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Original Article

Impact of Ramadan Fasting on Patients with Diabetes Type 1 Diabetes Mellitus: An Observational Study From Pakistan

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Abstract

Objective: This study assessed the impact of pre-Ramadan medical assessment, education, and individualized insulin adjustments on diabetes-related complications in fasting T1DM patients under medical supervision.

Methods: A prospective observational study was conducted at Fatima Memorial Hospital, Lahore, involving 28 T1DM patients (82.1% aged ≥ 20 years, 67.9% female). Participants underwent pre-Ramadan risk stratification (IDF-DAR guidelines), structured education, and insulin regimen optimization. During Ramadan, remote monitoring via WhatsApp provided real-time support. Outcomes included hypoglycemia, hyperglycemia, DKA, and hospitalization rates.

Results: Younger participants (<20 years) had higher hypoglycemia rates (80% vs. 34.8%, *p*=0.133) and were more likely to break fasts due to hypoglycemia (80% vs. 21.7%, *p*=0.026). Mean HbA1c was higher in younger patients (8.3% vs. 7.3%, *p*=0.008). No hospitalizations occurred. Most participants (50%) fasted >20 days, with 11.3% completing all fasts. Frequent glucose self-monitoring was associated with better outcomes (*p*=0.03 for females).

Conclusion: Pre-Ramadan assessment, education, and remote supervision enable safer fasting in low-to-intermediate-risk T1DM patients. Younger individuals and those with poorer glycemic control require closer monitoring. Structured interventions mitigate acute complications, though larger studies are needed to refine guidelines.

Keywords: Ramadan fasting, Type 1 diabetes, hypoglycemia, insulin adjustment, Pakistan.

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Introduction

Fasting during the holy month of Ramadan is an obligatory religious observance for millions of Adult Muslims worldwide, characterized by abstinence from food, drink, and medications from dawn to sunset. As per the geographic location, the period of fasting may vary from ten to twenty hours. Certain groups of people are exempted from fasting, such as those who are suffering from an illness — this includes some people with diabetes. While the act of fasting holds deep spiritual significance, it presents unique physiological implications for individuals, particularly those with chronic medical conditions such as Type 1 Diabetes Mellitus (T1DM) due to marked changes in intake of food and fluid.[1,2] For patients with T1DM, maintaining optimal glycaemic control is crucial to prevent acute complications like hypoglycemia, hyperglycemia, dehydration, diabetic ketoacidosis (DKA), and long-term complications such as retinopathy, nephropathy, and cardiovascular disease. This makes fasting with type 1 diabetes a challenging prospect for both patients and healthcare professionals looking after them. Individuals with T1DM are at high risk of severe complications but despite these risks, a sizable number of patients including both adults and children still choose to fast for various personal, religious, and social reasons. The prevalence of type 1 diabetes mellitus (T1DM) among participants in the EPIDIAR, DAR-MENA, and DAR Global Survey was 8.7%, 7.2%, and 20.2%, respectively. Notably, the DAR Global Survey had the highest proportion of T1DM patients, with 25% being ≤18 years old (mean age: 14.5 years). This survey spanned 13 countries and revealed that

17.1% of Muslim participants with T1DM fasted during Ramadan. However, while 50.7% of patients under 18 received Ramadan-specific diabetes education, this figure was higher (63.3%) among those over 18. This highlights a concerning trend: a significant portion of individuals with T1DM fast without proper education or medical supervision.[3,4,5]

The primary concern for individuals with T1DM who fast during Ramadan is the increased risk of hypoglycemia, particularly during the daylight fasting hours. The prolonged periods of fasting without food intake may lead to a depletion of hepatic glycogen stores, increasing the risk of hypoglycemia, especially in those who use rapid-acting insulin analogs. Studies have shown a significant increase in hypoglycaemic episodes during Ramadan among individuals with T1DM who fast. The incidence of hypoglycaemia can increase up to 4.7 times during Ramadan hence predisposing patients to potentially serious health consequences.[6]

The risk of hyperglycemia and DKA is also increased whilst fasting, particularly in a few hours after breaking the fast. The Iftar meal which usually has a high carbohydrate content can cause post-iftar hyperglycemia, especially if insulin dosages are not optimized. Reduced insulin dose whilst fasting along with dehydration, can cause hyperglycemia and DKA. A study by Salti et al. (2004) demonstrated that individuals with T1DM who fasted during Ramadan had a 3-5-fold increased risk of DKA compared to non-fasting individuals.[3]

Although a lot of literature now exists on fasting in Type 2 diabetic patients, there is a dearth of evidence-based research on safe and effective management of fasting during Ramadan in children and adolescents with T1DM. Consequentially, performing a pre-Ramadan assessment and delivering relevant education to young patients with T1DM may hold substantial benefits despite their challenges.

Therefore, we have conducted this prospective study to assess the impact of pre-Ramadan medical assessment by endocrinologists, education, and individualized insulin adjustment by assessing the incidence of diabetes-related complications (hypoglycemia, hyperglycemia, diabetic ketoacidosis) in people with type 1 diabetes who are at low or intermediate health risk (as per Diabetes and Ramadan practical guidelines) and who fast during Ramadan with ongoing medical supervision.[7] High-risk individuals were advised not to fast.

The aim of this study is to assess the impact of pre-Ramadan medical assessment and individualized insulin adjustment by assessing the incidence of diabetes-related complications (hypoglycemia, hyperglycemia, diabetic ketoacidosis) in people with type 1 diabetes who are at low or intermediate health risk and who fast during Ramadan with ongoing medical supervision.

Methods

This is a prospective observational study conducted at Fatima Memorial Hospital, Lahore in collaboration with Meethi Zindagi (a not-for-profit organization for people with type 1 diabetes).

Ramadan education and pre-Ramadan assessment sessions for adults (aged 18 and above) with type 1 diabetes were arranged one week prior to the start of Ramadan. The assessment team comprised of diabetes educators and investigator endocrinologists. The type 1 diabetes community also shared its fasting experiences as part of peer support.

During the study period (Ramadan), all participants had round-the-clock over-the-phone access to the investigator endocrinologists for ongoing medical advice and troubleshooting through a WhatsApp group. Blood glucose data for all study participants was shared after every single fast observed by all participants. The duration of the study was the duration of holy month of Ramadan. There was no restriction to the number of days a participant could fast and it was left to the individuals as per their individual tolerability without compromising medical safety.

Pre-Ramadan assessment was done using the International Diabetes Federation(IDF) Diabetes & Ramadan risk assessment score chart at a pre-arranged type 1 diabetes Ramadan education and assessment session. Assessment/troubleshooting during Ramadan was done using the study proforma which every participant was required to complete and share with the study investigator after every single fast they observed. All participants completed a post-Ramadan evaluation questionnaire used in the DaR global survey (with consent of the corresponding author) for compiling data related to study impact assessment and results.[5]

Data was entered and analysed in SPSS version 28. Descriptive analysis was performed on all the variables. Categorical variables like gender, treatment regimens, and comorbidities were presented in the form of frequency and percentage. Continuous variables like age, duration of diabetes, and HbA1c were presented in the form of mean and standard deviation or median.

Results

A total 28 participants of the study were included in the study and their responses analysed. Participants were categorized into two age groups. The majority of the sample (82.1%, n = 23) were aged 20 years or older, while the remaining 17.9% (n = 5) were below 20 years of age. Of the total participants, 67.9% (n = 19) were female and 32.1% (n = 9) were male.

The mean duration of living with Type 1 diabetes among participants was 14.2 years, with a standard deviation of 9.5 years. The duration ranged from a minimum of 1.5 years to a maximum of 31.0 years.

Table 2 shows the analysis of the questionnaire responses. This is a comparative analysis showing 28 individuals with Type 1 diabetes, divided into two age groups: those under 20 years (<20) and those aged 20 years or older (≥20). The females comprise a majority in both — 60% in the younger group and 69.6% in the older group. The mean duration of living with Type 1 diabetes was shorter among the younger group (9.0 years) compared to the older group (15.4 years), though this difference was not statistically significant (p=0.180). Similarly, older participants fasted more days on average during Ramadan (19.0 days vs. 15.4 days), without significance (p = 0.524).

The younger participants were more likely to have broken their fasts during Ramadan, with 80% reporting at least one instance compared to 34.8% in the older group, though this trend did not reach statistical significance

Table 1: *Demographic characteristics of study participants:*

Characteristics		n (%)
AGE Group	<20	5 (17.9)
	≥20	23 (82.1)
Gender	Female	19 (67.9)
	Male	9 (32.1)
For how long you have been living with type 1 diabetes?	Mean (SD)	14.2 (9.5)
	Range	1.5 - 31.0

Table 2: *Analysis of responses of the participants to the questionnaire*

Characteristics		<20	>=20	Total	p
Total n (%)		5 (17.9)	23 (82.1)	28	
Gender	Female	3 (60.0)	16 (69.6)	19 (67.9)	1.000
	Male	2 (40.0)	7 (30.4)	9 (32.1)	
1. For how long have you been living with type 1 diabetes?	Mean (SD)	9.0 (3.4)	15.4 (10.1)	14.2 (9.5)	0.180
2. How many days did you manage to fast this year?	Mean (SD)	15.4 (9.7)	19.0 (11.7)	18.4 (11.3)	0.524
3. Days did you manage to fast this year?	1-10	2 (40.0)	6 (26.1)	8 (28.6)	0.822
	11-20	1 (20.0)	5 (21.7)	6 (21.4)	
	21-30	2 (40.0)	12 (52.2)	14 (50.0)	
4. Did you have to break any fast in Ramadan?	No	1 (20.0)	15 (65.2)	16 (57.1)	0.133
	Yes	4 (80.0)	8 (34.8)	12 (42.9)	
5. How many fasts did you have to break?	0	1 (20.0)	15 (65.2)	16 (57.1)	0.036
	1	1 (20.0)	5 (21.7)	6 (21.4)	
	2	3 (60.0)	2 (8.7)	5 (17.9)	
	3	0 (0.0)	1 (4.3)	1 (3.6)	
6. Did you have any daytime hypoglycemia during this Ramadan?	No	1 (20.0)	15 (65.2)	16 (57.1)	0.133
	Yes	4 (80.0)	8 (34.8)	12 (42.9)	
7. Did you break your fast during this Ramadan because of hypoglycemia?	No	1 (20.0)	18 (78.3)	19 (67.9)	0.026
	Yes	4 (80.0)	5 (21.7)	9 (32.1)	
8. Did you have any daytime hyperglycemia during this Ramadan?	No	2 (40.0)	7 (30.4)	9 (32.1)	1.000
	Yes	3 (60.0)	16 (69.6)	19 (67.9)	
9. Did you break your fast during this Ramadan because of hyperglycemia (BG > 300 mg/dl)?	No	5 (100.0)	22 (95.7)	27 (96.4)	0.112
	Yes	0 (0.0)	1 (4.3)	1 (3.6)	

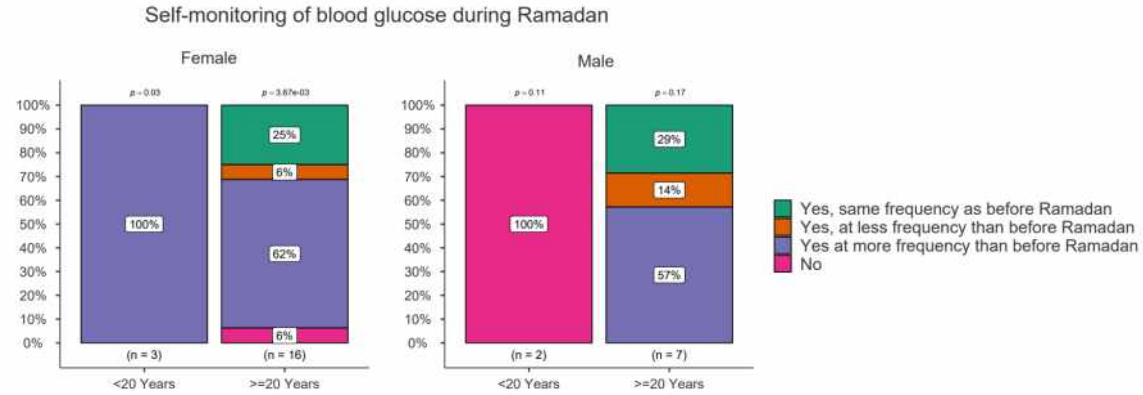

Figure 1: *Self-monitoring behaviour among type 1 DM patients*

(p = 0.133). A statistically significant difference was found in the number of fasts broken (p = 0.036), where 60% of the younger group broke two fasts compared to only 8.7% in the older group. Day-time hypoglycemia was more commonly reported among younger participants (80% vs. 34.8%), though this difference was not significant (p=0.133). Importantly, a significantly higher proportion of the younger group reported breaking fast specifically due to hypoglycemia (80% vs. 21.7%, p = 0.026).

The occurrence of day-time hyperglycemia did not differ significantly between groups (60% in <20 vs. 69.6% in ≥20, p = 1.000), nor did the number of participants who broke their fast due to hyperglycemia (0% in <20 vs. 4.3% in ≥20, p = 1.000).

There were no hospitalizations either due to hypoglycemia or hyperglycemia during the study.

The figure 1 illustrates self-monitoring of blood glucose during Ramadan among individuals with Type 1 diabetes, stratified by age and gender. Among females under 20 years, none reported monitoring their blood glucose, while in the ≥20 age group, the majority (62%) monitored more frequently, with others monitoring at the same or reduced frequency. This difference was statistically significant (p = 0.03). Among males, none among the <20 age group monitored their glucose either, whereas in the ≥20 group, 57% monitored more frequently and 29% maintained the same frequency (p = 0.11 and p = 0.17, respectively).

Table 3 shows that the mean HbA1c level was 8.3% in diabetics <20 years of age while it was 7.3 in those > 20 years age, with a statistically significant difference (p=0.008). Regarding treatment regimen, 2 individuals (40.0%) in the <20 years group and 20 individuals (87.0%) in the ≥20 years group were on basal/bolus insulin, with a p-value of 0.050. Premixed insulin was used by 3 participants (60.0%) in the <20 years group and 2 participants (8.7%) in the ≥20 years group, accounting for 5 individuals (17.9%) overall. Only one individual (4.3%) in the ≥20 years group used an insulin pump. As for comorbidities, all 5 participants (100.0%) in the <20 years group and 21 (91.3%) in the ≥20 years group reported no comorbid conditions, with only 2 individuals (8.7%) in the ≥20 years group having comorbidities.

Discussion

Maintaining stable blood glucose levels during Ramadan requires careful monitoring and adjustment of insulin regimens.[8] The changes in meal timing necessitate modifications in both basal and bolus insulin doses to match the altered metabolic demands. Typically, insulin doses need to be reduced during fasting hours to prevent hypoglycemia, while increased doses may be required at Iftar to manage postprandial hyperglycemia[7,9,10,11]. Continuous glucose monitoring (CGM) systems and insulin pumps have been shown to be particularly helpful in preventing both hypoglycemia and hyperglycemia during Ramadan by providing real-time feedback on blood glucose levels and enabling fine-tuning of insulin delivery.[12] In recent years, studies have explored the effectiveness of different insulin regimens during Ramadan to improve glycaemic control in patients with T1DM who choose to fast. For instance, a study by Hassanein et al. (2021) demonstrated that patients using insulin pumps experienced fewer hypoglycaemic events and better overall glycaemic control compared to those using multiple daily injections (MDI).[13] Additionally, newer insulin analogs such as insulin degludec and insulin glargine U300, which have longer durations of action and more stable pharmacokinetics, have shown promise in minimizing glycaemic fluctuations during fasting.[14]

There has been a profound emphasis on the importance of structured educational programs that provide guidance on dietary management during Ramadan for patients with T1DM. These programs often include individualized meal plans, advice on carbohydrate counting, and instructions on adjusting insulin doses based on food intake. A randomized controlled trial by Afandi et al. (2019) found that patients who received structured education on diabetes management during Ramadan had significantly fewer hypoglycaemic episodes and better glycaemic control compared to those who did not receive such education.[15]

Diabetes education specialists play an increasingly

Table 3: *Analysis of HbA1c levels, types of insulin, and DM complications.*

Characteristics		<20 Years	>=20 Years	Total	p
Total n (%)		5 (17.9)	23 (82.1)	28	
HbA1c	Mean (SD)	8.3 (0.5)	7.3 (0.7)	7.5 (0.7)	0.008
Treatment Regimen	Basal/Bolus insulin	2 (40.0)	20 (87.0)	22 (78.6)	0.050
	Premixed insulin	3 (60.0)	2 (8.7)	5 (17.9)	
	pump	0 (0.0)	1 (4.3)	1 (3.6)	
Co-Morbidity	No	5 (100.0)	21 (91.3)	26 (92.9)	1.000
	Yes	0 (0.0)	2 (8.7)	2 (7.1)	

important role in delivering personalized care to develop a management plan that fits the lifestyle behaviours, culture, and beliefs of their patients.[16,17] During Ramadan, the role of the diabetes educator is to assist people living with diabetes who are seeking to fast by providing Ramadan-focused guidance on monitoring their blood glucose during the day, detecting signs of low blood sugar, altering drug dosage and timing, diet and fluid intake and performing appropriate levels of physical activity. If people with diabetes understand the risks and know how to manage them accordingly, they may be able to fast safely without any complications.[18,19]

This obviated the medical need for those with T1DM who intend to fulfil Ramadan fasting should have a pre-Ramadan medical assessment to evaluate their individualized medical risk stratification for fasting. For those who were declared medically fit to fast during Ramadan, Ramadan-focused diabetes education was provided along with self-monitoring of blood glucose (SMBG) instructions by diabetes educators. Individualized insulin dose adjustments and changes to insulin regimens were made by endocrinologists to minimize glycaemic complications.

As per our study results 11.3% of our type 1 cohort included in the study were able to safely complete the whole month of fasting whilst 11.7% fasted for more than 20 days and 9.7% for less than 20 days. The study cohort included patients with T1D on most insulin regimens in use to manage T1D whilst one patient was using insulin pump. As per pre-Ramadan education most participants monitored their blood glucose levels more frequently however still not with the advised frequency. Those who were unable to complete all fasts broke their fast in time as per pre-Ramadan education and on-going remote medical support via the WhatsApp group. This prevented any severe episodes of both hypoglycemia and hyperglycemia and hence there were no hospitalizations.

Whilst our study design did not have a control group and a very limited cohort of participants the results of our observational study demonstrate that people with type 1 diabetes can fast safely if pre-Ramadan medical risk assessment is coupled with pre-Ramadan education and on-going medical supervision during Ramadan for medical troubleshooting. Some analytics were not comparable within the cohort resulting in skewed analysis.

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Authors' Contribution

AM: Conception.

FA, MIH: Design of the work.

KSC, AA, UM: Data acquisition, analysis, or interpretation.

FA, KSC, AA, UM, NS: Draft the work.

AM, MIH: Review critically for important intellectual content.

All authors approve the version to be published.

All authors agree to be accountable for all aspects of the work.

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