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# Management of diabetes during ramadhan

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**Abstract**
Fasting during holy month of Ramadhan is an obligatory for all healthy adults Muslims. When making decision of fasting it is important to consider both religious and health aspects. From medical point of view, patients with type- 1 diabetes are generally advised strongly to not fast. Many risks and complications including hypoglycemia, hyperglycemia, ketoacidosis, dehydration are associated in both type one and type two diabetes with fasting. Patients should not stop taking medications during Ramadhan; however, they should go through assessment and education about diet plan and drugs before the beginning of Ramadhan in order to get right adjustment to the types and dosage of their medications.

**Keywords:** hyperglycemia, hypoglycemia, ketoacidosis

## Introduction
There are about 1.5 billion Muslims worldwide. Fasting is quite common among Muslims. EPIDIAR population based study in 13 Islamic countries showed 43% of patients with type 1 Diabetes and 79% of patients with type 2 diabetes fast during Ramadhan [1]. This leads to the estimation that around 40-50 million people with diabetes worldwide fast during Ramadhan. Muslims who fast must abstain from drinking, eating, use of oral medications and smoking from predawn to after sunset. Depending on geographical location and season, the duration of daily fast may range from few to more than 20 hrs. Breaking the fast after sunset meal called 'Iftar'and closing or last meal before dawn is called sahoor. Fasting is not meant to create excessive hardship on individual. Quran specifically exempts the sick Muslim from the fasting (Holy Quran, Al-Bakarah, 183-185 ) specially if fasting might lead to harmful consequences for individual, yet many patients with diabetes insist on fasting and thereby creating challenge for themselves and their physicians. It is important for all diabetics to undergo a full assessment 1 to 2 months before Ramadhan. Appropriate counselling and education about risks and of fasting and their medicines dose adjustment/modifications.

## Pathophysiology
In healthy persons, feeding stimulates insulin secretion. Insulin promotes the storage of glucose in liver and muscles as glycogen. During fasting circulating glucose tends to fall that causes decrease in Insulin secretion and rise in catecholamine and glucagon secretions to maintain blood glucose level by glycogen break down and neoglucogenesis [2]. As fasting prolongs glycogen stores become depleted and fatty acids are released to be used as fuel by heart liver kidneys and muscles, sparing glucose for continued use by brain and RBCs. In normal individuals without diabetes, the process is delicately regulated between insulin and counter hormones that help maintain glucose levels in physiological range.

In diabetics, the insulin secretion is perturbed by underlying pathophysiology and pharmacological agents, which enhance insulin function n secretions. Inpatients with sever insulin deficiency a prolonged fast can lead to excessive breakdown of glycogen and increased neoglucogenesis and ketogenesis leading to hyperglycemia and ketoacidosis specially in type 1 diabetes. Ketoacidosis is uncommon in type 2 diabetes.

## Risks linked with fasting in patients with Diabetes
There are several risks associated and related to fasting during Ramadhan in patients with diabetes. Studies have shown high rate of acute complications [1].

## Hypoglycemia
Decreased or no food intake for several hrs is well known risk factor for hypoglycemia. Hypoglycemia accounts for 2-4% mortality in pts with type 1 diabetes [3].
EPIDIAR study [1]. showed fasting during Ramadan increased risk of severe hypoglycemia, 4 folds in type 1 diabetes (from 3 to 14 events /100 pt/month) and 7.5 fold in pts with type 2 diabetes ( from 0.4 to events/100pt/month).

## Hyperglycemia
Hyperglycemia results in pts severe insulin deficiency from excessive breakdown of glycogen. Hyperglycemia may have been due to excessive reduction in dosage of medication to prevent hypoglycemia. EPIDIAR study showed, during Ramdan fivefold increase in incidence of severe hyperglycemia in pts with type 2 and threefold increase in pts with type 1 with or without ketoacidosis requiring hospitalization [1].

## Diabetic ketoacidosis
Diabetic ketoacidosis a dangerous and sometimes fatal condition develops in patients who fast during Ramadan especially with

type 1 diabetes are at increased risk for this. In this condition, there is accumulation of ketone bodies in blood. This is because of reduced insulin intake during fasting and gross hyperglycemia from excessive glycogen breakdown.

**Dehydration and Thrombosis**

During fasting there is decreased fluid intake which if prolonged may cause dehydration. This is compounded in hot and humid climates particularly in individuals who perform hard physical labor. Hyperglycemia is one other cause leading osmotic diuresis and contributes to volume and electrolyte depletion and dehydration. The hypovolemia, results in hypotension specially orthostatic type particularly in patients with preexisting autonomic neuropathy which could cause falls, injuries and fractures etc. patients with diabetes exhibit a hypercoagulable state [4]. Hypovolemia and dehydration state increases the blood viscosity and enhances the risk of thrombosis.

**Breaking the Fast**

Fasting during Ramadan has religious regions. However, Diabetics should understand that in some situations they must end fast in order to avoid serious complications.

All patients understand and must always immediately end their fast if

- Blood sugar level drops to below 60mg/dl[3.3mmol/l], treat low sugar
- Blood sugar level exceeds 300mg/dl [16.7mmol/l]
- Blood sugar level reaches 70mg/dl at within few hrs, of start of fast especially in one is on Insulin and SU drugs. Treat hypo immediately.
- You start feeling unwell, disoriented, confused or faint break the fast, check sugar immediately and have drink of water n other fluid, juices.

**Medical assessment, Risk stratification before Ramadan and Patient Education and individualization**

It is important for all diabetic patients to undergo full assessment 1-2 months before Ramadan. It is worth emphasizing that fasting for patients with diabetes represents an important decision that should be made in light of guidelines for religious exemptions and after careful consideration of associated risks following full discussion and assessment of the treating physician.

- Appropriate blood tests should be ordered and evaluated.
- Make sure BP, lipids and blood sugar are well controlled.
- Necessary changes in diet and or medication regimen should be made.
- Even patients who wish not to fast also required undergoing this assessment because they still have risk of getting some complications because of eating and other habits and traditions during month of Ramadan.
- It is essential that patient and family receive the necessary education and counseling about self-care including s/s of hyper and hypoglycemia, blood glucose monitoring, meal planning and medication management of acute complication and use of glucose gel, glucose tabs or glucagon injection by family members.
- Normal levels of physical activity may be maintained. Moderate to heavy exercise may be a higher risk to hypoglycemia and should be avoided specially few hrs before sunset meal (Iftar).

**Ramadan Nutrition plan (RNP)**

The diet during Ramadan should not differ significantly from a balanced healthy diet. 50-60% of individuals who fast maintain their weight, while 20-25% either gain or lose weight during fasting month [1].

Based on goal of achieving optimal medical nutrition therapy during Ramadan an ideal RNP should include

Consumption of adequate daily calories and divide them between sahoor and iftar and 1 or 2 snacks.

Avoid Ingesting large amount of food rich in carbohydrates and fat especially at sun set meal (iftar)

Complex carbohydrates may be advisable at predawn meal (sahoor) because of delay in digestion and absorption.

Follow the Ramadan plate as

| | |
|---|---|
| One cup vegetable | 4 oz. of lean protein |
| 1.5 cup whole grain rice | 1/3 rd. cup beans/lentils/peas |
| Two Spoons of oil | 1-2 dates and one glass of low fat milk |

Maintain adequate hydration by drinking sufficient water and non-sweetened beverages between meals

Minimize caffeinated drink intake as it can result in fluid loss.

**Management of Patients with Type-1 diabetes [5].**

Patients with type 1 DM in young adults and adolescents and brittle or poorly controlled are at high risk of developing severe complications and strongly advised to not fast. As long as glucose levels in adults with T1DM are stable can fast under strict supervision.

Glycemic control near normal requires use of multiple daily Insulin injection 3 or more OR subcutaneous continuous infusion through Insulin pump.

**1. Insulin Pump therapy**

Basal rate insulin- A reduction of 20-40% in last 3-4 hrs of fasting, similarly an increase in dose by 0-30% after iftar early hrs.

1. Multiple dose Insulin therapy

- Long/ Intermediate acting Insulin- A dose reduction of 20-40% is recommended for dose at Iftar
- Short acting Insulin- Normal dose taken at Iftar and dose reduction of 25-50% recommended at sahoor.

**Management of Patients Type-2 Diabetes [5].**

1. Diet controlled patients. In patients T2DM well controlled with diet alone, risks associated with fasting are low. There is still potential risk of postprandial hyperglycemia after Iftar and sahoor meal if they over indulge in eating. Modify the exercise program in intensity and timings.
2. Patients treated with oral hypoglycemic agents. These agents by large act by either increasing insulin sensitivity or increasing insulin secretion.

Metformin- Patients on this agent can safely fast, as possibility of hypoglycemia is minimal.

Dose adjustment. For single daily dose if adjustment required then take it at Iftar.

For twice-daily dose, take it at sahoor and iftar.

Prolonged release Metformin, if modification required then need to be taken at Iftar.

1. Short acting Insulin secretagogues. Repaglinide and Nateglenide. They are useful due to short duration of action and be taken before Iftar and sahoor meals and dose can adjusted according to meal size.
2. Sulphonylureas (SU). These agents have inherent risk of hypoglycemia so their use be with caution.

For once daily dose need to be taken at Iftar (pm). For twice daily dosing if modification required need to be taken at Iftar and sahoor.

Third generation SU be used instead of second generation due high risk of hypoglycemia.

1. TZDs Pioglitazone, Roziglitazone once daily no change needed
2. Use DDP4I and SGLT2 inhibitors with caution, no dose modification.
3. GLP-1 RAs have to be titrated at least 6 weeks prior to Ramadan.
4. INSULINs [5]. Major object is to suppress hepatic glucose output. The incidences of hypoglycemia is less in comparison to T1DM on Insulin

a. Long term Insulin.

For NPH, Determir/ Glargine/ Degludec Once daily.
A dose reduction by15-30 % can be done and need to be taken at Iftar.

**Twice daily, doses modification.**

a. Morning dose be taken at Iftar and evening to be taken at sahoor with 40- 50% dose reduction
b. Short acting Insulin. A reduction of 25-50% recommended at sahoor
c. Premixed Insulin

For once daily dosing- Normal dose to be taken at Iftar.
For Twice daily dosing. Normal dose at Iftar, dose at sahoor should be reduced by 25-50%.

## Conclusion

The rising prevalence of diabetes in the Muslim population, combined with the high numbers that participate in fasting, creates a pressing need for effective guidance for the management of diabetes during Ramadan
A patient decision to fast should be made after ample discussion and assessment with treating physician concerning the risks involved and modifications needed. The pre assessment, education and counseling about diabetes management during Ramadan will help the patient make informed decision.
Individualized Ramadan-specific treatment regimens should be provided for each patient, which are sensitive to regional and cultural factors
Education, communication and accessibility are all critical to the success of the guidance provided [5].
Barriers in implementing the management should be identified and overcome by raising the awareness among people.

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