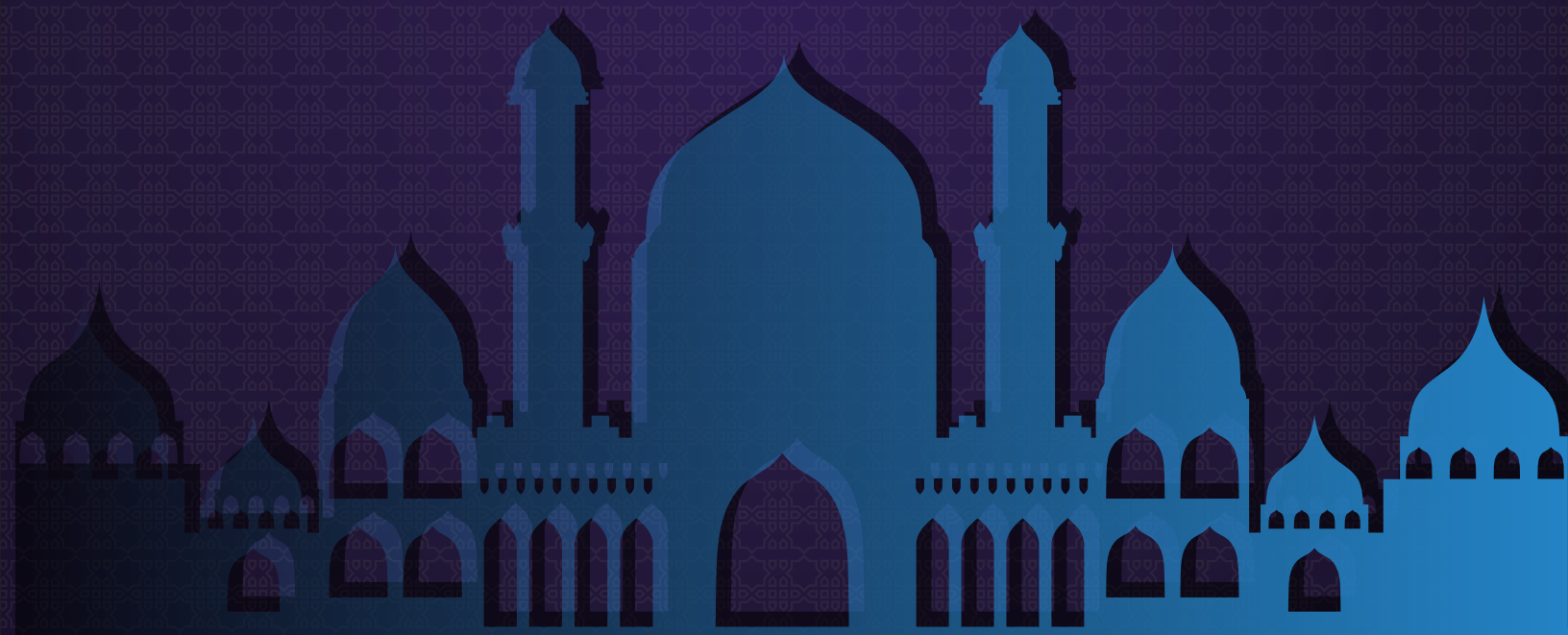
Bangladesh Endocrine Society (BES)
Guideline on Management of Diabetes During Ramadan 2025



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Guideline on Management of Diabetes During Ramadan 2025

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Preface

Fasting during the month of Holy Ramadan is one of the five pillars of Islam. It is obligatory for all physical and mentally healthy adult to perform fasting in the Holy month of Ramadan. In fact, most of the Muslim population have intense spiritual desire to participate fasting even those who could seek exemption. There is certain risk associated with fasting which might exacerbate their existing illness. Along with global increased prevalence of Diabetes Mellitus there is rise of diabetic Muslim population throughout the world as well as in Bangladesh. So, there is increased number of diabetic population who intend to fast. It is evident that there are lots of cultural variation in Muslim population in different parts of the world even in the same country with different social and family background. Persons with diabetes should seek medical advice before deciding to proceed fasting during Ramadan. Coordination between medical and religious advice is essential with some message to ensure safe fasting for people with Diabetes Mellitus. It is not possible to formulate a universal guideline for whole Muslim population. Considering social, cultural aspect of our own population with different physical and comorbid status, it is imperative to formulate rational and practical recommendation on individual basis. An ideal guideline should be based on our own evidences which is going to be conducted soon during this Ramadan. This second edition intends to provide adequate evidences and information with practical recommendations from our own and different international consensus statements for our physicians. We believe it will enable our physician to help our Muslim population with Diabetes to remain free of anticipated complications. This edition 2025 will cover who can fast or who cannot fast from medico-religious perspective. Planned structural education for patients with Ideal meal plan, exercise pattern, home blood glucose monitoring with adjustment and modification of antidiabetic medications at initiation and during fasting days, when to breakfast, sick day management, follow up plan after Ramadan have been given emphasized in this edition. We have also added diet plan chart from BADAS guideline and religious leader opinions regarding insulin injection and blood test during fasting period. Heartfelt gratitude and credits goes to all dedicated members of task force, scientific sub- committee, members of Executive Committee to compile the guideline. Without their sincere guidance and hard effort, it was impossible to bring the guideline formulation into day light.

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Introduction:

It is obligatory for every physically and mentally healthy adult Muslim to perform fasting in the holy month of Ramadan. During this month, Muslims refrain from eating, drinking and conjugal relations between dawn and sunset. The Holy Quran says: "O you who believe! Fasting is prescribed to you as it was prescribed to those before you so that you may attain self-restraint"[1]. Most of the Muslim population intend to participate in fasting, even those who could seek exemption, such as the elderly, children, the infirm, and pregnant women [2]. It is thought that fasting may provide some health benefits, including an opportunity for a better lifestyle, facilitating weight loss and smoking cessation, and some favorable effects on the lipid profile [3, 4]. Possible health hazards of fasting include hypoglycaemia, hyperglycaemia, dehydration and acute metabolic complications such as diabetic ketoacidosis (DKA) [2].

Bangladesh is a country with Muslim predominance. According to the 2011 census, the population of this country was 144 million, 90.39% of which were Muslim [6]. The number of diabetic population in Bangladesh was 13.13 million in 2021 [7]. The EPIDIAR study found that 89.8% of Bangladeshi patients with type-2 diabetes fasted for at least 15 days during Ramadan [8]. Therefore, Ramadan has a major impact on the management of diabetes in the Muslim population of this country.

The first guidelines for the management of diabetes during Ramadan were published by the American Diabetes Association (ADA) in 2005 [2]. They classified patients with diabetes into one of four risk categories: very high, high, moderate and low risk depending on the type of diabetes, medical history, glycaemic control, type of medication, presence of comorbidities and the individual's personal circumstances [2]. Later in 2016, experts from the International Diabetes Federation (IDF) and the Diabetes and Ramadan (DAR) International Alliance updated the risk classifications for fasting in the IDF-DAR Practical Guidelines, taking into account a more practical approach while recognizing the need to consider the everyday practice of many people with diabetes [5]. The recommendations in IDF-DAR guidelines were approved by the Mofty of Egypt [5].

Due to the regional variations in religious practice among different Muslim sectors with variation of culture and food habits, it is not possible to formulate a universal guideline for the whole Muslim population. It is imperative to formulate unique regional or national guidelines for diabetes and Ramadan, taking into account the above mentioned factors. An ideal guideline should be based on evidence, and should address the problems related to Ramadan fasting and diabetes, such as: whether to fast or not to fast from medico-religious perspective, the ideal meal and exercise pattern, blood glucose monitoring, modification of antidiabetic agents and follow-up plan during Ramadan fasting etc.

Pre-Ramadan Assessment& Risk Stratification

Changes in lifestyle& circadian rhythym, shifting in fluid & energy balance and alteration in timing of antidiabetic medications during the month of Ramadan fasting results in metabolic disturbances. Fasting is associated with increased glycemic variability and therefore increased risk of hypoglycemia, severe hyperglycemia (with or without diabetic ketoacidosis), dehydration and thrombosis in diabetic patients [2,9].Diabetes patients with pre-existing CVD or stroke are at greater risk of complications when fasting. Unstable CVD or stroke patients are also at very high risk from fasting. Individuals with diabetes and CKD stage 3 are at high-risk from fasting while those with stage 4-5 are at very high risk from fasting during Ramadan. Patients on dialysis or those who had a kidney transplant are also considered high risk from fasting [10]. Therefore, every person with diabetes should be assessed individually before Ramadan using standardized risk stratification tools.

A pre-Ramadan individualized assessment should be performed by healthcare professionals 1-3 months (ideally 6-8 weeks)) prior to the start of fasting to reduce these risks [11,12]. To stratify risk and develop an individualized management plan, needs assessment–

1. Detailed medical history
2. Aspects of diabetes and ability to self manage
3. Presence of co-morbidities
4. Individual's prior experience in managing diabetes during Ramadan fasting
5. Individual's ability to self manage diabetes
6. Other aspects increasing the risk of fasting

The risk stratification is based on several factors [13]: type and duration of DM, risk or occurrence of hypoglycemia, level of glycemic control, Self-Monitoring of blood glucose(SMBG), acute metabolic complications, chronic microvascular/macrovascular complications/co-morbidities, pregnancy, frailty/mental stability, level of physical labour, previous Ramadan experiences & support, duration of fasting hours, climate, diabetes treatment regimens and polypharmacy with multiple glucose lowering drugs, etc.

BES recommends the IDF & DaR 2021 guideline risk calculation score and stratify individuals into three risk categories, low, moderate and high, with some modifications(Fig-1) [13].

Considering risk scores and risk categories, BES recommends similar to IDF-DaR 2021 guideline recommendations (Table.1) [14].

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 >90% (>75 mmol/mol)	2
• A1C levels 7.5-9% (59-75 mmol/mol)	1
• A1C levels<7.5% (<59mmol/mol)	0
5. Type of treatment	
• Multiple daily mixed insulin injections	3
• Basal bolus/Split insulin pump	2.5
• Once-dailymixed insulin Basal Insulin	2
• Glibenclamide/glyburide	1.5
• Gliclazide/modified release or glimepiride or repaglinide	1
• Other therapy not including sulfonylureas or insulin	0.5 0
6. Self-monltoring 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

Risk element	Risk score
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 andcognitive 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
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.

Figure-1: Ramadan risk stratification score card

Table 1: Medical & religious risk score recommendations

Risk score/level	Medical Recommendations	Religious Recommendations
LOW RISK 0-3 points	Fasting is probably safe. Ensure 1. Medical evaluation 2. Structured education 3. Medication adjustment 4. Strict monitoring 5. Preparedness to break the fast if hypoglycemia/severe hyperglycemia or worsening of other related medical conditions	1. Fasting is obligatory 2. Advice not to fast is not allowed, unless patient is unable to fast due to the physical burdenof fasting or needing to take medication or food or drink during the fasting hours
MODERATE RISK 3.5-6 points	Fasting safety is uncertain. If insist fasting, ensure 1. Medical Evaluation 2. Structured education 3. Medication adjustment 4. Strict monitoring 5. Preparedness to break the fast if hypoglycemia/severe hyperglycemia or worsening of other related medical conditions	1. Fasting is preferred but patients may choose not to fast if they are concerned about their health after consulting the doctor and taking into account the full medical circumstances and patient's own previous experiences 2. If the patient does fast, they must follow medical recommendations including regular blood glucose monitoring
HIGH RISK >6 points	Fasting is probably unsafe	Advise against fasting

Pre-Ramadan Education & Monitoring

Ramadan-focused education is needed to make people aware of the risks associated with diabetes and fasting, and to teach them the strategies to minimize the risks [15,16]. Education should be delivered in a culturally sensitive manner by trained healthcare professionals [16,17]. Persons with diabetes who have received structured Ramadan-focused education are more compliant with Ramadan diabetes management recommendations [15]. Educational programs are effective to maintain and improve glycemic control during Ramadan [16,18-20] and decreasing hypoglycemia episodes [21,22]. A combination of structured education and frequent blood glucose monitoring is essential for safe fasting during Ramadan [23].

Pre-Ramadan education should be targeted at people with diabetes, and healthcare professionals (HCPs). Educational campaigns should also target the general population [24]. Pre-Ramadan assessment and education should ideally be started 12 weeks before the start of Ramadan [25].

Components of a Ramadan focused education program are [25]-

- Pre-Ramadan planning
- Risk stratification
- Medical nutrition therapy
- Fluid and electrolytes
- Exercise
- Drug adjustment
- Blood glucose monitoring
- Breaking the fast

Monitoring blood glucose during Ramadan:

Self-monitoring of blood glucose (SMBG) is essential for every diabetic patient who chooses to fast and it should be emphasized that testing does not invalidate religious fast. Monitoring depends on treatment regimens and patients risk profile. SMBG should be performed multiple times during the day and most importantly, whenever symptoms of hypoglycemia or acute illness occur.

High risk diabetic patients should be in SMBG monitoring on multiple times of day. The regularity of the blood glucose checks is dependent on the frequency of insulin treatment and/or the risk of hypo or hyperglycemia. Low risk patients and patients on metformin, DPP4 inhibitor, GLP1 analogue monotherapy or in combination of these drugs should also monitor their blood sugar. To get a true understanding of how blood glucose changes while fasting, patients should be encouraged to keep a Ramadan logbook detailing the measurement.

Table-2: Time of SMBG in Ramadan [25]

Good to do	Must to do
• Pre Suhoor – before taking meal (for adjustment of OAD, premixed insulin) • Early Morning – 2 hrs after Suhoor (patients are in bolus, split, premixed regimen, OAD) • Around 10 am – patients in split regimen, premixed insulin, OAD • Mid-day –11 am to 2 pm (Premixed Insulin, intermediate acting insulin, OAD , basal Insulin) • Pre Iftar meal - for every patients and dose adjustment for long acting insulin analogue, long acting OAD • 2 hrs after Iftar –Bolus insulin, OAD • At any time when there are symptoms of hypoglycemia / hyperglycemia or feeling unwell	• Before Iftar • 2 hour after Iftar • Mid-day

Frequency of SMBG should be daily for first 3 days, every 3rd day from next week onwards and every alternate day in the last week.

Modification of Diet & Physical Activity

Dietary advice for patients with diabetes during Ramadan [5]

Large carbohydrate meals, sugary drinks are to be avoided. Meal plan and dietary frequency should be followed as healthy balanced diet accounting height, weight, and occupation as done during pre-Ramadan period. Well balanced meals should be ensured with 50%-60% carbohydrate, 20–30%protein, <20% fat (preferably mono-and polyunsaturated), low glycaemic index, complex starchy carb, high fibre foods. Proteins like egg, fish, meat, milk, yoghurt must be included and carbohydrate like bread, beans, rice, plenty of vegetables and salads can be added. A moderate number of fresh fruits is permitted. Foods that are high in saturated fats should be discouraged like ghee, butter, samosas, pakoras, puri, parata or heavy fried meat. Sugary desserts like jilapi, laddo, barfi, other sweets must be avoided. Sweetened drinks are advised to avoid. Allowed amount of fresh fruits can be taken as juice without added sugar. Small amounts of oil especially vegetable oil (corn/soyabean/olive oil) should be encouraged while cooking.

Hydration and electrolytes balance can be maintained by taking more drinking water or other non-sweetened beverages like dub water, lemon water etc. Small and six-times healthy balanced diet of pre-Ramadan should be accommodated in two to three times of meal frequency between Iftar, Dinner and Suhoor. Diet should be planned keeping same calorie and quality and respecting patient desire and customs according to previous eating patterns. Suhoor is advised to take close to Fajar Prayer and it will be the main meal of the equivalent to lunch of pre Ramadan period.

Unhealthy nutrition habits (Should be Avoided) [5]

- Taking large meals at Iftar and taking desserts loaded with sugar after Iftar, which may result in severe postprandial hyperglycemia and weight gain.
- Taking significant amounts of highly processed carbohydrates at Iftar, or between Iftar and Suhoor, which may also cause severe hyperglycemia.
- Having large and frequent snacks between the two main meals, which can contribute to longer periods of hyperglycemia.
- Temptation to take Suhoor early or avoiding Suhoor meal or less amount of meal, which may result in hypoglycemia before Iftar, especially when fasting hours are longer than usual.
- Consumption of large portions of high glycemic index and high glycemic load carbohydrates at Suhoor, which can lead to post-prandial hyperglycemia.

Exercise Recommendations during Ramadan Fasting [5]

- Fasting people are advised to avoid exercise during fasting time.
- Rigorous exercise is not recommended due to increased risk of hypoglycemia and dehydration.
- Physical exertion in Tarawih prayer can be considered as a part of daily exercise activity.
- Rest part of exercise can be done before or after Tarawih prayer in the house premises.

Modification of Oral Antidiabetic Drugs (OADs)

The cornerstone of a Ramadan individualized management plan is therapeutic modification [25-27]. The type of medication the patient is taking for Diabetes management influences the potential risks [28-31].

Adjustments of oral antidiabetic drugs in patients with Type-2 Diabetes who are fasting during Ramadan can be done in following ways [25,32]. [Table-3]

Table-3: Modification of OADs during Ramadan

Name of drug	Modification during Ramadan
Metformin	• Daily total dose remains unchanged. • Once daily dose should be taken at Iftar. • For twice daily dose, should be taken at Iftar and Suhoor. • For thrice daily dose, morning dose should be taken at Suhoor and combined lunch and evening dose at Iftar. • Prolonged release preparation should be taken at Iftar.
Sulfonylurea	• Switch to newer Sulfonylurea (Gliclazide, Gliclazide MR, Glimepiride) where possible. • Glibenclamide should be avoided. • For once daily dose, the total dose should be taken at Iftar. Dose may be reduced in patients with good glycemic control. • For twice daily dose, full pre-Ramadan breakfast dose should be taken at Iftar and 50% of the dinner dose should be taken in Suhoor.
Meglitinides	• Thrice daily dosing may be reduced/redistributed to two doses taken with Iftar and Suhoor according to meal sizes.
Acarbose	• No dose modification. • Pre-Ramadan morning dose is given at Iftar, lunch dose at dinner (if taken) and evening dose at Suhoor.
Thiazolidinediones	• No dose modification but should be taken with Iftar.
DPP-4 inhibitors	• No dose modification during Ramadan.
SGLT2inhibitors	• For stabilisation, SGLT2 inhibitors should be initiated at least one month prior to Ramadan. • No dose modification. • Dose should be taken with iftar. • Extra water should be ingested during non-fasting periods.

NB:

- At the start of Ramadan, up to dinner, OAD should be taken as per pre-Ramadan schedule.
- At Suhoor of first Ramadan, OAD should be omitted. At the end of Ramadan, up to Iftar, Ramadan schedule should be followed.
- On the Eid day breakfast, Pre-Ramadan schedule should be started.

Modification of injectable medications

Management of Patients with type 1 diabetes

Current recommendations aim at intensive glycemic management in patients with diabetes type 1 diabetes, which requires the use of multiple daily insulin injections (three or more) or the use of continuous subcutaneous insulin infusion through pump therapy [33-35]. A few type 1 diabetes patients prefer to fast during Ramadan, and most of them change their insulin regimens immediately before, during, and a few days after this month. Basal-bolus regimen is the preferred protocol of management as it is thought to be safer, with fewer episodes of hyper- and hypoglycemia. As an alternative once- or twice-daily injections of intermediate insulin along with pre-meal rapid-acting insulin is the management of choice. It is unlikely that other regimens, including one or two injections of intermediate-, long-acting, or premixed insulin, would provide adequate insulin therapy.

Insulin detemir, or glargine (U 100 or U 300), degludec demonstrated a significant decline in mean plasma glucose with minimal episodes of mild hypoglycemia. Similar results were seen with insulin glulisine, lispro, or aspart used instead of regular or conventional insulin. Compared with those who did not fast during Ramadan, patients with type 1 diabetes on insulin pump therapy who fasted showed a slight improvement in HbA1c without increasing the risk of hypoglycemia[36,37].

Management of Patients with type 2 diabetes

Necessary levels of basal insulin are required to prevent fasting hyperglycemia. One injection of a long-acting (or intermediate-acting) insulin can be useful in some patients as long as the dosage is appropriately individualized; however, most patients will require rapid- or short-acting insulin along with the basal insulin at meals, usually the evening meal typically comprises of a larger caloric load [38].

The use of a rapid-acting insulin analog instead of regular human insulin before meals in patients with type 2 diabetes who fast during Ramadan is associated with less hypoglycemia and smaller postprandial glucose excursions. It is recommended that insulin analogs both basal & bolus analog should be used during Ramadan in view of their safety and tolerability.

Hypoglycemia, though less frequent, is still a risk, especially in elderly patients or who have required insulin therapy for a long duration. This can be reduced by using basal insulin analogs such as insulin detemir or glargine, degludec along and rapid-acting insulin analogs such as aspart, lispro, or glulisine as a basal-bolus regimen.

Recommended changes to insulin regimen in patients with type 2 diabetes who fast during Ramadan[8]

Change of insulin regimen should be customized and individualized according to food habit, food composition adopted especially during the fasting state.

Table-4: Insulin dose modification during Ramadan

A) Basal insulin (Glargine {U 100 or U 300}, Detemir, Degludec, NPH)	
Glargine, Detemir, Degludec; Usuallyat bedtime and single dose	The same dose and time as pre-Ramadan if blood sugar (in SMBG) is high; May be reduced if fasting blood sugar is within target
NPH (single or twice daily) (not preferred)	If Single–same dose of dinner at Iftar if BG is high; Reduce by 15-30% if BG is within target. For twice daily- same dose of breakfast to be taken at Iftar (30-minute prior); reduce 15-30% if BG within target; Reduce dinner dose15-30% at Suhoor

Table-5: Insulin dose titration algorithm during fasting

Fasting/before breaking fast	Insulin units
<3.9 mmol/L (70 mg/dL) or symptoms of hypoglycemia	Break the fast and down-titrate
< 5.0 mmol/L (90 mg/dL)	–2 IU
5.0–7.0 mmol/L (90–126 mg/dL)	No change
B)Rapid/short acting insulin: Bolus [(analogue-Aspart, Lispro, Glulisine)/ regular]	
Once, twice or thrice daily	The same pre-Ramadan breakfast dose should be taken at Iftar;
+2 IU	Reduce pre-Ramadan dinner dose by 20-50% for Suhoor in Ramadan;
> 7.0 mmol/L (126 mg/dL)	The lunch dose will be shifted to dinner if full dinner is taken (usually reduced)
C)Premix (analogue-30/70, 50/50; conventional 30/70, 50/50, 25/75): May be used once daily or twice in Ramadan with caution.	
Single dose Twice daily (breakfast & dinner)	Once daily dose- same dose at Iftar Twice daily doses-The pre-Ramadan breakfast dose will be same for Iftar, Pre-Ramadan dinner dose may be reduced by 20-50% for Suhoor (depending on prolong fasting, carb content)
Switching can be done from low premix (25/75 or 30/70) to high premix(50/50 at Iftar if carbohydrate is more during the iftar meal.	

ADA recommends administration of short or rapid-acting insulin in combination with the basal insulin at meals, particularly at the evening meal, as an effective strategy under fasting condition. Rapid acting insulin analogue are associated with less hypoglycemia and smaller postprandial glucose excursions as compared to regular human insulin before meal in patients with T2DM who fast during Ramadan [39].

Advantages of rapid acting analogs compared to regular human insulins during Ramadan

Several published studies have shown that insulin treatments give a better control of PPG after taking the meal to break the fast [5,40].

- Rapid onset of action and higher peak with the same dose [41]
- Better control of post-prandial blood sugar
- Lesser risk of hypoglycemia especially late post-meal period during the fast
- Offers meal time flexibility as it can be given just before the meals or even after completing the meals
- Safe to use in patients with renal and hepatic impairment (Insulin aspart)
- Safe in pregnancy (Insulin aspart, lispro) with better glycemic control

Advantages of premix analogs over human premix insulin

- Rapid onset of action
- Better control of post-prandial blood sugar
- Lesser risk of night time hypoglycemia and hypoglycemia during the late post-meal period while the patient is fasting.
- Offers meal time flexibility as it can be given just before the meals or even after completing the meals
- Can be started once daily before iftar (evening meal) and then if needed can be upgraded to twice daily (iftar and Suhoor) and helps to reach target glycemic control in the majority of patients without significant risk of hypoglycemia [42].

These newer insulins have made possible the near-physiological replacement of prandial as well as basal insulin with many conveniences and have provided physicians with the appropriate tools to overcome the obstacles to improve metabolic control during fasting without increasing the risk for hypoglycemia and also improve diabetes outcomes [43].

Table-6: GLP-1 analogue dose modification during Ramadan [39].

Situation in pre-Ramadan	Action during Ramadan
Exenatide Single dose before breakfast.	Same dose before Iftar
Exenatide twice daily	Same as pre-Ramadan before Iftar/or Suhoor
Liraglutide	Same dose before Iftar
Dulaglutide/ Semaglutide weekly	Same dose as before pre-Ramadan weekly

Combination of different antidiabetic agent:

- Combination of Oral (OAD) and Insulin:
- Only doses of insulin and OAD- Secretagogues (SU and non-SU) need to be adjusted. Other oral agents need not require for adjustment.
- Combination of insulin glargine and glimepiride may be used during Ramadan in patients with Type 2 diabetes who wish to fast, provided glimepiride is given at the time of breaking the fast and insulin glargine titrated to provide FBG >6.7mmol/l. [44]
- Combination GLP1 analogue with OAD or Insulin:
- Keep the dose of GLP1analogue Liraglutide/ Exenatide/ Lixisenatide or weekly dulaglutide/ semaglutide same as pre-Ramadan dose even used with insulin. But insulin doses need to be adjusted accordingly. Similarly, SU needs to be adjusted, other OAD do not require adjustment [45].

Management of hyperglycaemia in pregnancy when fasting during Ramadan

Diabetes in pregnancy is associated with an increased risk of both hyperglycaemia and hypoglycaemia, with an increased risk for both the mother and the baby [46-48]

Nevertheless, fasting during pregnancy is an important personal decision and a practical approach is needed to clearly explain the potential risks of fasting to the mother and the fetus. Moreover, a structured education is needed to empower pregnant women with hyperglycemia with the knowledge and self-management skills for good pregnancy outcomes regardless of their fasting decision.

Pre-Ramadan Assessment

Many pregnant women are not clear on what to do during Ramadan fasting. Indeed, some studies indicate that many women get advice only from family members or the Imam but not taking any advice of healthcare professionals [49,50]. Hence, it is prudent that routine pre-pregnancy counseling, for Muslim women with hyperglycemia include a discussion on fasting during Ramadan.

Pregnant women with pre-existing diabetes who intend to fast during Ramadan should be identified several months prior to Ramadan. A complete assessment should be conducted, and a proper fasting risk evaluation should be performed.

Education and Blood Glucose Monitoring

All pregnant Muslim women with hyperglycaemia should receive formal training on target blood glucose levels and their impacts to the mother and baby; actions of insulin; injection techniques; the management of acute complications; and(the behind) the breaking of a fast.

All pregnant women with diabetes should also be made aware that testing blood glucose levels with a fingerpick test DOES NOT break their fast. Pregnant women with diabetes should check blood glucose levels as indicated. Self-Monitoring of Blood Glucose (SMBG) has been the gold standard of care for evaluating blood glucose levels in pregnant women with hyperglycaemia[49]. CGM or FGM provide a more comprehensive glucose profile and a better opportunity for intervention [51-54], yet the accuracy of such devices during hypoglycaemia needs to be established.

Physical Activity

Women are advised to maintain normal Household activity while fasting. The Taraweeh prayer is considered as exercise and should be taken into consideration when insulin dosage adjustments are made.

Nutritional care and meal planning

Pregnant women with diabetes should seek dietary advice before Ramadan wherever possible. The importance of healthy eating during Ramadan is emphasized regardless of fasting status. Abstaining from high calorie meals is essential. Fruit juices and sugary drinks should be avoided. Salty foods should also be avoided, and caffeine intake should be limited. Pregnant women should also be encouraged to eat foods rich in fiber and to drink 2-3 litres of water at night Pregnant women with diabetes must take Suhoor as late as possible. Balance diet based on pregnancy status, advised by registered nutritionist is preferable.

Recommendations for the management of hyperglycaemia in pregnancy during Ramadan fasting

During pregnancy, women with hyperglycaemia would be treated with insulin.
Pregnant women must understand that regardless of their fasting status, they need to sustain the standard blood glucose targets during pregnancy of:

- Fasting between 70-95 mg/dL (3.9 – 5.3 mmol/L).
- Post-prandial < 120 mg/dL(6.7 mmol/L).

Pregnant women must also understand that during pregnancy they should break their fast if any of the following occur:

- BG levels < 70 mg/dL (3.9 mmol/L) during fasting hours or blood glucose is high above 16.7 mmol/l
- Feeling unwell.
- Reduced fetal movement.
- Fetal growth is inappropriate according to gestational week

T2DM or GDM controlled by diet alone or with Metformin

Metformin can continue upto 1st trimester if patient is already on drug but better to stop and should not initiate.
It is recommended that pregnant women with T2DM or GDM take precautionary measures, these include:

Regular SMBG to ensure that they are within the recommended targets. At the very least they should test:

- Before the sunset meal.
- 1-2 hours after meals (depending on the individual patient's routine of 2 or 3 meals during Ramadan).
- Once during the day while fasting, particularly in the afternoon.
- Anytime they feel unwell.

Insulin treated pregnant women

Pregnant women who are treated with insulin should adhere to the following:
Glucose monitoring - this should be performed as already mentioned, with an emphasis on testing at any time during the day where the patient may be feeling unwell or displaying signs of hypoglycaemia or hyperglycaemia. Multiple times of the day depends on treatment regimen.

For recommendations on insulin dose adjustments please see Table 7.

Table-7: Insulin dose adjustment recommendations in pregnancy during Ramadan

Type of Insulin Regimen	Adjustment during Ramadan fasting	Monitoring during Ramadan fasting
1. Premixed (analogue or conventional)	• Shift the morning pre-Ramadan dose to the Iftar Inject 50% of the pre-amadan evening dose at Suhoor	5-7 point blood glucose monitoring
2. MDI (basal bolus) with conventiona insulins	NPH insulin • Morning pre-Ramadan dose to be taken at iftar • 50% of the pre-Ramadan dose to be taken at Suhoor Regular insulin • Dose at Iftarto be adjusted based on the 2 hr post iftar glucose reading • Suhur dose 50% of the pre-Ramadan evening dose Afternoon dose to be skipped	5-7 point blood glucose monitoring
3. MDI (basal bolus) with analogue insulins	Basal insulin • 30-40% reduction in dose and to be taken at Iftar or fixed time of night, better to pre Ramadan time *RAI* • Dose at Suhoor to be reduced 30-50% • Pre-lunch dose to be skipped • Dose at Iftar to be adjusted based on the 2 hr post iftar glucose reading	5-7 point glucose monitoring
4. CSII / Insulin Pump	Basal rate adjustment • 20-40% decrease for the final 3-4 hours of fast • 10-30% increase for the initial few hours of iftar Bolus doses • Same principles as prior to Ramadan, and reducing the dose post-Suhoorby 20%	CGM

Management of diabetes among the elderly when fasting during Ramadan

It is important to recognise that age in and of itself is not a good reason to categorise individuals as high risk for fasting during Ramadan, but rather it is the associated implications of old age that need consideration. Indeed, the elderly that do manage to fast can be more motivated than their younger counterparts — the DAR Global Survey found that 69% of those aged ≥ 65 years fasted for 30 days compared to 60% in those < 65 years [55,56].

However, people in the elderly ages can often have other comorbidities alongside diabetes. Indeed, people with diabetes have a heightened risk of complications such as diabetic kidney disease, cardiovascular disease (CVD) [57], retinopathy among others. Indeed, old age can be a risk factor for diseases such as dementia or recurrent falls, hip fractures, amputation and visual impairment. In a study of elderly participants with diabetes and an added risk of CVD during Ramadan, it was found that there was an increased risk of impaired renal function [58]. Fasting during Ramadan was also found to have an effect on postural balance and attention in the elderly and may increase the risk of falls or fall-related injuries. Volume depletion is also an important issue, especially among those aged over 75. This increase in the risk of complications occurring in elderly people with diabetes can have a direct impact on the number of days fasted during Ramadan. [56]

In elderly individuals with such comorbidities, there will inevitably be changes to their:

- Physical activity patterns
- Ability to self-manage blood glucose (SMBG)
- Ability to take medications
- Feeding patterns
- General independence and family support

Therefore, pre-Ramadan education to elderly individuals with diabetes and their surrounding support network need to be clear and individualized covering all circumstances to prevent any unexpected outcomes from arising during the Ramadan fast.

Hypoglycaemia

The risk of hypoglycaemia is particularly increased [9] and may present with neuroglycopenic manifestations in the form of dizziness, delirium and confusion. Therefore, every measure must be taken to mitigate the risk of this occurring. This may include an increase in SMBG, or changes to treatment regimens that can cause hypoglycaemia such as beta blockers, salicylates, warfarin and tricyclic antidepressants. A particularly important concern among the elderly is hypoglycaemia unawareness and these individuals should be discouraged from fasting. However, any changes made to these medications must be conducted in accordance with guidance from the relevant physicians as any changes could have significant consequences. The DAR 2020 Global Survey showed that people with T2DM aged ≥ 65 reported episodes of hypoglycaemia in statistically significantly higher proportions than those aged < 65, 17.4% and 15.2% respectively ($p<0.001$). Furthermore of those that experienced hypoglycaemia, 9.9% of those aged ≥ 65 had to go to the emergency department compared to 4.3% of individuals aged < 65 and similarly a there was a suggestion that a greater proportion of those aged ≥ 65 required hospital admission [56,59].

Hyperglycaemia

Hyperglycaemia was defined as blood glucose levels > 16.6 mmol/L, 300 mg/dL). The DAR 2020 Global Survey also showed that hyperglycaemia remains a large issue among the elderly. It was reported that there was a significantly higher proportion of elderly individuals with T2DM reporting hyperglycaemia during Ramadan 2020, with 19.3% among those aged ≥ 65 compared to 15.6% among those aged < 60, $p=0.006$. Among all, the mean number of days with hyperglycaemia was 8.1 which was similar in both age groups.

Management of elderly individuals with diabetes that fast-during Ramadan

People that are in older age groups fast during Ramadan for many reasons and it is important that their wishes to do so must be respected. As mentioned, many elderly individuals that fast do so with a heightened risk of complications. It is important that these are considered and taken into account when any individuals guidance or advice are offered.

Elderly individuals that do seek to fast during Ramadan must be given greater support than their younger counterparts. This can be through friends, relatives or caregiver's, but it is imperative that elderly individuals that do plan on fasting have these support networks in place before conducting the fast. The heightened risk of complications arising during the Ramadan fast and the increased likelihood that individuals have accompanying comorbidities increases the need for extra care.

Pre-Ramadan education of elderly individuals with diabetes

Pre-Ramadan education for people seeking to fast during Ramadan remain an important consideration for all people seeking to fast during Ramadan and more so among the elderly. All measures must be implemented into individualised pre- Ramadan education and it is, therefore, crucial that HCPs work together in producing the most effective programmes.

SMBG Protocol is same as BES Ramadan Guideline:

In individuals that are being treated with oral antidiabetic medications the following recommendations should be considered:

- Where sulfonylureas are used, gliclazide and glimepiride should be used instead of glibenclamide.
- SGLT2 inhibitors doses should be reviewed in accordance with advice from a specialist and considerations must be given to benefit vs risks of adverse events especially in elderly people with impaired renal function or those that are treated with diuretics or history of postural hypotension.
- Among individuals using insulin therapy it is recommended that analogue insulins are considered over human insulins.

Risks of fasting during Ramadan: Cardiovascular, Cerebrovascular and Renal complications

Impact of fasting during Ramadan for people with diabetes on cardiovascular disease (CVD)

Diabetes has been frequently associated with an increased risk of CVD [60,61]. In addition, people with diabetes also have a heightened risk of stroke [62]. Importantly, the practice of unsafe fasting including a high intake of carbohydrates, low levels of activity, poor sleeping patterns, inadequate hydration, and missing doses of essential medicines could have an impact on the risk of CVD or stroke in people with diabetes [63,64].

On the other hand, when fasting is conducted safely these risks could be mitigated. It has been demonstrated that proper glycaemic control can reduce the number of cardiovascular events [65]. Likewise, fasting has also been shown to significantly increase levels of nitric oxide (NO) and decrease markers of oxidative stress [66,67], with a variable effect on lipoprotein levels, high sensitivity C-Reactive protein (hsCRP) levels and blood pressure [68,69]. The last two decades have seen an increase in the awareness of the risks that diabetes poses to CVD. However, it is important to understand the impact that fasting during Ramadan has on the risk of CVD.

Fasting during Ramadan and acute coronary syndrome (ACS)

Acute coronary syndrome (ACS) is a term that refers to a range of conditions that involve a restriction of blood flow to the coronary arteries. Such conditions include unstable angina and myocardial infarction (MI). Evidence suggests

that there is no clear association between fasting during Ramadan an increase in acute cardiac events [70,71]. Suwaidi et al. demonstrated no true differences in the percentage of people with diabetes that were admitted with ACS before (51%), during (56%) and after (59%) Ramadan [72].

In addition, there were some protective effects of fasting during Ramadan found in some studies. Temizhan et al. found a significant reduction in the number of ACS events during Ramadan when compared to times outside of Ramadan [73]. Likewise, Burazeri et al. found protective associations between a composite measure of religiosity and ACS in a cross-sectional study [74].

Fasting during Ramadan and cardiac arrythmias

There have been few studies assessing the impact of fasting during Ramadan on cardiac arrythmia and further research into this condition is needed. A retrospective review from 1991– 2010 looking into patients that were hospitalised with atrial fibrillation found no significant differences in the time periods of admission when comparing times prior to, during and after Ramadan. There was even the finding in a subgroup of patients that had underlying ischemic heart disease that showed a reduction in hospitalisations during Ramadan [75]. There was no additional cardiac arrythmia episodes in patients with hypoglycaemia that utilised continuous glucose monitoring (CGM) during Ramadan [76].

Fasting during Ramadan and stroke

Diabetes is an independent risk factor for stroke and the effect of fasting during Ramadan in people with diabetes needs to be established. Assy et al. in a cross-sectional designed study found that people with type 2 diabetes mellitus (T2DM) were no more likely to be hospitalised for ischaemic or haemorrhagic stroke during Ramadan than in the months before or after Ramadan [77]. Moreover, El-Mitwalli et al. confirmed these results in a longitudinal study in Egypt [78]. A retrospective review by Bener et al. also reported similar findings in Qatar where 50% of the cohort had diabetes, although no subgroup analyses were shown to see this effect in those with diabetes [79]. Conversely, others found the opposite showing fasting during Ramadan was associated with a significantly higher risk of stroke. Selcuk et al., in a retrospective review, found a greater frequency of ischaemic stroke during Ramadan than compared to before or after Ramadan [80].

It is clear that there are conflicting findings on the impact of Ramadan on the risk of stroke. Some have found that there is a greater risk during Ramadan and others have found no difference in the risk. Greater research is needed in randomised cohorts where confounding can be removed and the specific effects of fasting on the risk of stroke can be assessed. Also, studies should aim to follow up individuals that have pre-existing stroke and diabetes and assess whether these patients can safely fast during Ramadan.

Considerations and recommendations (CVD and stroke)

It is recommended that all people with diabetes and pre-existing CVD, that are seeking to fast during Ramadan should receive a specific risk assessment and individualised advice.

Individuals with diabetes that have macrovascular complications such as stable or unstable CVD or stroke should remain classified as high risk. These individuals should generally be discouraged from fasting

Those that are in the higher risk categories for fasting and still choose to fast must:

- Receive a thorough risk assessment from their diabetes specialist, cardiologist and/or neurologist well in advance of Ramadan.
- Obtain individualised advice based on their current health status and treatment regimes.
- Receive pre-Ramadan education and understand how to properly conduct safe fasting with diabetes.

- Practice safe fasting as discussed in these guidelines wherever applicable.
- Receive pre-Ramadan screening.
- Make appropriate adjustments of therapies in accordance with their symptoms of CVD or stroke. For example, diuretics, antihypertensive, anti-diabetes medication and insulin regimens will need adjusting to give the greatest chance of achieving safe fasting during Ramadan.
- Anti HTN drug need to dose reduction to prevent postural hypotension
- Make a concerted effort to stay hydrated and get an adequate amount of sleep and nutrition prior to conducting fasting.

Fasting during Ramadan and Renal function

There have not been many studies conducted that have investigated the direct effect of fasting during Ramadan in people with diabetes on renal function [81-83.

El-Wakil et al. showed in a comparative prospective study that those with CKD were more likely to have increased levels of urinary NAG compared to healthy individuals that fasted during Ramadan. Importantly, they showed that the increase in urinary NAG levels were associated with blood glucose levels, highlighting the importance of glycaemic control among those with diabetes [84]. Mbarki et al. also showed that individuals with CKD that fasted during Ramadan could experience deterioration in renal function, particularly in those with an estimated glomerular filtration rate (eGFR) of less than 60 mL/min/1.73m2 [85]. Bakhit et al. also showed that the higher the stage of CKD the worse the renal outcomes during Ramadan [86]. Importantly, others also noted that CKD can lead to an increased risk of CVD in individuals that fast-during Ramadan [87].

On the other hand, Bernieh et al. showed an improvement in eGFR during and after Ramadan with no significant changes to biochemical measures such as urinary electrolytes, protein or osmolarity [88]. Kara et al. also showed similar outcomes in a comparative study of people that fasted compared to those that did not.[89].
Fasting during Ramadan in individuals on dialysis

There have been several studies conducted in individuals that have undergone dialysis, and many have found that fasting can be safely conducted during Ramadan without any added complication. Several studies have also taken into account the effect of diabetes. These studies have been summarised below.

Al-Wakeel et al. showed, in a study of 31 participants on peritoneal dialysis, that fasting was not associated with mortality or morbidity [90]. A study in 40 participants on haemodialysis that fasted on non-dialysis days found that fasting had no effect on weight gain, blood-pressure or electrolytes [91]. Likewise, another study on participants that underwent haemodialysis and fasted during Ramadan, showed that there was no excess mortality or morbidity as a result of fasting [92]. A large prospective, multi-centre, comparative study of individuals on haemodialysis was conducted in Saudi Arabia. More than half of the study participants had diabetes. It was found that there were no differences in pre- and post-dialysis blood pressure, serum potassium, albumin or cardiovascular events between those that fasted and those that did not fast during Ramadan [93].

Fasting during Ramadan in individuals that have undergone a renal (kidney) transplant

There have also been many studies that have looked into the effect of fasting during Ramadan in individuals that have undergone a kidney transplant.

Ghalib et al. found that eGFR did not change from levels before Ramadan after fasting during Ramadan, even after adjusting for diabetes and age. They also found no differences in biochemical measurements between participants that fasted and those that did not fast [94]. These results were similar to that found by Ibrahim et al. who conducted a retrospective study in the Kingdom of Saudi Arabia [95]. A prospective study in Iran found that fasting was not associated with acute rejections of transplants or other complications [96].

Considerations and recommendations (CKD, Dialysis and Kidney Transplants)

- All individuals with diabetes (both T1DM and T2DM) and CKD should discuss their intentions to fast during Ramadan with diabetes and renal specialists at least three months prior to Ramadan and attend Ramadan focused education.
- Individuals with stable renal transplants and diabetes (both T1DM and T2DM) may be able to fast safely providing they are monitored carefully by their transplant team before, during, and after Ramadan, and given careful advice on how to take immunosuppressive and anti-diabetic medication.
- Individuals with diabetes (both T1DM and T2DM) and CKD of stages 3-5, or on dialysis should be considered high-risk,and fasting should be discouraged.
- Those that are considered high risk and still choose to fast must:
- Be carefully monitored and have weekly reviews during Ramadan
- Make a concerted effort to stay hydrated outside of fasting periods
- Monitor electrolyte and creatinine levels at various points during Ramadan to ensure safe fasting is being conducted and whether it should continue
- Avoid foods with high potassium or phosphorous content.

Emergencies Related to Diabetes during Ramadan

Major complications associated with fasting in patients with diabetes are[97]:

- Hypoglycemia
- Hyperglycemia
- Diabetic ketoacidosis/HHS
- Dehydration and thrombosis

General prevention measures to avoid acute complications:

The key components needed to be addressed to minimize acute complications related to diabetes during Ramadan fasting are risk assessment, providing structured Ramadan focused education to people with diabetes, frequent blood glucose monitoring, appropriate and individualized advise of nutrition and exercise, appropriate drug and dose modification, and addressing comorbidities and personal circumstances [5,8,97-99].

Risk assessment: Those diabetic patient with very high risk and high risk should be recommended not to fast. Emphasis should be given to frequent capillary blood glucose monitoring [5].

Ramadan-focused diabetes education: Patients should be empowered with Ramadan focus structured education with the knowledge of recognizing symptoms of hypoglycemia, hyperglycemia and other acute complications three months (at least 1 month) prior to beginning of Ramadan [5].

Self-monitoring of blood glucose (SMBG): Patient should do frequent SMBGs in the first few days of fast to become aware of their glycemic profile with changed meal intake and altered dosage of medications. Thereafter frequency of testing can be reduced [97]. SMBG should be done prior to Suhoor, 2 to 4 hours after Suhoor, between 11 am to 2 pm, before Iftar and 2 hours after Iftar. SMBG Self-monitoring of blood glucose (SMBG) does not invalidate religious fast [99]. Low risk patients should also perform SMBG during pre-Suhoor, midday, pre-iftar and whenever symptoms of hypoglycemia or acute illness occur [99]. High risk persons should monitor SMBG more frequently during fasting period, with special attention during noon, afternoon and before iftar times.

Diet plan: Dietary recommendations should be individualized and tailored to patients' lifestyle requirements, age, comorbidities and other medical needs [100]. Adherence to diabetic diet is vital during Ramadan to avoid hypoglycemia, hyperglycemia and dehydration. Excessively eating when the fast is broken and inappropriate dose modifications of medicines should be avoided. [97]. Suhoor meal should be taken as late as possible. [5].

Maintaining hydration: Hydration should be maintained between meals by drinking water and non-sweetened beverages. [97]. Iftar should begin with water and 1–2 dates to raise blood glucose. [5]. The dosage of antihypertensive medications should be adjusted to prevent hypotension. [97].

Exercise: Excessive physical activity should be avoided, particularly during few hours before Iftar. Tawari prayer should be considered as a part of physical activity [97].

Drug and dose modification: Second generation Sulfonylurea (Gliclazide, Gliclazide MR, Glimepiride) are preferred due to low risk of hypoglycemia compared to first generation, while, dose and timing of OAD should also be changed during Ramadan.

With SGLT 2 inhibitors, extra water should be ingested during non-fasting periods to prevent dehydration. It should not be used in elderly, patients with eGFR <20ml/min/1.73m2, in conditions that may lead to hypotension [5,32,101].

Analog insulins are preferred over conventional insulins due to lower risk of hypoglycemia. Analog basal-bolus regimen is the safest regimen to be used during Ramadan fasting [34].

Post- Ramadan Follow-up

At the end of Ramadan, up to the last iftar, the Ramadan schedule of anti-diabetic medication and meal patterns should be followed. From Eid day, the pre-Ramadan medication and meal pattern schedule should be followed. Eid-ul-Fitr, a day of the festival, marks the end of Ramadan, and patients with diabetes should be made aware of the risks of dietary overindulgence during this time. A post-Ramadan follow-up meeting with a physician is advisable, ideally within 1-2 weeks after Eid-ul-Fitr, to assess how the patient handled the fasting, the level of glycemic control, the incidence of hypoglycemia, hyperglycemia, or any acute complication like DKA, HHS that would help the physician to make a patient-specific Ramadan plan for the next year [2,102-104].

The physician should assess the patient's body weight and BMI, check the SMBG records during Ramadan and days after the Eid-ul-Fitr and measure HbA1c, serum creatinine, and lipid profile. Post-Ramadan follow-up should include necessary changes to the patient's medication regimen, meal planning, and physical activity plan[105,106].It should be stressed to the patient that a safe fast one year does not automatically make them low risk for the next year due to the progressive nature of the disease.

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