 years old. Each patient had a 2-month visit and A1c each 3 to 4 months.

**Results:** In total, 4,541 PwD were enrolled; 1,931 PwD tried fasting for different durations (37% low, 33% medium, 30% high risk). Two hundred and thirty eight PwD fasted  $\geq 60$  days (range 60–147 days [extended fasting]), distributed between low, moderate, and high-risk categories as 46, 31, and 23%, respectively. When we compared 238 PwD who fasted  $\geq 60$  days to 1,333 PwD who fasted < 60 days, the two groups were matched for gender, age, BMI, HbA1c, eGFR, insulin use, and their distribution between the risk categories. Using Repeated-Measures-Statistics, there was a significant reduction in HbA1c and lipid profile in the extended fasting group more than the other group, yet it was a suboptimal level. The BMI changes in both groups were not significant. The risk of hypoglycemia and hyperglycemia, which cause the breaking of the fast, was nearly similar between both groups.

**Conclusion:** There is a shortage of Fasting Risk Calculators to stratify the fasting risk in this large cohort of PwD. About 32% of PwD considered high-risk category achieved fasting. Of those, approximately 23% fasted for more than 60 days. Although fasting > 60 days produces significant HbA1c and lipid profile changes, its effect is suboptimal. Prolonged fasting did not affect BMI reduction in either group.

### 6.2 Neuropathy and Diabetic Foot Disease: Are They a Risk for Fasting?

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The impact of fasting was assessed in T2DM patients from the Gulf, Maghreb countries, Middle East and Turkey, Indian subcontinent, and Southeast Asia without DPN ( $n = 8,202$ ), DPN ( $n = 2,538$ ), and DPN with DFU ( $n = 500$ ) during Ramadan 2020 and 2022. Patients with DPN + DFU and DPN were older (yrs.) ( $58.9 \pm 11.4$ ,  $58.5 \pm 10.6$ ) compared with those with no DPN ( $53.0 \pm 11.7$ ) and had a higher HbA1c ( $10.0 \pm 2.4$  vs.  $8.9 \pm 3.6$  vs.  $8.1 \pm 1.9$ ), systolic blood pressure (BP;  $138.8 \pm 27.3$  vs.  $133.4 \pm 24.3$  vs.  $126.1 \pm 26.5$ ) and greater prevalence of retinopathy (42.0 vs. 29.5 vs. 7.2%), nephropathy (39.8 vs. 25.1 vs. 3.2%), neuropathy (100 vs. 100 vs. 0%) and CVD (23.8 vs. 19.4 vs. 0%). Those with DPN + DFU (89.2%) were more likely to have had education on RF compared with those with DPN (64.7%) and no DPN (66.3%). Those with DPN + DFU (12.7%) were least likely to not undertake SMBG compared with no DPN (24.6%) and DPN (29.3%), and indeed, they were threefold more likely to undertake SMBG three to four times daily (DPN + DFU—28.2%) compared with DPN (10.8%) and no DPN (12.7%). Most patients fasted (no DPN—89.6%, DPN—78.0%, DPN + DFU—77.8%). However, the incidence of hypoglycemia was highest in patients with DPN + DFU (33.8%) compared with DPN (24.1%) and no DPN (12.2%), occurring predominantly between 3 PM and iftar (no DPN—61.2%, DPN—62.4%, DPN + DFU—62.4%). As a consequence of hypoglycemia, a large proportion of patients broke their fast (no DPN—55.6%, DPN—80.4%, DPN + DFU—92.4%) with a two-fold increase in admission to hospital in those with DPN + DFU (7.6%) compared with those with DPN (4.5%) and no DPN (3.5%). Consequently, a greater proportion (threefold) of patients with DPN + DFU (50.4%) compared with DPN (15.3%) and no DPN (14.8%) stopped fasting. While there was no difference in those who reduced the dose of their glucose-lowering medication (no DPN—27.7%, DPN—29.3%, DPN + DFU—30.5%), a much smaller proportion of patients with DPN + DFU (1.5%) compared with those with no DPN (17.6%) and DPN (12.4%) increased SMBG monitoring.

### 6.3 Ramadan Fasting and Diabetic Retinopathy

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**Introduction:** Diabetic retinopathy (DR) is a well-known complication of diabetes mellitus (DM) and is a leading cause of loss of vision in the Middle East and worldwide. The available treatment for DR and diabetic macular edema (DME) includes laser therapy, a vascular endothelial growth factor and steroid implant injections can help reduce the effect of DM on the renal aiming to preserve or regain vision. However, the core management continues to rely on controlling DM. Endocrinologists face challenges during religious fasting (i.e., Ramadan) in controlling patients' blood sugar levels.



**Methods:** The aim of this review is to assess the effects and safety while fasting generally and during Ramadan on DR and DME. The literature review of fasting effect on DR and data analysis from Diabetes and Ramadan (DAR) Global survey 2020 to 2022 are presented.

**Results:** There are numerous articles discussing the changes that occur in renal microvasculature during intermittent fasting with seldom articles regarding RF. The general consensus that fasting does alter the sympathetic, parasympathetic. Inflammatory cascade pathways possibly lead to a reduction in blood pressure, increase in insulin sensitivity, and reduction in inflammatory biomarkers in the renal circulation which yields a positive effect on the progression or even regression of DR and DME. DR is not currently included as one of the factors in the scoring system for RF safety considered by DAR.

**Conclusion:** Fasting has a positive effect on reducing the progression or even regression of DR and DME and hence should be encouraged but further ophthalmic studies are required in this field. The addition of DR to the RF scoring system by DAR is recommended.

#### 6.4 The Future of Diabetes and Ramadan Risk Calculator Bachar Afandi<sup>1</sup>

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**Introduction:** The Diabetes and Ramadan Risk Calculator (DAR-RC) has played a pivotal role in guiding HCPs in assessing fasting safety for individuals with diabetes during the holy month of Ramadan.

**Objectives:** This presentation critically evaluates the DAR-RC, aiming to understand its strengths and limitations. The focus is on addressing emerging challenges in specific populations and issues, advocating for adaptations to enhance its applicability.

**Methods and Results:** The presentation reviews existing evidence and practices, proposing strategic modifications for a few aspects of the DAR-RC. Recommendations include omitting pregnancy from the risk calculator, promoting CGM, recognizing closed-loop insulin systems, implementing frailty screening tools, prioritizing elderly patients, supporting more research on new diabetes medications, and accommodating regional variations. These adjustments aim to optimize the calculator's accuracy and global relevance.

**Conclusions:** The future of the DAR-RC depends on its adaptability to evolving medical knowledge and technology. The presentation advocates a proactive stance in refining the DAR-RC to address emerging challenges and ensure its ongoing effectiveness in guiding HCPs during Ramadan.

## 7. Cardiovascular Diseases Risks and Diabetes in Ramadan

### 7.1 Hypertension and Ramadan Fasting Mohamed Hassanein<sup>1</sup>

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**Introduction:** Hypertension (HTN) is the highest condition, and about a third of the Dubai population is diagnosed with HTN. The majority of PwD are also hypertensive. Despite such a high frequency of both problems coexisting, there is a paucity of data on the impact of fasting on the blood pressure

of PwD. Similarly, the impact of HTN on the safety of fasting for PwD is not studied.

**Methods:** We looked into the existing literature to dissect the impact of fasting during Ramadan on blood pressure in PwD. Data from the DAR Global Survey 2020 and 2022 were analyzed to look into the safety of fasting in those with diabetes and HTN versus those with diabetes but not known to be hypertensive.

**Results:** The majority of studies show a marginal reduction in BP. However, such a positive impact is short-lived as people return to their routine lifestyle after Ramadan. The DAR Global Survey indicated that approximately 52% of the T2D population was previously diagnosed with HTN. They tend to be older, with longer duration of diabetes, have higher rates of diabetes-related complications, and 50% of them are treated with insulin. Consequently, a higher proportion of them opted not to fast, and a higher proportion of those who fasted had hypoglycemia or hyperglycemia.

**Conclusion:** Fasting in Ramadan probably leads to marginal improvements in BP in PwD though these effects are transient. A higher percentage of people with preexisting hypertension and diabetes decide not to fast compared with PwD and previous hypertension. They also tend to have slightly higher rates of hypo and/or hyperglycemia. Further research is required to understand these changes better.

### 7.2 Effect of Ramadan Fasting on Lipid Profile and Cardiometabolic Markers in Patients with Diabetes MoezAllislam Ezzat Faris<sup>1</sup>

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Fasting has the potential to improve fat metabolism and be efficient for the management of patients with diabetes. Fasting in diabetic patients can be safely performed, when necessary, with the support of HCPs. The challenge of observing RF by patients with diabetes revolves around the delicate balance between religious observance and health management. The dawn-to-dusk abstinence from food and drink, including water, by diabetic patients poses potential cardiometabolic risks, making these patients need to control their blood lipids carefully. Dyslipidemia is among the adverse metabolic sequelae that patients with diabetes may develop during Ramadan. Published research unravels controversial results concerning the effect of observing RF by patients with diabetes on lipid profile and other cardiometabolic risks, with variable consequences noticed among both types of diabetes. For patients with T2DM, a recent meta-analysis on 28 observational studies conducted in Middle Eastern, African, and Asian countries found significant decreases in the FPG level by  $-15.28$  mg/dL, HbA1c% by  $-0.27$ , total cholesterol by  $-12.88$  mg/dL, LDL-C by  $-4.42$  mg/dL, HDL-C by  $-1.09$  mg/dL, triglycerides by  $-2.47$  mg/dL and decreases in anthropometrics after observing RIF. For T1DM, reviews showed no change in the lipid profile for those on multiple daily injections during Ramadan. In another systematic review of 22 studies on T1DM, 17 variable changes in lipid profile and cardiometabolic risk factors were reported. Further, insufficient evidence was reached to link RF with increased or reduced incidence of cardiovascular events in PwD observing RF. However, there were some indications that stroke risks may be increased. In conclusion, observing RF by diabetic patients under medical supervision, adhering to prescribed drug regimen and modification, and without having major risk factors results in a slight improvement of overall metabolic and lipid profile.

### 7.3 Weight Loss in Ramadan: Fact or Fiction

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Weight loss in overweight and obese patients with T2D was shown to improve glycemic control, reverse diabetes course, or even induce remission from diabetes. Meanwhile, as practiced in Ramadan, time-restricted eating improved insulin sensitivity and reduced visceral and intrahepatic fat. So, Ramadan is a glorious opportunity for Muslims to lose weight and improve glycemic control. If fasting is complimented with hypocaloric and/or low carbohydrate diet plans, patients with diabetes may lose, on average, around 2 to 2.5 kg by the end of the month. To accelerate weight reduction, women have to follow a low-caloric dietary plan of 1,200 to 1,500 calories, and men have to follow a plan of 1,500 to 1,800 calories per day, as shown in the Ramadan Nutrition Plan. The DAR mobile application provides several structured menus in different languages, ideal for weight loss. Exercise is mandatory for successful weight loss, especially stretching and strength. A 20- to 30-minute exercise after the Esha or Taraweh prayer is ideal. To make weight loss a fact during Ramadan, it is highly recommended that patients (1) avoid sugary drinks, sweetened soft drinks, and beverages and replace them with water; (2) avoid deserts with added sugar and replace them with fruits; and (3) avoid high-carbohydrates snacks and replace them with vegetables. Diabetes remission is possible for patients whose diabetes duration is less than 5 years after 8 to 10% weight loss using the DROP protocol (Diabetes Remission Outcome Protocol) developed by Joslin Diabetes Center of Harvard University. DROP nutrition plan includes time-restricted eating for 16 hours (e.g., RF) combined with a very low-calorie diet of 800 to 1,000 calories per day with strength exercise and CGM for 12 weeks. Ramadan should be a good start for the weight loss journey.

### 7.4 Smoking and Ramadan, a Challenge or an Opportunity?

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Tobacco use is one of the most preventable causes of premature deaths globally and an important risk factor for CVD, cancers, and respiratory diseases. People living with diabetes who smoke cigarettes are at an increased risk of mortality compared with nonsmokers. A fifth of the world's population is Muslim, and most Muslims live in areas where the prevalence of smoking is high and often increasing. Although the religious status of smoking was initially considered to be neutral, this designation has been revised by Muslim scholars now that the harms of smoking have been established. Most scholars deem smoking to be haram (forbidden) or mukrooh (discouraged). People living with diabetes should receive structured education and risk stratification prior to the month of Ramadan. During the month of Ramadan, Muslims do not smoke during the fasting period as this will invalidate the fast. There is a paucity of evidence regarding the success of smoking cessation interventions during Ramadan but some small studies suggest that this may be a missed opportunity as there are lower rates of withdrawal symptoms, reduced number of cigarettes smoked, and an increased implementation of religious dictates. On the contrary, cultural practices such as communal meals and gatherings at the end of the fasting period may contribute to increased smoking and exposure of smokers and nonsmokers to second-hand smoke.

### 7.5 Fasting, Diabetes, and Cardiovascular Diseases, What Have We Learned from Recent Studies?

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**Introduction:** Despite the large number of people who fast during Ramadan, there are few studies on the impact of fasting during Ramadan on cardiovascular patients. During Ramadan, there is usually a change in the rhythm and quality of food and the circadian rhythm with a shorter nocturnal sleep period and an extension of the siesta period. All these changes certainly have an impact on patients with CVD and their treatment as well. This review aims to see the impact of Ramadan on diabetic patients with CVD.

**Method and Results:** We reviewed the literature and included several studies we have performed with our research group. In addition, we add the results of the DAR cardiovascular survey. This is to help HCPs educate and manage patients with cardiovascular conditions who are considering fasting. According to our review, fasting in Ramadan for patients with cardiac disease is safe in some studies and not in others. The risk of hypoglycemia could be high during fasting, and this may increase the risk of cardiac events. Several studies have even shown that the inflammatory phenomenon and endothelial dysfunction can be influenced by fasting. In addition, drug metabolism could change during the fasting month.

**Conclusion:** In PwD and CVD, research is limited. In addition, because of the behavioral changes in terms of diet, sleep, and medication administration, diabetic patients with CVD should be advised by their doctors several weeks before Ramadan to fast or not to fast and should be educated about precautions on drug intake. DAR score is very useful to guide physicians about the risk of fasting in this special population.

### 7.6 Ramadan Fasting and Congestive Heart Failure

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There is evidence from observational studies and clinical practice that patients with heart failure who are well compensated and asymptomatic can fast with appropriate precautions. Indeed, fluid restriction, which is the hallmark of outpatient heart failure therapy, would be even better complied with during Ramadan. In addition, there are two forms of heart failure with preserved and reduced ejection fraction, and the adjustment of medical therapy guidelines directing medical therapy during RF to comply with the fasting hours is not only feasible but easily implemented among most patients. Systematic reviews have also shown the safety of this approach. A particular focus on risk assessment and counseling before Ramadan requires specific clinical visits to evaluate volume status and heart failure functional capacity and biomarkers, including renal function and the N-terminal prohormone of brain natriuretic peptide. In addition, the detailed counseling of the patient on the reduction of diuretic dosing and also the management of SGLT2 inhibitors (which are a mainstay of the four pillars of medical therapy in HF, even in nondiabetic patients) is of critical importance during fasting to avoid complications and still maintain these lifesaving therapies—additionally counseling on the timing of CHF medications (that are twice daily in most cases) to coincide with the timing of breaking the fast and Suhoor.