

From presentations by:

Dr Nader Lessan

Consultant Endocrinologist,
Imperial College London
Diabetes Centre
Honorary Senior Lecturer,
Imperial College London

Dr Sueziani Binte Zainudin

Consultant Endocrinologist,
Sengkang General Hospital
Clinical Lecturer, Yong Loo Lin
School of Medicine, National
University of Singapore

**Professor Muhammad
Yakoob Ahmedani**

Professor of Medicine, Baqai
Medical University, Pakistan
Deputy Director: Baqai
Institute of Diabetology and
Endocrinology

**Dr Nazeer Ahmed
Mohamed**

Physician, Milpark Hospital,
Johannesburg

Professor Inass Shaltout

Professor of Internal Medicine
and Diabetes, Cairo University
President: Arabic Association
for the Study of Diabetes and
Metabolism

Dr Fatheya Al Awadi

Consultant Endocrinologist
Head: Endocrine Department,
Dubai Hospital
President: Emirates Diabetes
Society

Diabetes and Ramadan – practical guidance to ensure a safer fast



Learning objectives

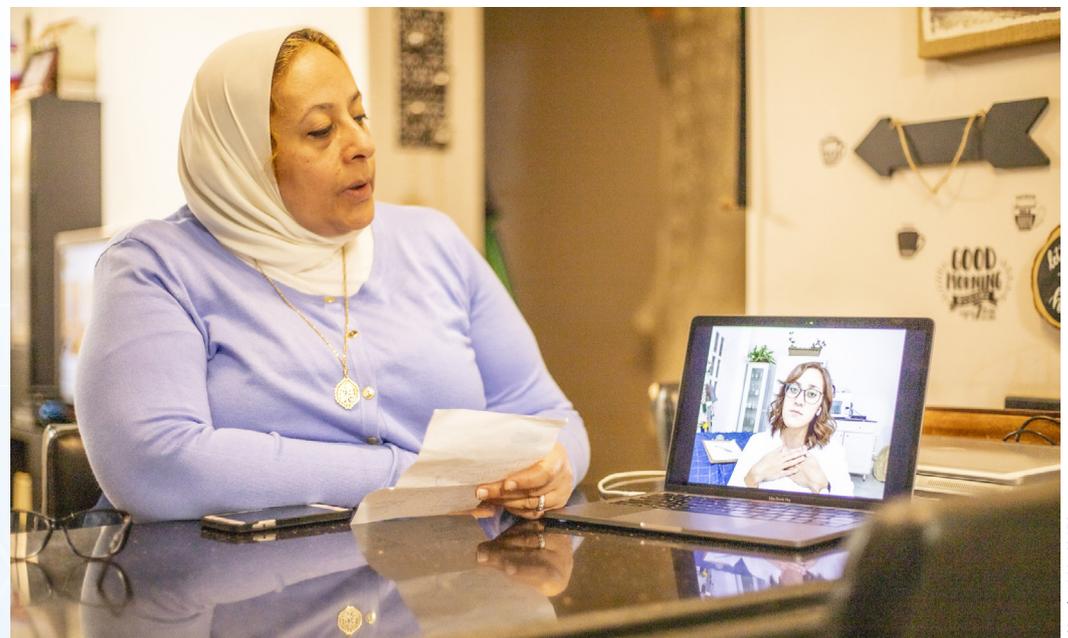
You will learn:

- How to prepare T2DM patients in your practice for fasting during Ramadan, particularly those who are on insulin
- How to apply the Diabetes and Ramadan International Alliance's (DAR) evidence-based guidance on achieving a safe and healthy fast for diabetes patients in your practice

Introduction

Fasting is an important component of Ramadan and allows Muslims to devote themselves to their faith. Followers must refrain from eating and drinking between dawn and sunset, and must also abstain from using oral medications, sexual activity and smoking. People who live with a medical condition can be exempted from fasting; however, a majority of people living with diabetes choose to fast, and some choose to do so contrary to medical advice.¹ Globally, there are approximately 150 million diabetic Muslims. Fasting may increase the risk of diabetic complications such as acute glycaemic events, hypoglycaemia, hyperglycaemia and diabetic ketoacidosis, as well as dehydration and thrombosis. These complications may be exacerbated by concurrent COVID-19 infection.²

By recently developing a comprehensive set of practical guidelines that provide real-world recommendations to healthcare professionals and those with diabetes who choose to fast, the International Diabetes Federation and the Diabetes and Ramadan (DAR) International Alliance have met the clear need for coherent, evidence-based guidance to ensure a safe and healthy fast in the population with diabetes.¹



©iStock-1222169476



This report was made possible by an unrestricted educational grant from Sanofi. The content of the report is independent of the sponsor.

What are the pathophysiological effects of Ramadan fasting?

Of interest, the recent DAR 2020 Global Survey indicated that hypoglycaemia occurred most frequently between 3pm and Iftar, followed by the time range between midday and 3pm. The least frequent timing of symptomatic hypoglycaemia was between Suhoor and 9am

Alteration of sleep patterns to accommodate the meal before fasting begins (Suhoor) and delayed sleep after the evening meal (Iftar) may give rise to sleep deprivation, which has been associated with decreased glucose tolerance and, of current interest, insulin resistance. Many hormone rhythms, including those of serum leptin, ghrelin, cortisol

Glycaemic changes during fasting

Depending on the duration of fasting, there are three distinct phases of glucose homeostasis: the post-absorptive phase lasts for 6-24 hours, the gluconeogenic phase lasts from days 1-10, and the protein conservation phase occurs if fasting lasts for more than 10 days. During fasting, circulating glucose levels fall and insulin secretion is suppressed. Glucagon and catecholamine secretion is increased, stimulating glycogenolysis and gluconeogenesis, which then leads to an increase in blood glucose levels. When glycogen stores are depleted and levels of insulin are low, fatty acids are released from adipocytes and oxidised to generate ketones. Earlier in the fasting day, there is a marked dominance of carbohydrate usage as the main source of fuel, whereas lipids become more important towards the afternoon as Iftar draws closer. In practice, most people who take their first meal at dawn are in a state of glycogen depletion by the late afternoon, at which point ketogenesis occurs. Omission of Suhoor leads to a depletion of glycogen stores and results

Effect of medication type

Continuous glucose monitoring (CGM) studies have indicated an increase in the mean amplitude of glycaemic excursions (MAGE) in the early stages of Ramadan compared to that of before Ramadan, but only in individuals taking two or more antidiabetic drugs and those using sulphonylureas (SUs). Increases in MAGE observed in early Ramadan are not evident in late-Ramadan and post-Ramadan. Insulin-treated individuals showed

and melatonin, alter with Ramadan fasting. Absolute restriction of fluid intake between dawn and sunset can have potentially important consequences, particularly for individuals with poorly controlled diabetes; a small study of an 18-hour period of fasting indicated a corresponding fluid deficit of 1.47kg for the period.^{1,3}

in a ketotic state much earlier in the fasting day.^{1,4}

When fasting, insulin resistance/deficiency can lead to excessive glycogen breakdown and increased gluconeogenesis in people with diabetes. The EPIDIAR study⁵ found that during Ramadan there was a 4.7-fold and 7.5-fold increase in the incidence of severe hypoglycaemic complications in people with type 1 diabetes (T1DM) and type 2 diabetes (T2DM), respectively, compared to non-Ramadan periods. The incidence of severe hyperglycaemia was also found to be increased during Ramadan (three-fold and five-fold in people with T1DM and T2DM, respectively). Of interest, the recent DAR 2020 Global Survey² indicated that hypoglycaemia occurred most frequently between 3pm and Iftar, followed by the time range between midday and 3pm. The least frequent timing of symptomatic hypoglycaemia was between Suhoor and 9am.

the least favourable glucose profile, followed by those treated with SUs. For people with non-insulin-treated T2DM, fasting during Ramadan was found not to cause any significant changes in glucose variability or time in hypoglycaemia compared to the non-fasting pre-Ramadan period. Those treated with metformin or not treated at all had the most favourable CGM profile.^{1,6}

Insulin-treated individuals showed the least favourable glucose profile, followed by those treated with SUs

Injectable therapy in Ramadan – T2DM

Insulin treatment

The administration of insulin via the subcutaneous, intramuscular or intravenous routes does not constitute a breaking of the Ramadan fast.

It is important to assess whether a different treatment regimen is necessary or whether dose adjustment of the insulins used prior to Ramadan is required; this will be determined by the patient's pre-Ramadan glycaemic control. Changing the treatment regimen for only the Ramadan period may lead to errors and non-adherence, and require additional education that is not readily available due to time and resource constraints. People who have controlled their diabetes well prior to Ramadan will usually require a dose reduction to minimise the risk of hypoglycaemia. This dose reduction is often not applicable in individuals with a history of poor control as insulin doses would probably be insufficient. DAR provides guidance for dose adjustment of long- and short-acting insulins (Figure 1) and for premixed insulins (Figure 2) for the T2DM patient who wishes to fast during Ramadan.¹

Patients need to be educated on self-monitoring of blood glucose (SMBG) and

self-titration of insulin doses to ensure safe fasting. Monitoring is dependent on the insulin regimen used. Those individuals at high risk or very high risk for hypoglycaemia should check their blood glucose levels several times throughout the day when fasting. Patients using premixed insulins should aim for at least 2-3 daily readings and also whenever hypoglycaemic symptoms appear; those using other insulin regimens should aim to use the seven-point blood glucose monitoring method.¹

There is some evidence that insulin analogues, when used in place of human insulin, can reduce the risk of hypoglycaemia during Ramadan fasting in patients with T2DM. Additionally, insulin analogues could be associated with a lower risk of postprandial hyperglycaemia when compared to human insulin. There are also practical advantages associated with insulin analogues in that they are injected just before a meal or even after a meal; individuals who are fasting can administer the injection at the time of Iftar or Suhoor, instead of 30 minutes prior to the meal. The starting dose of insulin analogues should be 20-30% lower than the dose of regular insulin.¹

People who have controlled their diabetes well prior to Ramadan will usually require a dose reduction to minimise the risk of hypoglycaemia

Changes to long- and short-acting insulin dosing during Ramadan

Long-/intermediate-acting (basal) insulin	Short-acting insulin
<p>NPH/detemir/glargine/glargine 300/degludec ONCE-DAILY Reduce dose by 15–30% Take at Iftar</p>	<p>Normal dose at Iftar Omit lunch-time dose Reduce Suhoor dose by 25–50%</p>
<p>NPH/detemir/glargine/ TWICE-DAILY Take usual morning dose at Iftar Reduce evening dose by 50% and take at Suhoor</p>	

Fasting/pre-Iftar/pre-Suhoor blood glucose	Pre-Iftar	Pre-Iftar*/Post-Suhoor**
	Basal insulin	Short-acting insulin
<70mg/dl (3.9mmol/l) or symptoms	Reduce by 4 units	Reduce by 4 units
<90mg/dl (5.0mmol/l)	Reduce by 2 units	Reduce by 2 units
90–126mg/dl (5.0–7.0mmol/l)	No change required	No change required
>126mg/dl (7.0mmol/l)	Increase by 2 units	Increase by 2 units
>200mg/dl (16.7mmol/l)	Increase by 4 units	Increase by 4 units

*Reduce the insulin dose taken before Suhoor; **Reduce the insulin dose taken before Iftar

Figure 1. Dose adjustments for long- and short-acting insulins¹

EARN FREE CPD POINTS

Join our CPD community at

www.denovomedica.com

and start to earn today!

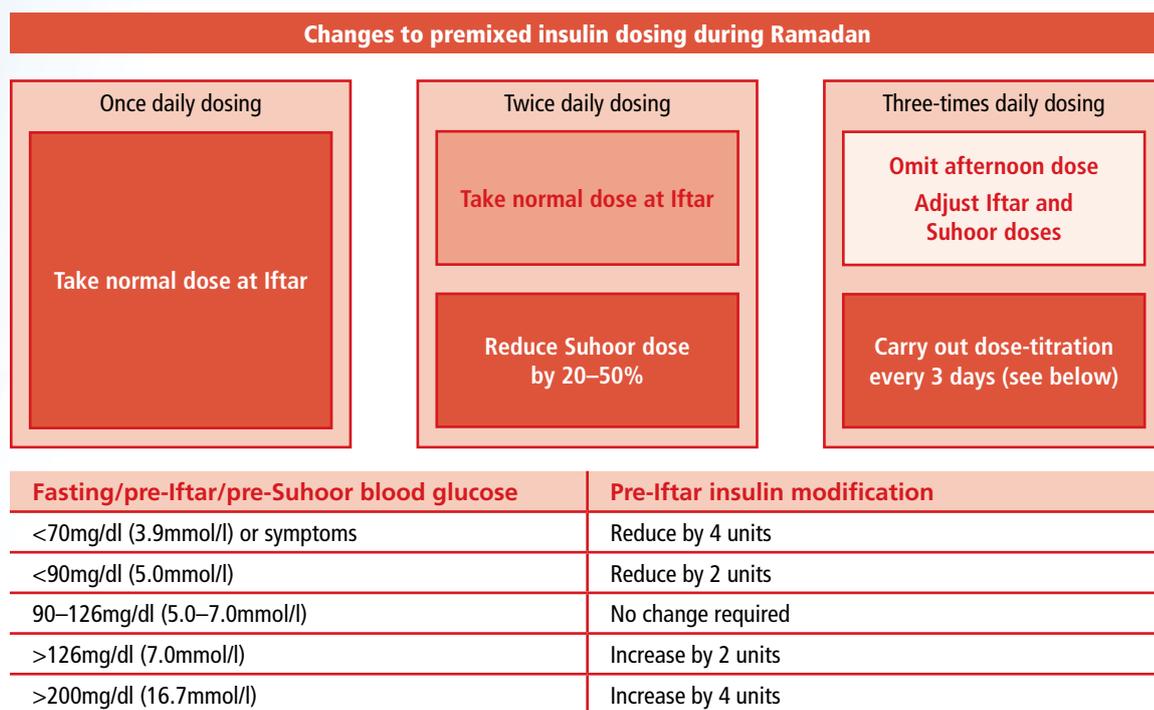


Figure 2. Dose adjustments for premixed insulin¹

What is the evidence for insulin use during Ramadan?

There is an increasing body of evidence supporting the safety of basal insulin in T2DM patients who are fasting during Ramadan. Two small observational studies found no evidence of increased risk of hypoglycaemia in individuals using insulin glargine during Ramadan when compared with non-fasting individuals or those using oral antidiabetic drugs.^{7,8} The ORION trial,⁹ a larger prospective observational study across 11 countries, demonstrated that insulin glargine-300 could be used safely in combination with oral agents in a real-world clinical setting. In this study, the majority of participants fasted for the full month of Ramadan and there was a low incidence of symptomatic hypoglycaemia and no episodes of severe hypoglycaemia. ORION also demonstrated that glycaemic control can be successfully intensified in the Ramadan period without any additional risk of hypoglycaemia.

Premixed insulins that combine short- and intermediate-acting insulins can be more convenient for individuals with diabetes as they require fewer injections than basal-bolus regimens. However, premixed insulins may be associated with a higher risk of hypoglycaemia in non-fasting individuals.^{10,11} The commonest premixed insulin formulations are low-ratio premixed insulins with 25–30% short-/rapid-acting insulin and 70–75%

intermediate-acting insulin. This poses a challenge during Ramadan as the lower ratio of short-/rapid-acting insulin may provide inadequate prandial cover in the evening for the resultant postprandial hyperglycaemia. Since the dose of prandial insulin cannot be independently adjusted, there is also a risk of both postprandial hyperglycaemia and hypoglycaemia after the morning meal.¹

A regimen of premixed insulin lispro Mix50 (50% lispro and 50% lispro protamine) in the evening and regular human insulin with natural protamine Hagedorn (NPH) (30:70) in the morning was compared with regular human insulin with NPH (30:70) given twice daily during Ramadan in a small observational study. Switching the evening meal dose to insulin lispro Mix50 significantly improved glycaemic control without increasing the incidence of hypoglycaemic events.¹² A new regimen in which 40% of the daily insulin dose was given as insulin detemir at Suhoor and 60% as a biphasic insulin aspart before Iftar was assessed in a randomised study. The new regimen was found to be non-inferior to standard care with a significantly lower hypoglycaemic event rate.¹³ These studies demonstrate that in appropriately selected individuals, premixed insulin can be safely used when fasting during Ramadan.¹

ORION also demonstrated that glycaemic control can be successfully intensified in the Ramadan period without any additional risk of hypoglycaemia

Glucagon-like peptide-1 receptor agonists (GLP-1 RAs)

GLP-1 RAs act in a glucose-dependent manner and so the risk of severe hypoglycaemia is low when used as monotherapy, but this risk may be higher when they are given with SUs

or insulin. If GLP-1 RA therapy has already been appropriately dose-titrated at least 2-4 weeks prior to Ramadan, no further treatment modification is required.¹

What is the evidence for GLP-1 RA use during Ramadan?

A number of studies on the use of GLP-1 RAs during Ramadan have been published. The safety and efficacy of liraglutide was examined in the TREAT4¹⁴ and LIRA-Ramadan¹⁵ studies. Compared to SUs, more individuals using liraglutide in the TREAT4 study achieved the primary outcome of HbA_{1c} <7%, no weight gain and no severe hypoglycaemic events, with reductions in HbA_{1c} and weight being statistically significant. The LIRA-Ramadan study did show statistical significance for fewer confirmed hypoglycaemic episodes in patients using liraglutide, rather than SUs, as an add-on to metformin.

The recent LixiRam study¹⁶ was conducted in people with insufficiently controlled T2DM who intended to fast during Ramadan. Individuals were treated with lixisenatide,

as an add-on to basal insulin or with SUs together with basal insulin and one oral glucose-lowering agent. Compared to SUs, those using lixisenatide had fewer documented symptomatic hypoglycaemic events, which was not statistically significant in subgroup analysis;¹⁷ but the difference was statistically significant for ‘any hypoglycaemia’. Changes in body weight and HbA_{1c} were similar in both treatment arms.

These studies demonstrate that liraglutide and lixisenatide are safe as an add-on treatment to pre-existing antidiabetic regimens, including metformin and insulin. Data on exenatide are limited to one study but the short duration of action and dosing of exenatide suggest that as with liraglutide, the risk of hypoglycaemia during Ramadan is low.¹

If GLP-1 RA therapy has already been appropriately dose-titrated at least 2-4 weeks prior to Ramadan, no further treatment modification is required

How important is monitoring of blood glucose during Ramadan?

The frequency of SMBG depends on many factors, including the type of diabetes and current medications, but should be carried out regularly by all. It is important for all people with diabetes to measure blood glucose levels after Iftar to detect postprandial hyperglycaemia, and also whenever they

experience symptoms of hypoglycaemia, hyperglycaemia, or feel unwell. SMBG once or twice a day may be sufficient for those at moderate or low risk; those at high or very high risk should check their blood glucose levels several times a day.^{1,18}

Pre-Ramadan assessment

Ideally, a pre-Ramadan assessment needs to take place 6-8 weeks before the start of Ramadan (Figure 3). A detailed medical history and a risk assessment (Table 1) will form the basis of all recommendations thereafter; this includes advice on whether fasting is safe (low- or moderate-risk scores) or not (high-risk score), strategies for dose modifications and treatment regimen adjustments, the provision of Ramadan-focused education and nutritional advice. Factors that may influence the development of a personalised care

plan for diabetics who choose to fast during Ramadan are listed in Table 2.

It is recommended that a post-Ramadan follow up also be performed, as crucial information about the individual’s successes and challenges may ensure that Ramadan fasting the following year can be more successful. The pre- and post-Ramadan follow-up must be undertaken each Ramadan as successful fasting in one year does not guarantee success the following year.¹

EARN FREE CPD POINTS

Join our CPD community at

www.denovomedia.com

and start to earn today!

The pre- and post-Ramadan follow-up must be undertaken each Ramadan as successful fasting in one year does not guarantee success the following year

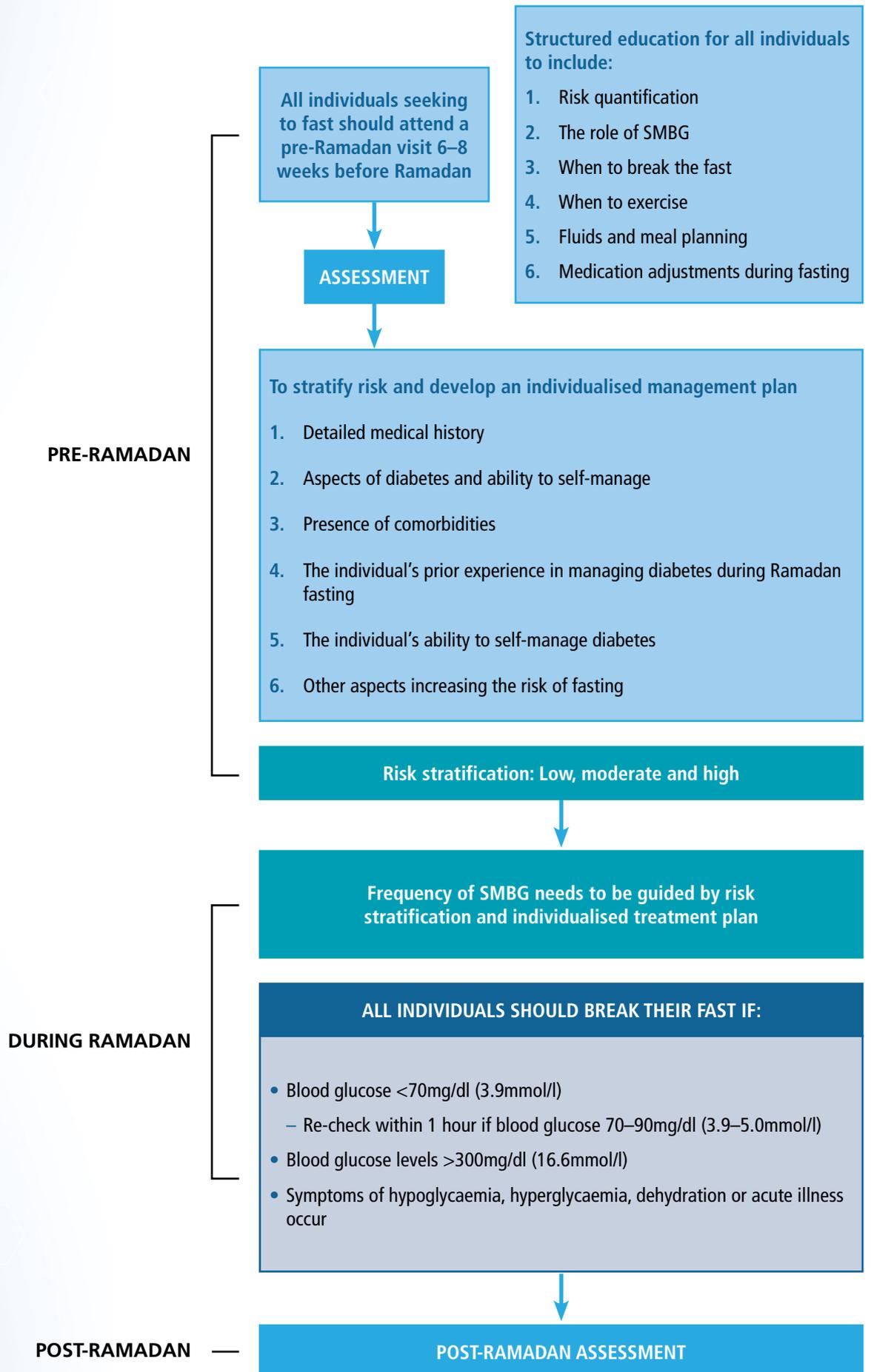


Figure 3. Assessment of diabetes patients wanting to fast during Ramadan¹

Table 1. Elements for risk calculation and suggested risk scores for people with diabetes seeking to fast during Ramadan¹*A risk score of 0-3 indicates low risk, 3.5-6 indicates moderate risk, and >6 indicates high risk*

Risk element		Risk score
Diabetes type and duration	Type 1 diabetes	1
	Type 2 diabetes	0
	Duration ≥10 years	1
	Duration ≤10 years	0
Presence of hypoglycaemia	Hypoglycaemia unawareness	5
	Recurrent/severe hypoglycaemia	4
	Daily mild hypoglycaemia	3
	Hypoglycaemia 1-6 times per week	2
	Hypoglycaemia <1 per week	1
	No hypoglycaemia	0
Characteristics of glycaemic control	HbA _{1c} >9% (11.7mmol/l)	2
	HbA _{1c} 7.5-9% (9.4-11.7mmol/l)	1
	HbA _{1c} <7.5% (9.4mmol/l)	0
SMBG	Indicated but not conducted	2
	Indicated but conducted suboptimally	1
	Conducted as indicated	0
Acute complications <i>DKA: diabetic ketoacidosis</i> <i>HONC: hyperglycaemic hyperosmolar nonketotic coma</i>	DKA/HONC in last three months	3
	DKA/HONC in last six months	2
	DKA/HONC in last 12 months	1
	No DKA or HONC	0
Chronic complications/ comorbidities	Unstable angina/heart failure/eGFR <30ml/min/1.73m ²	6
	eGFR 30-45ml/min/1.73m ²	4
	Stable CVD/eGFR 45-60ml/min/1.73m ²	2
	No CVD and normal eGFR	0
Pregnancy	Pregnant not within targets	4
	Pregnant within targets	2
	Not pregnant	0

**EARN FREE
CPD POINTS**

Join our CPD community at

www.denovomedica.com

and start to earn today!

Frailty and cognitive function	Impaired cognitive function	4
	Frail	3
	>70 years old with no home support	1
	No frailty or loss in cognitive function	0
Physical labour	Intense physical labour	1
	No physical labour	0
Previous Ramadan experience	Overall negative experience	1
	No negative or positive experience	0
Fasting hours (location)	≥16 hours	1
	<16 hours	0
Diabetes treatment	Multiple daily mixed insulin injections	3
	Basal-bolus/Insulin pump	2.5
	Once-daily mixed insulin	2
	Basal insulin	1.5
	Glibenclamide	1
	Gliclazide/MR or glimepiride or repaglinide	0.5
	Other therapy not including SU or insulin	0

Table 2. Recognised factors that may influence the development of a personalised fasting care plan during Ramadan¹

Ramadan-related factors	Diabetes-related factors	Factors concerning the individual
<ul style="list-style-type: none"> • Length of daylight fasting hours • Season of fasting • Weather • Geographical location • Social changes • Past experiences 	<ul style="list-style-type: none"> • Type of diabetes • Duration of diabetes • Diabetic complications • Antidiabetic therapies • Previous control • Proneness to hypoglycaemia • Hypoglycaemic unawareness • Access to care 	<ul style="list-style-type: none"> • Age (adolescents and elderly) • Gender • Occupation • Pregnancy/lactation • Meal pattern • Exercise nature/timing • Motivation • Personal preferences

What is the objective of Ramadan-focused education?

The objective of Ramadan-focused education is to raise awareness of the risks associated with diabetes and fasting and to provide strategies to minimise them. Education should be simple, engaging and delivered in a culturally

sensitive manner by well-informed individuals. Key areas of diabetes education that should be provided prior to Ramadan are listed in Figure 3.^{1,19-21}

What is the role of technology in Ramadan education?

COVID-19 presents new challenges for face-to-face interactions and clinical follow-up. Teleconsultation, telemedicine and telemonitoring have all been identified as effective modes of managing the needs of people with diabetes and have been shown to enhance education and SMBG. Recent studies have

demonstrated that delivering online educational courses via smartphone applications and SMS could be a preferred mode of educating individuals about their diabetes and interacting directly with their healthcare providers; these tools can also reduce the need for multiple visits to clinics.^{1,22,23}

What is the epidemiology of diabetes and Ramadan fasting?

Several studies have investigated the frequency of fasting during Ramadan among people with diabetes. EPIDIAR (Ramadan 2001)⁵ and CREED (Ramadan 2010)²⁴ were retrospective population-based studies; DAR-MENA (Ramadan 2016)^{25,26} and the DAR 2020 Global Survey² were prospective observational studies. The rates of Ramadan fasting among the various study participants with T2DM have remained relatively stable over the last two decades, with 83.5-89.7% intending to fast.

Even though they are categorised as high and very high risk for the development of specific complications during Ramadan fasting, there

is a trend in recent years that shows more adults with T1DM choosing to fast, with a clear increase in individuals being able to fast for at least 15 days of Ramadan. Of the DAR 2020 Global Survey participants, approximately one-quarter of T1DM participants completed the entire 30 days of fasting.

Concerns about the ongoing COVID-19 pandemic have not influenced the decision to fast in 91.5% of the DAR 2020 Global Survey participants; however, of those who agreed that COVID-19 had affected their decision to fast, a significantly greater proportion were older than 65 years.²

People with diabetes experience both positive and negative mental and psychological outcomes when fasting during Ramadan

What are the potential effects of Ramadan fasting on mental wellbeing?

People with diabetes experience both positive and negative mental and psychological outcomes when fasting during Ramadan. Mental benefits of fasting during Ramadan may include a sense of fulfilment in participating in all aspects of Ramadan, improvements in self-control and ability to resist temptations, a greater sense of empathy with those less fortunate, a greater sense of community and

an opportunity to strengthen relationships. Sleep deprivation and disruption of circadian rhythm can lead to a reduction in cognition and greater feelings of lethargy, and some diabetic patients participating in Ramadan fasting report short-term feelings of stress, anxiety, irritability and agitation. There may also be a heightened fear of diabetes-related complications.^{1,8,24,27}

EARN FREE CPD POINTS

Join our CPD community at

www.denovomedica.com

and start to earn today!



Key learnings

- T2DM patients on insulin and sulphonylureas are at particular risk during their Ramadan fasting
- Assess your patients early and ensure that patients adapt their insulin dosages and monitoring practices appropriately
- GLP-1 RA's are very useful antidiabetic agents as clinical trials, such as LixiRam with lixisenatide, have shown fewer hypoglycaemic events in basal insulin-using patients being treated with this GLP-1 RA during Ramadan fasting.

NOW EARN FREE CPD POINTS



Click here to access and submit deNovo Medica's CPD modules

References

Click on reference to access the scientific article

1. International Diabetes Federation, in collaboration with the Diabetes and Ramadan International Alliance. Diabetes and Ramadan Practical Guidelines 2021.
2. Hassanein M, Hussein Z, Shaltout I, et al. The DAR 2020 Global survey: Ramadan fasting during COVID 19 pandemic and the impact of older age on fasting among adults with type 2 diabetes. *Diab Res Clin Pract* 2021 (in press).
3. Danielsson EJD, Lejbman I, Akeson J. Fluid deficits during prolonged overnight fasting in young healthy adults. *Acta Anaesthesiol Scand* 2019; **63**(2): 195-199.
4. Lessan N, Ali T. Energy metabolism and intermittent fasting: The Ramadan perspective. *Nutrients* 2019; **11**(5): 1192.
5. Salti I, Benard E, Detournay B, et al. A population-based study of diabetes and its characteristics during the fasting month of Ramadan in 13 countries: results of the epidemiology of diabetes and Ramadan 1422/2001 (EPIDIAR) study. *Diabetes Care* 2004; **27**(10): 2306-2311.
6. Aldawi N, Daewiche G, Abusnana S, et al. Initial increase in glucose variability during Ramadan fasting in noninsulin-treated patients with diabetes type 2 using continuous glucose monitoring. *Libyan J Med* 2019; **14**(1): 1535747.
7. Bakiner O, Ertorer ME, Bozkirli E, et al. Repaglinide plus single-dose insulin glargine: a safe regimen for low-risk type 2 diabetic patients who insist on fasting in Ramadan. *Acta Diabetol* 2009; **46**(1): 63-65.
8. Cesur M, Corapcioglu D, Gursoy A, et al. A comparison of glycemic effects of glimepiride, repaglinide, and insulin glargine in type 2 diabetes mellitus during Ramadan fasting. *Diabetes Res Clin Pract* 2007; **75**(2): 141-147.
9. Hassanein M, Buyukbese MA, Malek R, et al. Real-world safety and effectiveness of insulin glargine 300 U/mL in participants with type 2 diabetes who fast during Ramadan: The observational ORION study. *Diabetes Res Clin Pract* 2020; **166**: 108189.
10. Bellido V, Suarez L, Rodriguez MG, et al. Comparison of basal-bolus and premixed insulin regimens in hospitalized patients with type 2 diabetes. *Diabetes Care* 2015; **38**(12): 2211-2216.
11. Mosenzon O, Raz I. Intensification of insulin therapy for type 2 diabetic patients in primary care: Basal-bolus regimen versus premix insulin analogs - When and for whom? *Diabetes Care* 2013; **36**(Suppl 2): S212-S218.
12. Hui E, Bravis V, Salih S, et al. Comparison of Humalog Mix 50 with human insulin Mix 30 in type 2 diabetes patients during Ramadan. *Int J Clin Pract* 2010; **64**(8): 1095-1099.
13. Shehadeh N, Maor Y, Ramadan Study Group. Effect of a new insulin treatment regimen on glycaemic control and quality of life of Muslim patients with type 2 diabetes mellitus during Ramadan fast - an open label, controlled, multicentre, cluster randomised study. *Int J Clin Pract* 2015; **69**(11): 1281-1288.
14. Brady EM, Davies MJ, Gray LJ, et al. A randomized controlled trial comparing the GLP-1 receptor agonist liraglutide to a sulphonylurea as add on to metformin in patients with established type 2 diabetes during Ramadan: the Treat 4 Ramadan trial. *Diabetes Obes Metab* 2014; **16**(6): 527-536.
15. Khalifa A, El Rashid A, Bashier A. Safety and efficacy of liraglutide as an add-on therapy to pre-existing anti-diabetic regimens during Ramadan, a prospective observational trial. *J Diabetes Metab* 2015; **6**(9): 590.
16. Hassanein M, Sahay R, Hafidh K, et al. Safety of lixisenatide versus sulfonylurea added to basal insulin treatment in people with type 2 diabetes mellitus who elect to fast during Ramadan (LixiRam): An international, randomized, open-label trial. *Diabetes Res Clin Pract* 2019; **150**: 331-341.
17. Sahay R, Hafidh K, Djaballah K, et al. Safety of lixisenatide plus basal insulin treatment regimen in Indian people with type 2 diabetes mellitus during Ramadan fast: A post hoc analysis of the LixiRam randomized trial. *Diabetes Res Clin Pract* 2020; **163**: 108148.
18. McEwen LN, Ibrahim M, Ali NM, et al. Impact of an individualized type 2 diabetes education program on clinical outcomes during Ramadan. *BMJ Open Diabetes Res Care* 2015; **3**(1): e000111.
19. Zainudin SB, Abu Bakar KNB, Abdullah SB, et al. Diabetes education and medication adjustment in Ramadan (DEAR) program prepares for self-management during fasting with tele-health support from pre-Ramadan to post-Ramadan. *Ther Adv Endocrinol Metab* 2018; **9**(8): 231-240.
20. Shaltout I, Zakaria A, Abdelwahab AM, et al. Culturally based pre-Ramadan education increased benefits and reduced hazards of Ramadan fasting for type 2 diabetic patients. *J Diabetes Metab Disord* 2020; **19**(1): 179-186.
21. Bravis V, Hui E, Salih S, et al. Ramadan Education and Awareness in Diabetes (READ) programme for Muslims with type 2 diabetes who fast during Ramadan. *Diabet Med* 2010; **27**(3): 327-331.
22. Hassanein M, Abdelgadir E, Bashier A, et al. The role of optimum diabetes care in form of Ramadan focused diabetes education, flash glucose monitoring system and pre-Ramadan dose adjustments in the safety of Ramadan fasting in high risk patients with diabetes. *Diabetes Res Clin Pract* 2019; **150**:

- 288-295.
23. Gad H, Al-Muhannadi H, Purra H, *et al.* The effect of Ramadan focused education on patients with type 2 diabetes: A systematic review and meta-analysis. *Diabetes Res Clin Pract* 2020; **162**: 108122.
 24. Jabbar A, Hassanein M, Beshyah SA, *et al.* CREED study: Hypoglycaemia during Ramadan in individuals with type 2 diabetes mellitus from three continents. *Diabetes Res Clin Pract* 2017; **132**: 19-26.
 25. Al Awadi F, Eghtay A, Al Arouj M, *et al.* Patterns of diabetes care among people with type 1 diabetes during Ramadan: An international prospective study (DAR-MENA T1DM). *Adv Ther* 2020; **37**(4): 1550-1563.
 26. Hassanein M, Al Awadi FF, El Sayed El Hadidy K, *et al.* The characteristics and pattern of care for the type 2 diabetes mellitus population in the MENA region during Ramadan: An international prospective study (DAR-MENA T2DM). *Diabetes Res Clin Pract* 2019; **151**: 275-284.
 27. Al-Ozairi E, Al Awadhi MM, Al-Ozairi A, *et al.* A prospective study of the effect of fasting during the month of Ramadan on depression and diabetes distress in people with type 2 diabetes. *Diabetes Res Clin Pract* 2019; **153**: 145-149.

EARN FREE CPD POINTS

Are you a member of Southern Africa's leading digital Continuing Professional Development website earning FREE CPD points with access to best practice content?

Only a few clicks and you can register to start earning today

Visit

www.denovomedia.com

For all Southern African healthcare professionals

deNovo Medica

Find us at



DeNovo Medica



@deNovoMedica



deNovo Medica

This CPD-accredited programme was written by Glenda Hardy Bsc (Hons) Medical Cell Biology, on behalf of *deNovo Medica* based on the presentations from the 9th DaR International Alliance Conference, 21-22 January 2021 (virtual conference)

Disclaimer

The views and opinions expressed in the article are those of the presenters and do not necessarily reflect those of the publisher or its sponsor. In all clinical instances, medical practitioners are referred to the product insert documentation as approved by relevant control authorities.

Published by

© 2021 **deNovo Medica**
Reg: 2012/216456/07

70 Arlington Street, Everglen, Cape Town, 7550
Tel: (021) 976 0485 | info@denovomedia.com