



Ramadan and Diabetes

Guide to a safe fast

Before deciding to fast, please read this guide and consult your doctor or diabetes management team

The month of Ramadhan [is that] in which was revealed the Qur'an, a guidance for the people and clear proofs of guidance and criterion. So whoever sights [the new moon of] the month, let him fast it; and whoever is ill or on a journey - then an equal number of other days. Allah intends for you ease and does not intend for you hardship and [wants] for you to complete the period and to glorify Allah for that [to] which He has guided you; and perhaps you will be grateful.

Chapter (2) sūrat I-baqarah (The Cow), Verse (2:185)



**International
Diabetes
Federation**



Fasting during Ramadan: A Comprehensive Review for Primary Care Providers

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The holy month of Ramadan (one of the five pillars of Islam) falls on the ninth month of the lunar calendar.

Fasting from dawn to sunset is a key component of Ramadan.

While this is practiced by millions of people globally, some health conditions such as diabetes can make this practice more challenging.

Comprehensive guidelines have been recently published by the International Diabetes Federation .

A survey of 262 family physicians in Turkey indicated only 22% stated they were aware of international guidelines for Ramadan and diabetes management, and only 10% acknowledged having referred to the guidelines .

Although intermittent fasting and timerestricted eating are specific dietary strategies for energy restriction, religious fasting has been practiced for thousands of years and is part of many faith-based traditions. Duration, frequency, and type of fast vary among different religions . For example, ***Jewish people abstain from any intake for 25 h during Yom Kippur . For Muslims, Ramadan fasting lasts for a full month, when abstinence from any food or drink is required from dawn to dusk .*** Individuals with diabetes who fast have an increased risk for hypoglycemia, dehydration, hyperglycemia, and ketoacidosis

Prefasting risk assessment is essential to increase level of safety .

Various risk factors need to be considered for every individual wishing to fast. Some of these factors are related to the type of fast, type of diabetes, and/or the individual. Indeed, health care professionals should inquire about any religious fasting for people with diabetes and provide education and support to accommodate their choice. The number of days of fasting is an important factor to consider. In Ramadan fasting, a person fasts from dawn to dusk for a lunar month (29–30 days). It is important for the health care professional to comprehensively assess these risk factors well in advance of fasting date, as some of them are modifiable.

Fasts vary from 10 to 18 or more hours depending on location and seasonal variations .

In addition to fasting, many Muslims continue to work during the day and may alter their sleep schedule to participate in extra night prayers known as Taraweeh, which can involve hours of standing in congregational prayer.

According to the Epidemiology of Diabetes and Ramadan (EPIDIAR) study conducted during 2001, of 12,243 subjects with type 1 and type 2 diabetes in 13 countries, “42.8% of patients with type 1 diabetes and 78.7% of patients with type 2 diabetes reported fasting at least 15 days during Ramadan” . This includes individuals with diabetes who may have been advised to abstain from fasting due to the threat of adverse health outcomes.

Given that many Muslims with diabetes choose to fast, health practitioners must be prepared to tailor therapeutic and lifestyle management to the rigors of a 10–18 h fast.

Since the last publications related to this topic, this review article covers updated current guidelines in addition to discussing the metabolic effects of Ramadan fasting and diabetes management.

While many Muslims feel an obligation to fast in honor of the tradition and for spiritual attainment, Muslim religious scholars have derived exceptions for various populations based on holy texts. Holy Quran Sura 2 verses 183–185 clearly exempts certain categories from fasting including individuals with chronic illnesses in who fasting may be detrimental to health.

In 2005, and updated in 2010, the American Diabetes Association (ADA) published guidelines for the management of diabetes during Ramadan fasting, stratifying patients into four risk categories: very high, high, moderate, and low, based on diabetes type, glycemic control, and comorbidities .

In 2009, a collection of Muslim scholars including the 19th session of the Council of International Fiqh upheld this stratification and the avoidance of fasting in the very high- or high-risk categories .

The International Diabetes Federation (IDF) and Diabetes and Ramadan Alliance (DAR) have formulated comprehensive guidelines for health professionals caring for diabetes patients who observe Ramadan fast.

International Diabetes Federation-diabetes and Ramadan risk categories and recommendations for patients with diabetes who fast during Ramadan (Adopted from Hassanein *et al.* [2] with permission)

| Risk category and religious opinion on fasting* | Patient characteristics | Comments |
|---|--|--|
| <p>Category 1: very high risk</p> <p>Listen to medical advice MUST NOT fast</p> | <p>One or more of the following:</p> <ul style="list-style-type: none"> • Severe hypoglycemia within the 3 months prior to Ramadan^b • Unexplained DKA within the 3 months prior to Ramadan • Hyperosmolar hyperglycemic coma within the 3 months prior to Ramadan • History of recurrent hypoglycemia • History of hypoglycemia unawareness • Poorly controlled T1DM • Acute illness • Pregnancy in pre-existing diabetes, or GDM treated with insulin or SUs • Chronic dialysis or CKD stage 4 & 5 • Advanced macrovascular complications • Old age with ill health | <p>If patients insist on fasting, then they should:</p> <ul style="list-style-type: none"> • Receive structured education • Be followed by a qualified diabetes team • Check their blood glucose regularly (SMBG) • Adjust medication dose as per recommendations • Be prepared to break the fast in case of hypo- or hyperglycemia • Be prepared to stop the fast in case of frequent hypo- or hyperglycemia or worsening of other related medical conditions |
| <p>Category 2: high risk</p> <p>Listen to medical advice</p> <p>Should NOT fast</p> | <p>One or more of the following:</p> <ul style="list-style-type: none"> • T2DM with sustained poor glycemic control^c • Well-controlled T1DM • Well-controlled T2DM on MDI or mixed insulin • Pregnant T2DM or GDM controlled by diet only or metformin • CKD stage 3 • Stable macrovascular complications • Patients with comorbid conditions that present additional risk factors • People with diabetes performing intense physical labor • Treatment with drugs that may affect cognitive function | |
| <p>Category 3: moderate/low risk</p> <p>Listen to medical advice</p> <p>Decision to use licence not to fast based on discretion of medical opinion and ability of the individual to tolerate fast</p> | <p>• Well-controlled T2DM treated with one or more of the following:</p> <ul style="list-style-type: none"> ◦ Lifestyle therapy ◦ Metformin ◦ Acarbose ◦ Thiazolidinediones ◦ Second-generation SUs ◦ Incretin-based therapy (DPP-4 inhibitors or GLP-1 RAs) ◦ SGLT2 inhibitors ◦ Basal insulin | <p>Patients who fast should:</p> <ul style="list-style-type: none"> • Receive structured education • Check their blood glucose regularly (SMBG) • Adjust medication dose as per recommendations |

CKD: Chronic kidney disease, DAR: Diabetes and Ramadan International Alliance, DKA: Diabetic ketoacidosis, DPP-4: Dipeptidyl peptidase-4, GDM: Gestational diabetes mellitus, GLP-1 RA: Glucagon-like peptide-1 receptor agonist, IDF: International Diabetes Federation, MDI: Multiple dose insulin, SGLT2: Sodium-glucose co-transporter-2, SMBG: Self-monitoring of blood glucose, SU: Sulphonylurea, T1DM: Type 1 diabetes mellitus, T2DM: Type 2 diabetes mellitus. ^aIn all categories: people with diabetes should follow medical opinion if the advice is not to fast due to high probability of harm. ^bHypoglycemia that is not due to accidental error in insulin dose. ^cThe level of glycemic control is to be agreed upon between doctor and patient according to a multitude of factors

Understand your risk category

CATEGORY 1 Very High Risk

MUST NOT FAST

If you have one or more of the following:

- Severe and repeated low blood glucose events three months before Ramadan
- Diabetic ketoacidosis
- Kidney problems
- Poorly controlled type 1 diabetes
- Acute illness
- Pregnancy
- Heart problems
- Old age with ill health

CATEGORY 2 High Risk

SHOULD NOT FAST

If you have one or more of the following:

- Poorly controlled type 2 diabetes
- Type 1 or type 2 diabetes treated with single or multiple insulin injections
- Pregnancy
- Kidney problems, other complications of diabetes or other diseases
- A physically demanding occupation
- Treatment with drugs that may affect mental function

CATEGORY 3 Moderate/Low Risk

Decision to use license not to fast based on discretion of medical opinion and your ability to tolerate fast.

If you have well-controlled type 2 diabetes treated with one or more of the following:

- Lifestyle therapy
- Tablets and injectable medicines such as insulin

Whichever category you fall under, **consult your doctor before deciding to fast.**

For patients who are in the moderate and low risk categories, the decision to fast should be practiced after discussion with a physician

While Ramadan is a month of fasting, the **consumption of high-calorie, high-fat, and carbohydrate-rich foods is common during the non-fasting hours in most cultures .**

Muslims around the globe cook and serve traditional Suhoor and Iftar meals, in addition to snacks that may be consumed between the two meals at night. Often, these meals may contain an excess of simple carbohydrates, syrups, and oils. In a study of 30 Tunisian male participants, it was found that caloric intake increased with a decreased frequency of meals.

This included increased mono-unsaturated fatty acids, poly-unsaturated fatty acids, and cholesterol intake .

Furthermore, individuals may alter their daily activities to include less exercise to stave off dehydration, especially if they are fasting in hotter climates.

The **normal human physiology** in the fed state functions with an increase in secretion of insulin by the beta cells of the pancreas after consumption of a meal with simultaneous inhibition of glucagon secretion due to paracrine effect on the alpha cells.

Insulin stimulates hepatic and muscle glucose uptake and glycogen synthesis

. During fasting in healthy individuals, **as glucose levels fall in the first few hours of fasting, insulin secretion is suppressed.**

As glucose levels fall below the physiological range (**65–70 mg/dL or 3.6–3.9 mmol/L**), glucagon and epinephrine are secreted . **These counterregulatory hormones stimulate hepatic glycogenolysis and gluconeogenesis to maintain glucose within the physiological range.** As duration of fasting progresses to 12–36 h, the hepatic glycogen stores are depleted, and lipolysis of adipose tissues ensues with release of fatty acids . This metabolic switch in glucose metabolism occurs whereby the liver converts the fatty acids to ketones, beta-hydroxybutyrate (β -OHB) and acetoacetate which are used as an alternate source of fuel for the brain, muscle, erythrocytes, and other tissues

In individuals with **type 2 diabetes** where **insulin resistance** is a primary defect, the metabolic switch may be delayed, resulting in a longer duration to generate fatty acid for energy .

This can potentiate **hypoglycemia** with Ramadan fasting that lasts 12–18 h when compared to fasting that may last for 10 h.

Hyperglucagonemia as seen in type 2 diabetes, when accompanied by consumption of high glycemic index foods at sunset meal (Iftar) can contribute to **hyperglycemia** .

Know your potential risk while fasting



Low blood sugar (Hypoglycaemia)



Sweating,
shaking



Fast pulse,
heart rate



Irritability,
anxiety



Dizziness



Tingling of
the lips



Fatigue



High blood sugar (Hyperglycaemia)



Extreme
tiredness



Increased
thirst



Headache



Blurred
vision



Fruity-scented
breath



Going to the
toilet more
often

Dehydration

- ◆ Increased thirst
- ◆ Not going to the toilet as often
- ◆ Dry mouth, lips and skin

Diabetic Ketoacidosis

- ◆ Fruity-scented breath
- ◆ Dryness of mouth
- ◆ Excessive thirst

In **type 1 diabetes** with absolute insulin deficiency and late stages of type 2 diabetes with progressive beta-cell failure, augmented gluconeogenesis and ketogenesis resulting in significant hyperglycemia can occur in the absence of exogenous insulin.

As these patients also demonstrate impaired counterregulatory hormone responses to hypoglycemia and/or experience hypoglycemia unawareness, they are at risk for severe hypoglycemia [16]. Thus, **people with diabetes** are at higher risk of **complications such as hypoglycemia, hyperglycemia, diabetic ketoacidosis, dehydration, and thrombosis**

It is well known that there are **daytime variations** in glucose tolerance in healthy individuals with decreased glucose tolerance and reduced insulin sensitivity in the later part of the day.

The **dawn phenomenon**, an increase in blood glucose levels and/or insulin requirements in the early morning hours, occurs at a greater magnitude in individuals with diabetes.

In patients with diabetes who on more than two medications, especially those with hypoglycemic potential (e.g., sulfonylureas and secretagogues), have been observed to have an increase in the mean amplitude of glycemic excursion(MAGE) in the early stages of Ramadan compared to before (p-0.006) but not in the late- and post-Ramadan periods.

Metabolic Effects of Ramadan Fasting

In patients with type 2 diabetes who fasted for 15–21 days, a statistically and clinically significant reduction in A1c of approximately 0.5% was found

A 2012 meta-analysis of 35 studies showed a **1.24 kg weight reduction** (95% confidence interval (CI), -1.60 to -0.88 kg) during the month of Ramadan fasting and the regaining of a mean weight of **0.72 kg (95% CI, 0.32 to 1.13 kg) during the 2 weeks following Ramadan**. Although there has been a significant reduction in fat percentage in overweight and obese people, leading to weight loss, it is **not a universal outcome**, and weight change with Ramadan fasting shows significant inter-individual **variability**.

A 2013 meta-analysis of 30 cohort studies found a **decrease in LDL and fasting blood glucose levels after Ramadan fasting** in healthy males and females compared with levels prior to Ramadan .

A statistically significant **increase in HDL cholesterol in females** and a **decrease in total cholesterol and triglycerides in males** was noted.

A study in **Saudi Arabia** of healthy men between age 18 and 39 years indicated that fasting glucose levels were elevated slightly at end of third week (RW3) and after Ramadan (AR) compared to before Ramadan (BR) (BR = 74.60 mmol/L vs RW3 = 81.52 mmol/L and AR-86.51 mmol/L).

The fasting glucose indicated a slight but statistically significant elevation during the end of Ramadan ($p = 0.011$), but **elevated values were within normal levels** (BR = 74.60 mmol/L vs. RW3 = 81.52 mmol/L and AR = 86.51 mmol/L).

In a **study on 65 healthy Thai subjects** that investigated the effect of Ramadan fasting on biochemical parameters, there were **no changes** in anthropometry, blood pressure, lipid profiles and body composition in both males and females before Ramadan, at the end of Ramadan, and after one month of Ramadan .

Fasting blood **glucose levels were significantly increased** a month after Ramadan when compared to baseline (5.09 ± 0.50 versus 4.83 ± 0.38 mmol/L, $p = 0.016$) in women .

There have been **inconsistent results** in several other studies across the world in which **fasting blood glucose and lipid profile were either significantly increased or significantly decreased or remained unchanged** .

. These **variations** could be **attributed to** varied dietary intake, physical activity, age, gender, cortisol secretion, and varied duration of fasting depending on the geographical locations.

Studies have indicated that in the **final week of Ramadan**, there is a **reduced rate of oxygen consumption** and **slower heart rate**, indicating the **slowing of metabolism** .

Hassanein et al. observed that there does not appear to be a significant change in the resting metabolic rate and total (24 h) daily energy expenditure . Some studies have reported **lower** concentrations of **inflammatory markers, CRP, IL-6, and TNF- α** .

Adiponectin and leptin are adipokines secreted by adipocytes.

Adiponectin appears to increase insulin sensitivity, and leptin is associated with insulin resistance. Adiponectin levels were lower and leptin levels were elevated in a Saudi study that was conducted in healthy practitioners during Ramadan.

Ghrelin, an appetite-stimulating hormone, was reported to have a marked reduction in the last week of Ramadan in overweight and obese individuals .

Changes in the sleep time impact the **circadian rhythm**, with epigenetic studies showing alterations in the circadian rhythm controlling genes during Ramadan .

With an altered circadian cycle, there may be a reduction in total sleep duration and decrease in the proportion of rapid eye movement (REM) sleep, which can affect insulin resistance.

Cortisol secretion was noted to be reversed during Ramadan with a shift towards lower morning cortisol and higher evening cortisol levels at the end of first week of Ramadan with eventual **reversal back** to near baseline by the end of week 3 of Ramadan .

The typical high morning-to-evening cortisol ratio reduced from 2.55 to 1.22 during Ramadan fasting.

It is well known that **cortisol affects insulin sensitivity** and is associated with a rise in blood glucose levels .

This coupled with the consumption of large quantities at and after Iftar can cause blood glucose to rise higher and more glycemic variability in people with diabetes.

Pre-Ramadan Visit

A pre-Ramadan visit **six to eight weeks before** Ramadan is recommended to complete **risk stratification** and review hypoglycemia and treatment including hypoglycemia unawareness and clarify common misconceptions.

Fasting during Ramadan does carry an **increased risk of adverse events** among Muslims with diabetes. The EPIDIAR study discovered a trend of increased risk of severe hypoglycemic events during Ramadan requiring hospitalization

Hence, it is critical that **fingerstick glucose** be monitored frequently and providers discuss this with patients who are fasting.

Consult your doctor before fasting

Treatment plan

- Check if you need to adjust the timing, dose or type of your medication

Diet modification

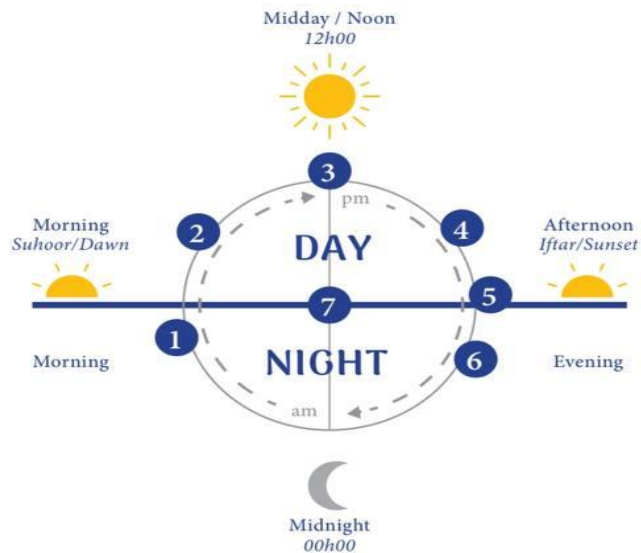
- Divide daily calories between Suhoor and Iftar + 1-2 snacks
- Consume high-fibre foods
- Eat plenty of fruits, vegetables and salads
- Drink fluids between sunset and sunrise

Avoid in excess

- Caffeinated drinks
- Sweetened drinks
- Sugary desserts

Importance of Blood Glucose monitoring

Changes in eating habits during Ramadan may affect your blood glucose levels and therefore it is important to check them frequently.



When to test?

1. Pre-dawn meal (suhoor)
2. Morning
3. Midday
4. Mid-afternoon
5. Pre-sunset meal (iftar)
6. 2-hours after iftar
7. At any time when you have symptoms of low or high blood glucose or are feeling unwell

As per the latest IDF-DAR 2021 guidelines, **a risk calculator** or scoring system has been recommended for risk stratification.

It takes into consideration various factors and individuals are placed into the risk category based on the score as in Table 1.

Table 5.4—Elements for risk calculation and suggested risk score for people with diabetes who seek to fast during Ramadan

| Risk element | Risk score |
|---|------------|
| 1. Diabetes classification and duration | |
| • Type 1 diabetes | 1 |
| • Type 2 diabetes | 2 |
| 2. Duration of diabetes (years) | |
| • A duration of ≥ 10 years | 1 |
| • A duration of < 10 years | 0 |
| 3. Presence of hypoglycemia | |
| • Hypoglycemia unawareness | 6.5 |
| • Recent severe hypoglycemia | 5.5 |
| • Multiple weekly hypoglycemia | 3.5 |
| • Hypoglycemia less than one time per week | 1 |
| • No hypoglycemia | 0 |
| 4. Level of glycemic management | |
| • A1C levels $> 9\%$ (> 75 mmol/mol) | 2 |
| • A1C levels 7.5–9% (59–75 mmol/mol) | 1 |
| • A1C levels $< 7.5\%$ (< 59 mmol/mol) | 0 |
| 5. Type of treatment | |
| • Multiple daily mixed insulin injections | 3 |
| • Basal bolus/insulin pump | 2.5 |
| • Once-daily mixed insulin | 2 |
| • Basal insulin | 1.5 |
| • Glibenclamide/glyburide | 1 |
| • Gliclazide modified release or glimepiride or repaglinide | 0.5 |
| • Other therapy not including sulfonylureas or insulin | 0 |
| 6. Self-monitoring of glucose | |
| • Indicated but not conducted | 2 |
| • Indicated but conducted suboptimally | 1 |
| • Conducted as indicated | 0 |
| 7. Acute complications | |
| • DKA or HHS in the last 3 months | 3 |
| • DKA or HHS in the last 6 months | 2 |
| • DKA or HHS in the last 12 months | 1 |
| • No DKA or HHS | 0 |
| 8. MVD complications and comorbidities | |
| • Unstable MVD | 6.5 |
| • Stable MVD | 2 |
| • No MVD | 0 |
| 9. Renal complications and comorbidities | |
| • eGFR < 30 mL/min/1.73 m ² | 6.5 |
| • eGFR 30–45 mL/min/1.73 m ² | 4 |
| • eGFR 45–60 mL/min/1.73 m ² | 3 |
| • eGFR > 60 mL/min/1.73 m ² | 0 |
| 10. Pregnancy* | |
| • Pregnant not within glycemic goals | 6.5 |
| • Pregnant within glycemic goals | 3.5 |
| • Not pregnant | 0 |
| 11. Frailty and cognitive function | |
| • Impaired cognitive function or frail | 6.5 |
| • > 70 years old with no home support | 3.5 |
| • No frailty or loss in cognitive function | 0 |
| 12. Physical labor | |
| • Highly intense physical labor | 4 |
| • Moderately intense physical labor | 2 |
| • No physical labor | 0 |
| 13. Previous Ramadan experience | |
| • Overall negative experience | 1 |
| • No negative or positive experience | 0 |

Continued on p. S100

Table 5.4—Continued

| Risk element | Risk score |
|--|------------|
| 14. Fasting hours (varies by geographical location for time of sunrise and sunset) | |
| • ≥ 16 h | 1 |
| • < 16 h | 0 |

Risk categories are defined as follows: score 0–3, low risk, fasting is probably safe; score 3.5–6, moderate risk, fasting is uncertain; score >6 , high risk, fasting is probably unsafe. DKA, diabetic ketoacidosis; eGFR, estimated glomerular filtration rate; HHS, hyperglycemic hyperosmolar state; MVD, macrovascular disease (cardiac, cerebral, or peripheral). *Individuals who are pregnant or breastfeeding have the right to not fast regardless of whether they have diabetes or not. Adapted from Hassanein et al. (230).

Pre-Ramadan assessment(6-8 weeks prior to Ramadan fasting)

| | | | | | | | |
|-------------------------------|-------------------------------------|---------------------------------------|---|-------------------|--|---|---|
| comprehensive medical history | Patient education on misconceptions | Importance of 7-point SMBG monitoring | Diet and meal planning - avoidance of high carb foods, adequate fluid intake(non-sugary drinks) | Smoking cessation | Education on identification, treatment of hypoglycemia and hyperglycemia | Exercise - continuation of baseline light-moderate exercise | Medications review and recommendation on dose adjustments |
|-------------------------------|-------------------------------------|---------------------------------------|---|-------------------|--|---|---|



Risk stratification

Low-should be able to fast

Moderate-advised not to fast

High-should not fast



During Ramadan

Follow up visit to ensure stable glucose

Reiterate importance of SMBG monitoring

Assess for hypoglycemia and hyperglycemia



Post Ramadan assessment

Assess experience and adverse events in preparation for next year

Misconceptions about the permissibility of aspects of diabetes care during the fast can **hinder compliance** and **increase the frequency of complications**. In one study, 77% of participants did **not check their blood glucose** due to the misconception that pricking fingers to provide blood for monitors voided their fasts . **These misconceptions should be dispelled by the physician during the pre-Ramadan visit.**

Knowing When Patients Should Break the Fast

At the initial pre-Ramadan visit, patients and their families should be instructed about symptoms of hypoglycemia and how to manage them using the 15–15 rule.

Stop fasting when:

- ◆ Blood glucose is **below 70mg/dl, 3.9mmol/L**
- ◆ Blood glucose is **above 300mg/dl, 16.6 mmol/L**

It is important to measure blood glucose again after 1-2 hours

Quick tips

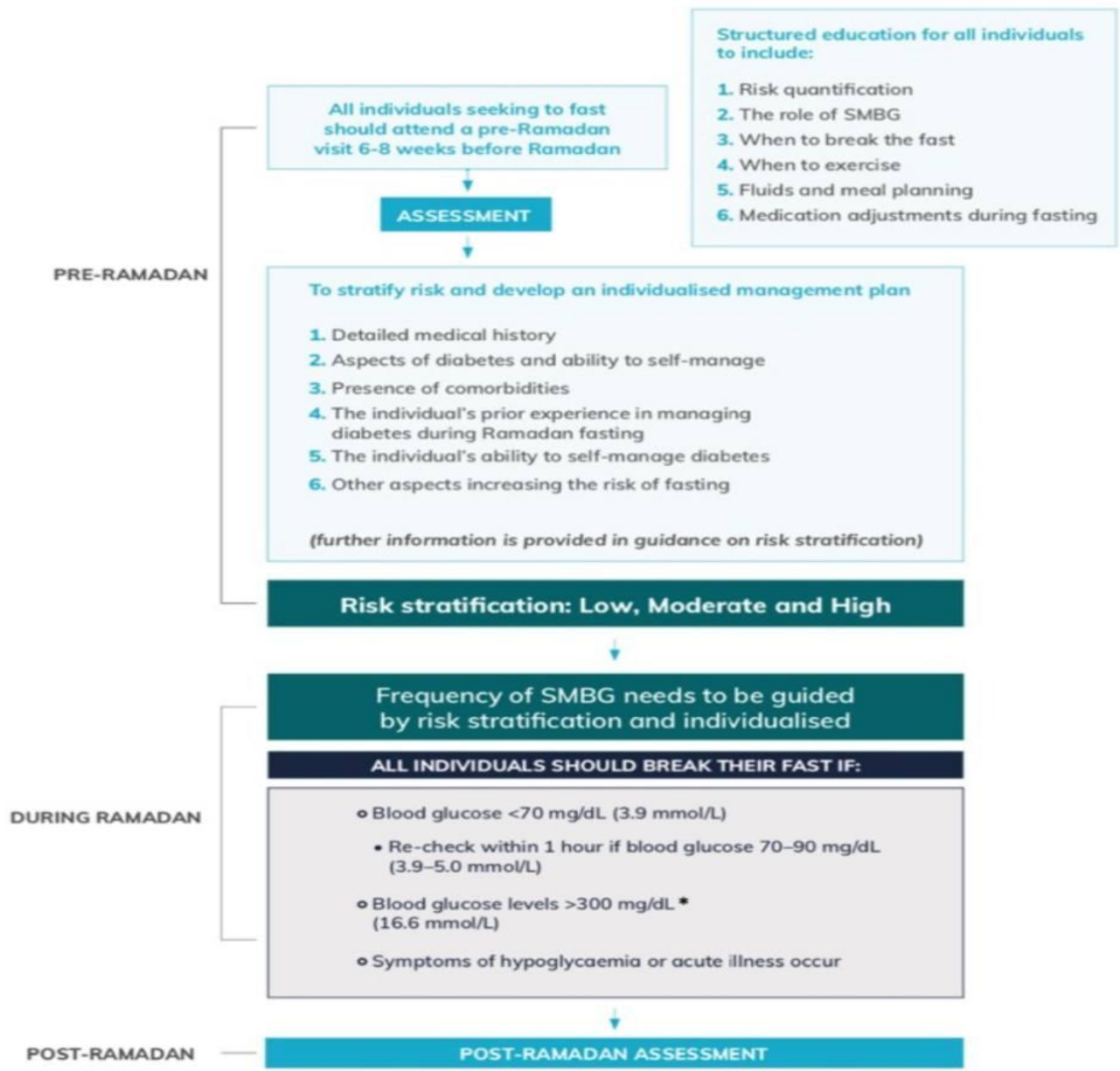
- ◆ Consult your doctor if you plan to fast to learn your risk.
- ◆ Check your blood glucose levels more often
- ◆ Drink plenty of water during non-fasting period to avoid dehydration during fasting time
- ◆ During Iftar, drink sugar-free and decaffeinated drinks to avoid dehydration
- ◆ To avoid problems during Taraweeh, eat starchy foods (eg. rice, pasta, beans) with Iftar and drink plenty of water
- ◆ Eat a varied and balanced diet throughout Ramadan
- ◆ If you feel unwell, immediately break your fast. Make sure to always have your medication with you.
- ◆ Visit your doctor after Ramadan

What DOES NOT BREAK your fast?

Blood glucose monitoring



Injecting insulin



SMBG, self-monitoring blood glucose

*this applies for those with sudden rise in blood glucose level, individualisation of care is advisable

IDF-DAR guidelines recommend the use of **CGM** as the method of choice if available for patients with diabetes who observe Ramadan fasting .

Studies have indicated that continuous (CGM) and flash or intermittently scanned glucose monitoring (FGM or iCGM) provide the benefit of predicting **hypoglycemia** and assessing glycemic excursions during Ramadan fasting.

Diabetes Medications

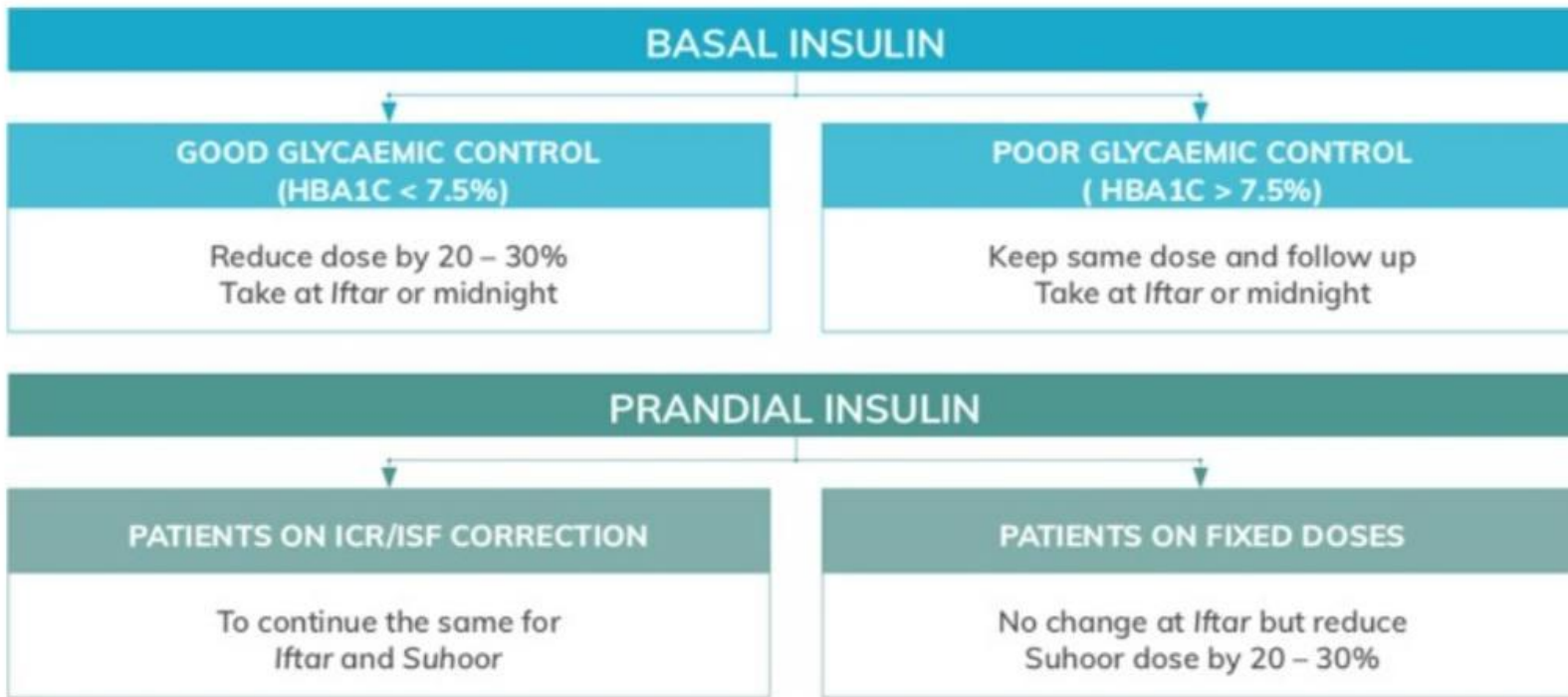
Oral anti-diabetes agents/Non-insulin injectables dose modifications during Ramadan Fasting

| | | | | | |
|--|--|--|---|---|---|
| Metformin <u>Once daily dosing</u> -No dose changes -Take at sunset meal(Iftar) <u>Twice daily dosing</u> - No dose changes -Take at sunset meal(Iftar) and predawn meal(Suhoor) <u>Three times daily dosing</u> -morning dose with Suhoor -Combine afternoon and evening dose and take at Iftar | Sulfonylurea / Glinides <u>Once daily dosing</u> - Take at sunset meal <u>Twice daily dosing</u> - Consider decreasing morning dose by 25-50% if well controlled diabetes - Evening dose unchanged at sunset meal(Iftar) | Incretin mimetics (DPP-4 inhibitors and GLP-1 RAs) No dose adjustments | SGLT2-i No dose adjustments (Take at Iftar preferably) | Thiazolidinediones (TZDs) No dose adjustments | Alpha-glucosidase inhibitors (Acarbose) No dose adjustments |
|--|--|--|---|---|---|

Figure 3. Oral anti-diabetes agents and non-insulin injectables dose modifications during Ramadan fasting.

Table 5 Recommended dose and regimen modifications for non-insulin based antidiabetic medications during Ramadan fasting.

| Antidiabetic Medications | Regimen/Dose modifications | Level of evidence supporting recommendation and grading from IDF-DAR writing group (Table 1 and 2) |
|------------------------------------|---|--|
| Metformin | Once daily No dose modifications Take at <i>Iftar</i> Twice daily No dose modifications Take at <i>Iftar</i> or <i>Suhoor</i> Three times daily Morning dose taken before <i>Suhoor</i> Combine afternoon dose with <i>Iftar</i> dose Prolonged release No dose modifications Take at <i>Iftar</i> | Level 4 and Grade D |
| Acarbose | No dose modifications | Level 4 and Grade D |
| TZDs | No dose modifications but doses can be taken with <i>Iftar</i> or <i>Suhoor</i> | Pioglitazone - Level 2 Grade B Other TZDs Grade D |
| Short acting insulin secretagogues | Three meal dosing can be redistributed to two doses according to meal sizes | Repaglinide - Level 2 Grade B Gliclazide, Gliclazide MR, and Glimepiride – level 3 Grade C |
| GLP-1 RAs | No dose modifications after appropriate dose titrations have been achieved | Exenatide, Liraglutide, Lixisenatide Level 2 Grade B Other GLP-1 RAs Grade D |
| DPP-4 inhibitors | No dose modifications | Vildagliptin, Sitagliptin - Level 1A/B Grade A Other DPP-4 inhibitors Grade D |
| SUs | Use newer drugs e.g. Glicazide, Glicazide MR, Glimepiride Once daily: Reduce dose in well controlled individuals Take at <i>Iftar</i> Twice daily Reductions of <i>Suhoor</i> dose in well controlled individuals | Level 3 and Grade C |
| SGLT2 inhibitors | No dose modifications Extra fluids to maintain hydration | Dapagliflozin, Canagliflozin - level 3 Grade C Other SGLT2 inhibitors Grade D |



NOTES ON PRANDIAL INSULIN:

- For better post prandial control, it is advised to take the bolus 20 mins prior to *Iftar* to account for high fat and/or high protein meals
- High blood glucose values may require extra correction doses based on insulin sensitivity ratio and target blood glucose
- Correction doses must not be given more frequently than every 3 hours to avoid insulin stacking and hypoglycaemia

An Individualised approach is essential for treatment adjustment according to patients SMBG or CGM data

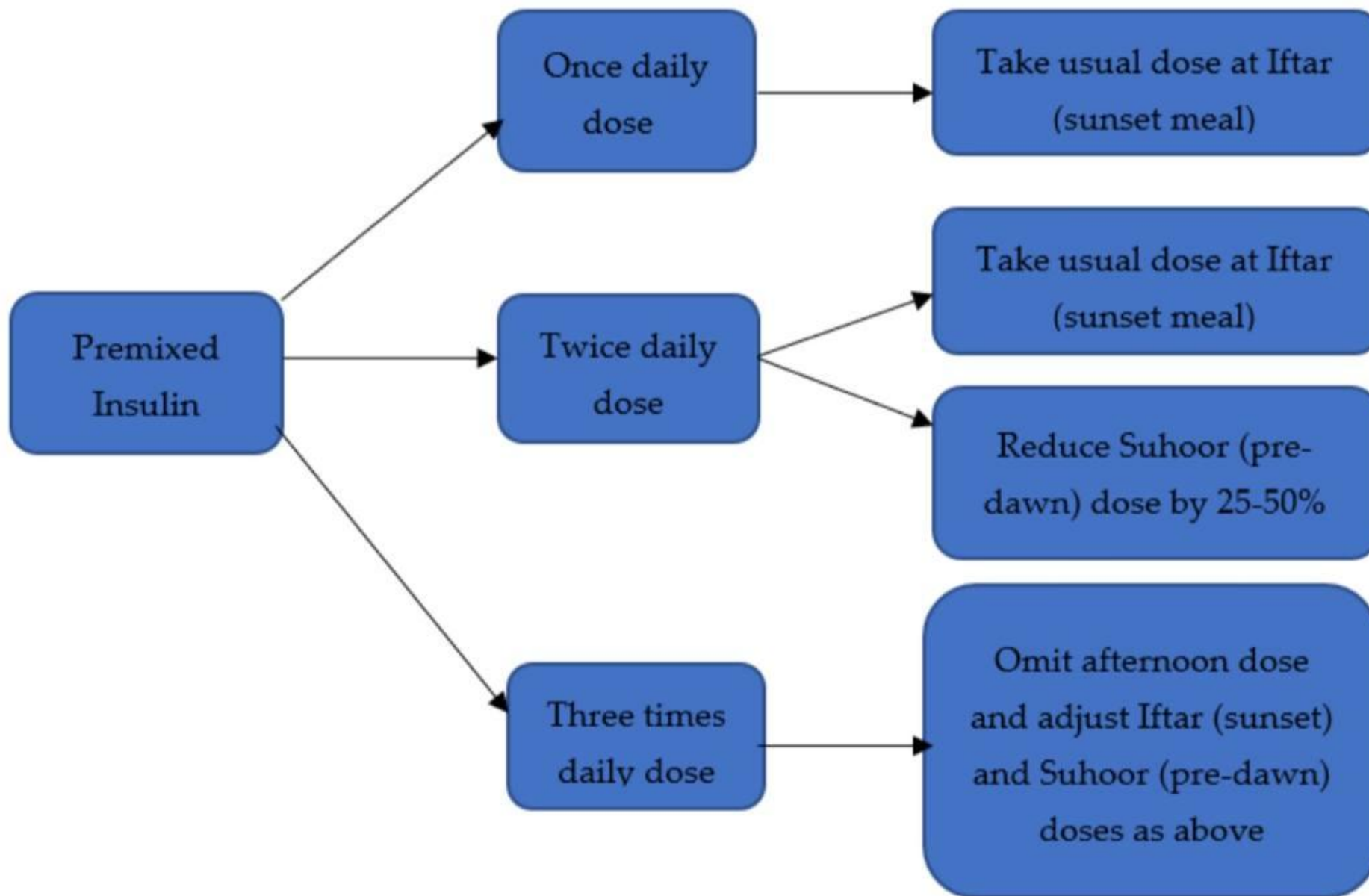


Figure 2. Guidance regarding the use of premixed insulin in patients with diabetes during Ramadan [1].

Table 4 Recommendations for Insulin Dose Adjustments based on type of regimen.

| Type of Insulin Regimen | Adjustment for fasting during Ramadan | Methods of monitoring during Ramadan |
|---|---|---|
| CSII / Insulin Pump | Basal rate adjustment-20–40% decrease for the last 3–4 h of fast-10–30% increase for the first few hours after <i>Iftar</i> Bolus doses-Same principles as prior to Ramadan | CGM |
| MDI (basal bolus) with analogue insulin | Basal insulin-30–40% reduction in dose and to be taken at <i>Iftar</i> Rapid Analogue Insulin-Dose at <i>Suhoor</i> to be reduced by 30–50%-Pre-lunch dose to be skipped-The dose around <i>Iftar</i> to be adjusted based on the 2-hour post- <i>Iftar</i> glucose reading | 7-point glucose monitoring |
| MDI (Basal bolus) with conventional insulin | NPH insulin-The usual pre-Ramadan morning dose to be taken in the evening during Ramadan-50% of the pre-Ramadan dose to be taken at <i>Suhoor</i> Regular insulin-Dose at evening meal remains unchanged- <i>Suhoor</i> dose to be 50% of the pre-Ramadan evening dose-Afternoon dose to be skipped | 7-point blood glucose monitoring or 2–3 staggered readings throughout the day |
| Premixed (analogue or conventional) | -Shift the usual pre-Ramadan morning dose to <i>Iftar</i> -50% of the pre-Ramadan evening dose at <i>Suhoor</i> | At least 2–3 daily readings and whenever any hypoglycaemic symptoms develop |

| Type of Insulin | Dosing Frequency | Recommended Change |
|---|------------------|--|
| Basal insulin (insulin glargine/NPH/Degludec/Detemir) | Once daily | Reduce dose by 15–30% and Take at Iftar (sunset meal) |
| Basal insulin (insulin glargine/NPH/Degludec/Detemir) | Twice daily | Take usual morning dose at Iftar (sunset meal), Reduce evening dose by 50% and Take at Suhoor (pre-dawn meal) |
| Short-acting insulin/Bolus insulin | | Take normal dose at Iftar (sunset meal), Skip lunch time dose and Reduce Suhoor (pre-dawn meal) dose by 25–50% |

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

Table 5. Suggestions regarding adjusting bolus insulin doses during Ramadan-Insulin dose titrations based on blood glucose.

| Pre-Sunset, Pre-Dawn Blood Glucose | Rapid- or Short-Acting Insulin Dose Adjustment |
|---|---|
| >250 mg/dL | Increase dose by 20% |
| >180 mg/dL | Increase dose by 10% |
| 100–180 mg/dL | No change |
| <100 mg/dL or symptoms of hypoglycemia | Reduce dose by 10% |
| <70 mg/dL | Reduce dose by 20% and preferably avoid fast |

Table 5.5—Changes in medications during fasting

| Medication name | Risk of hypoglycemia | Timing | Total daily dose |
|--|----------------------|--|---|
| Metformin, SGLT2 inhibitor, DPP-4 inhibitor, GLP-1 receptor agonist, acarbose, or pioglitazone | Low | <ul style="list-style-type: none">• If once daily, then take at main mealtime.• If twice daily, then split dose between the two meals.• If once weekly, no change of time. | <ul style="list-style-type: none">• No change |
| New generation sulfonylurea (glimepiride and gliclazide) | Low to moderate | <ul style="list-style-type: none">• If once daily, then take at main mealtime.• If twice daily, then split dose between the two meals. | <ul style="list-style-type: none">• Reduce dose if glucose levels are within individualized goal range and if no hypoglycemia or hyperglycemia is present at baseline. |
| Older generation of sulfonylurea (glyburide) | Moderate to high | <ul style="list-style-type: none">• Take at time of main meal | <ul style="list-style-type: none">• Replace with newer-generation sulfonylurea or reduce dose by 50%. |
| Basal insulin | Moderate to high | <ul style="list-style-type: none">• For longer-acting basal analogs (glargine 300 or degludec), no need to change timing.• For other basal insulins, take at beginning of breaking fast meal. | <ul style="list-style-type: none">• Choose the insulin with lower risk of hypoglycemia among the class.• Reduce dose by 25–35% if not well managed. |
| Prandial insulin | High | <ul style="list-style-type: none">• At mealtime | <ul style="list-style-type: none">• Reduce dose of insulin for the meal followed by fasting (35–50%).• For other meals, insulin dose should match carbohydrate intake. |
| Mixed insulin and insulin coformulations | High | <ul style="list-style-type: none">• If once daily, then take at main mealtime.• If twice daily, then split dose between the two meals | <ul style="list-style-type: none">• Reduce dose of insulin for the meal followed by fasting (35–50%).• For other meals, no change of dose. |

DPP-4, dipeptidyl peptidase 4; GLP-1, glucagon-like peptide 1; SGLT2, sodium–glucose cotransporter 2.



Thank you