

COMPLIANCE WITH MEDICAL ADVICE AND SAFETY IN HIGH-RISK DIABETIC PATIENTS DURING RAMADAN

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ABSTRACT

OBJECTIVES

This study was designed to evaluate compliance with medical recommendations and safety outcomes among high-risk diabetic patients during Ramadan in Peshawar, Pakistan.

METHODOLOGY

This descriptive study encompassed 246 high-risk diabetic patients (type 2 DM, risk score >6, aged 40-75 years) at Khyber Teaching Hospital, observed over six months, including Ramadan. Data were gathered via structured questionnaires, baseline and follow-up evaluations, and telephone interviews conducted after Ramadan. Compliance was assessed based on adherence to medical recommendations. The complications were compared between groups that followed the rules and those that did not. SPSS version 27 was used for statistical analysis.

RESULTS

A total of 246 individuals participated in the study, with a mean age, HbA1c, and average weight of 56.17 years, 9.4%, and 63 kg. 44.7% of the individuals who took part attempted to fast during Ramadan. Only 16.2% of individuals fasted for all 30 days, and 55.3% of individuals did not fast at all. Overall, 35.4% of individuals reported having hypoglycemia, with 68.1% of fasting individuals having at least one episode compared to 8.8% of the non-fasting group ($p < 0.001$). Patients who were fasting experienced more hyperglycemia and dehydration ($p < 0.001$). Regular self-monitoring of blood glucose was not very satisfactory, with only 31.7% of people following the recommended steps. Of 221 high-risk diabetic patients, the majority had type 2 diabetes and were on insulin therapy; however, only one-third frequently monitored their blood glucose levels.

CONCLUSION

Despite medical advice, many high-risk individuals with diabetes continue to observe fasting during Ramadan. This renders them more likely to develop hypoglycemia, hyperglycemia, and dehydration. For this highly susceptible population to be safer, it is important to improve patient education, offer tailored counseling, and follow risk-based guidelines.

KEYWORDS: Diabetes Mellitus, Ramadan, Fasting, Hypoglycemia, Hyperglycemia, High-Risk Patients, Compliance, Patient Safety, IDF-DAR Guidelines, Pakistan

INTRODUCTION

Diabetes Mellitus (DM) is a common metabolic disorder, with an estimated 537 million adults aged 20-79 years having DM, and it is expected to increase to 783 million by 2045.¹ Fasting during Ramadan is widely observed across the world. A survey conducted in 39 countries, which involved 38,000 Muslims, reported that an average of 93% of people fasted during Ramadan.² In Pakistan, around 33 million people live with diabetes, and Pakistan is now ranked third in the prevalence of diabetes, following China and India, according to the International Diabetes Federation (IDF) Diabetes Atlas 10th Edition.¹ Fasting has a profound impact on the metabolic and endocrine milieu

of the body. During fasting, insulin resistance/deficiency can lead to excessive glycogen breakdown and increased gluconeogenesis. As a result, there is an increased risk of hypoglycemia, hyperglycemia, diabetic ketoacidosis, dehydration, and thrombosis. As with fasting, feasting during Ramadan also carries risks for those with diabetes.³ Studies have indicated that fasting may increase the risks of hypoglycemia and hyperglycemia. Recently, the Diabetes and Ramadan-Middle East and North Africa (DAR-MENA) and Type 1 Diabetes Mellitus (T1DM) studies reported that 48.5% of participants fasted for the entire month of Ramadan. The incidence of confirmed and severe hypoglycemia was similar to that before Ramadan. In the DAR-MENA Type 2 Diabetes

Mellitus (T2DM) study, it was shown that hypoglycemia increased significantly during Ramadan (10.4%) when compared to before Ramadan (4.9%). Similarly, reports have indicated higher rates of hyperglycemia during Ramadan. The EPIDIAR study indicated that people with T2DM, with or without diabetic ketoacidosis (DKA), could have their rates of hyperglycemia increased 5-fold.⁴ The majority of Muslims consider fasting an extremely spiritual experience. Thus, many Muslim diabetics, even those who could seek exemption, have an intense desire to participate in fasting during Ramadan. Healthcare professionals (HCPs) must be conscious of the potential dangers of fasting for some individuals with diabetes. Risk stratification is an essential aspect of all diabetes and Ramadan recommendations. Every person with DM should be risk-stratified individually by the HCP to achieve the best possible care. IDF-DAR Diabetes and Ramadan Practical Guidelines provided a practical tool to help HCPs support their approach to safely guide people with diabetes who wish to fast during the holy month of Ramadan.⁴ The rationale for performing this study is to collect local data to assess patients' compliance with medical advice, falling in a high-risk group (as per IDF DAR), as fasting may be unsafe for them during Ramadan. There are very few articles and data available on type 2 diabetes and Ramadan and complications related to it, and we are lacking data in this part of the region. Type 2 diabetic patients and those who comply with medical advice will benefit. Moreover, patients' compliance will be compared with that of those who are non-compliant for complications and safety during Ramadan.

METHODOLOGY

This descriptive study was conducted at the Department of Medicine and Department of Endocrinology, Khyber Teaching Hospital, over a duration of 6 months, including the month of Ramadan. The sample size was calculated using OpenEpi, with hypoglycemia in high-risk diabetic patients during Ramadan estimated at 20%.⁶ Taking a 95% confidence interval and a 5% margin of error, the calculated sample size is 246. Non-probability consecutive sampling was used. Selection criteria included Type 2 diabetic mellitus patients labeled as high risk based on the IDF-DAR Fasting risk assessment calculator of having a score >6, patients of both genders and ages 40-75 years. Exclusion criteria were critically ill patients with stroke, hyperosmolar hyperglycemic state, diabetic ketoacidosis, acute kidney injury, sepsis, gangrene and amputation, and pregnant ladies with DM. Glycaemic control was stratified using HbA1c values as <7.5% (low risk), 7.5–9% (moderate risk), and >9% (high risk).⁷ Hypoglycemia was categorized according to the American Diabetes

Association (ADA): Level 1 hypoglycemia: Glucose <70 mg/dL (3.9 mmol/L) and ≥54 mg/dL — alert value. Level 2 hypoglycemia: Glucose <54 mg/dL (3.0 mmol/L) clinically significant hypoglycemia. Level 3 hypoglycemia (severe): Severe event characterized by altered mental and/or physical status requiring assistance, regardless of glucose value.⁸ After getting approval from the hospital's ethical committee to conduct the study at the Khyber Teaching Hospital, written informed consent was obtained from all the patients enrolled in the study. The study population strictly comprises patients satisfying the inclusion and exclusion criteria. A detailed history, including sociodemographic data (age, gender, education, type, and duration of diabetes), was taken, a physical examination was performed, and all the relevant information was recorded in a well-designed questionnaire. The baseline demographics were recorded in the well-designed questionnaire. High-risk diabetic patients based on the operational definition were selected. The patient records were assessed for glycemic status, and any previous workup done regarding diabetic complications was assessed as well. Baseline investigations, including renal function tests, eGFR, and HbA1c, were done for the purpose of risk assessment. Patients were followed after Ramadhan via telephone calls, and their compliance was assessed; then they were classified as compliant and non-compliant, and complications were compared. All the information was collected on a predesigned structured proforma. Data were stored and analyzed by the statistical program SPSS version 27. Categorical variables like gender, occupation, education, compliance, and outcome were described as frequencies and percentages. Quantitative variables like age, blood sugar level, and HbA1c were calculated as mean ± standard deviation or median (IQR) after checking for normality by the Shapiro-Wilk test. The comparison of compliant and non-compliant was done by using chi-square or Fisher's exact test at a 5% level of significance. Compliance and complication were stratified against age, gender, and duration of diabetes. Post-stratification chi-square or Fisher's exact test was applied. A p-value of < 0.05 was taken as statistically significant.

RESULTS

The study included 246 individuals who had diabetes, 91 of whom were men (37%) and 155 of whom were women (63%). The average age of those participating in the study was 56.17 years, with a range of 15 years. More than half of the participants who took part (58.1%) had very little education. In total, 56.9% of the patients lived in cities, while 41% lived in rural areas. The average weight of the patients was 63 ± 10.71 kg,

with a range of 49 to 110 kg. The average HbA1c level was $9.4 \pm 1.7\%$, and the lowest and highest levels were 4.9% and 16%, respectively. Before Ramadan, 21.5% of patients intended to fast, 37.4% reported that they did not plan to fast, and 41.1% reported that they would attempt to fast. During Ramadan, 110 patients observed fasting for a minimum of one day. Out of all the participants, 40 patients (16.2%) fasted for the full 30 days, 60 patients (24.3%) fasted for about 10 days, and 10 patients (4.06%) fasted for about 20 days. 136 patients (55.3%) did not fast at all. In Pakistan, the fasting period during Ramadan lasted about 15 hours each day. 159 patients (64.6%) did not report any episodes of hypoglycemia, while 87 patients (35.4%) did have at least one episode. Of the individuals who experienced hypoglycemia, 18.3% had mild episodes, 11.0% had moderate episodes, and 6.1% had severe episodes. One hundred eighty-five patients (75.2%) did not report hyperglycemia. However, 61 patients (24.7%) had one or more episodes of hyperglycemia while fasting, with the number of episodes ranging from 1 to 20. Twenty-one patients reported dehydration that necessitated a hospital visit. Of the 221 patients, 89.8% had type 2 diabetes and 10.2% had type 1 diabetes. 184 patients (74.7%) were getting insulin, 50 patients (20.3%) were getting sulfonylureas, and 12 patients (4.8%) were not getting either insulin or sulfonylureas. Thirty-one percent (31.7%) of the patients regularly checked their blood sugar levels, thirty-five percent (35%) did so poorly, and thirty-three percent (33%) did not check their levels at all. Most of the people who took part in the study did not do much physical activity during Ramadan. 182 of them (74%) reported they did not do any physical work, while 64 (26%) said they did moderate to intense physical work. Additionally, 150 patients (61%) indicated no adverse experiences during the preceding Ramadan, whereas 96 patients (39%) reported negative experiences that compelled them to terminate their fast prematurely. The chi-square analysis showed a strong link between fasting and hypoglycemia. Out of the 110 patients who fasted, 75 (68.1%) had multiple episodes of hypoglycemia. Conversely, of the 136 non-fasting patients, only 12 (8.8%) experienced hypoglycemia, while 124 (91.2%) remained asymptomatic ($p < 0.001$). Likewise, hyperglycemia was exclusively noted in the fasting cohort, with 59 patients experiencing multiple episodes, whereas no episodes were recorded in the non-fasting cohort ($p < 0.001$). Fasting patients also had a lot more episodes of dehydration. Twenty-one of them reported they had between one and eight episodes, while the non-fasting group did not have any ($p < 0.001$).

Table 1: Distribution of Glycemic Control, Treatment Modalities, and Hypoglycemia Risk

Risk Element	Frequency (n)	% Age
Type of diabetes		
Type 1 diabetes mellitus	25	10.2
Type 2 diabetes mellitus	221	89.8
Level of glycemic control		
HbA1c levels of $< 7.5\%$	24	9.8
HbA1c between 7.5% to 9%	77	31.3
HbA1c levels of $> 9\%$	143	58.1
Fasting group	134	
Non-fasted group	110	
Level of Hypoglycemia		
No hypoglycemia	159	64.6
Mild hypoglycemia	45	18.3
Moderate hypoglycemia	27	11.0
Severe hypoglycemia	15	6.1
Type of treatment		
Sulphonylurea	50	20.3
Insulin	184	74.7
Other Antidiabetic medication	12	4.8
Hyperglycemia episode	61	24.7
Duration of Diabetes		
< 10 years	68	27.6
> 10 years	178	72.4

Table 2: Comparison of hypoglycemia, hyperglycemia, and dehydration between fasted and non-fasted diabetic patients

Variable	Group	Present n (%)	Absent n (%)	P value
Hypoglycemia	Fasted	35 (31.8)	75 (68.2)	< 0.001
Hypoglycemia	Not fasted	124 (91.2)	12 (8.8)	< 0.001
Hyperglycemia	Fasted	59 (53.6)	51 (46.4)	< 0.001
Hyperglycemia	Not fasted	0 (0.0)	136 (100)	< 0.001
Dehydration	Fasted	21 (19.0)	89 (81.0)	< 0.001
Dehydration	Not fasted	0 (0.0)	136 (100)	< 0.001

DISCUSSION

Using the IDF–DAR Practical Guidelines framework, this study looked at how well high-risk diabetic patients followed medical advice and how safe it was for them to fast during Ramadan. Our results show how complicated it is for patients to want to fast, be religious, and deal with the medical risks that come with it. In our group, the average HbA1c was $9.4\% \pm 1.7\%$, with values going from 4.9% to 16%. This level of poor blood sugar control is in line with what previous studies in Pakistan and the Middle East have found, which showed that the average HbA1c levels of diabetic patients during Ramadan were between 8% and

10%.^{9,10,11} Only 16.2% (40 out of 246) of the people who took part in the study fasted for the whole 30 days of Ramadan. 24.3% fasted for about 10 days, and 4.06% fasted for 20 days. In the CREED study, 64% of participants fasted every day of Ramadan, and 94.2% fasted for at least 15 days.¹² This difference could be because our group had stricter risk stratification, more severe disease, or different ways of counseling patients. Hypoglycemia was the most common problem, affecting 68.1% of the patients in the fasting group. Of those, 6.1% had severe hypoglycemic events. In a study done at a tertiary care hospital in South Asia, on the other hand, only 10% of fasting patients had one or more episodes of hypoglycemia during Ramadan.¹³ The higher rate of hypoglycemia found in our study may be attributed to poorer baseline glycemic control, a greater proportion of patients using insulin, and less frequent adjustments to medication doses. In our group, 74.7% of people were getting insulin therapy, 20.3% were getting sulfonylureas, and 4.8% were not getting either insulin or sulfonylureas. In contrast to large observational studies like CREED, where most patients were treated with oral antidiabetic drugs (64.6%) and only 8.4% of patients were treated with insulin alone, this distribution is very different.¹⁴ The fact that our study group needed more insulin may help explain why they had more hypoglycemic episodes. During the holy month of Ramadan, many did not follow safety rules as well as they should have. Only 31.7% of the people who took part in the study regularly checked their blood sugar levels (SMBG). 35% checked them on an irregular basis, and 33% did not check them at all. The results are similar to those of the DAR-MENA study, which found that about 40% of fasting people with diabetes did regular SMBG and almost 30% did not check their glucose levels at all.^{15,16,17,18} Our population may not be very good at SMBG because they do not know enough about it, cannot afford it, or still believe that glucose monitoring invalidates the fast, which is still a common belief in South Asian communities.⁷ There was also a strong link between fasting and hyperglycemia episodes. There were multiple episodes of high blood sugar in 59 people in the fasting group, but none in the non-fasting group ($p < 0.001$). The same trends were seen in the DAR-MENA group, where fasting patients had more hyperglycemic events than non-fasting patients.¹⁴ These results support two important clinical implications when looked at together. First, fasting can make high-risk diabetic patients more likely to have hypoglycemia, hyperglycemia, and dehydration. However, structured pre-Ramadan counseling, individualized medication adjustments, and frequent SMBG can greatly lower these risks. Second, there is still a big gap between medical recommendations and patient practices. This shows how important it is to have culturally sensitive

counseling, better communication between doctors and patients, and educational programs in the community.

LIMITATIONS

Limitations of this study include its observational design and reliance on self-reported hypoglycemic/hyperglycemic episodes, which may underestimate actual incidence. Nevertheless, the results add to the growing evidence that strict adherence to IDF-DAR guidelines improves the safety of fasting, even among high-risk individuals.

CONCLUSIONS

High-risk diabetic patients continue to fast during Ramadan despite medical advice, often with poor baseline control and limited compliance with monitoring. This leads to a significantly higher burden of hypoglycemia, hyperglycemia, and dehydration. Implementation of structured, culturally appropriate education and risk-based guidance, as advocated by IDF-DAR, is essential to improve safety in this vulnerable population.

CONFLICT OF INTEREST: None

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AUTHORS CONTRIBUTION

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Shah Umam - Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Final Approval

Zahidullah Khan - Concept & Design; Data Acquisition; Drafting Manuscript; Critical Revision; Final Approval

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The authors accept responsibility for all aspects of the work and will ensure that any concerns regarding the accuracy or integrity of any part are properly investigated and resolved.



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