Risk Stratification for Fasting in Diabetic Patients Based on the IDF-DAR Guideline

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A R T I C L E I N F O	A B S T R A C T
	Introduction: Fasting during Ramadan is a religious obligation and may pose a risk to diabetic patients. This study aimed to stratify diabetic patients based on the International Diabetes Federation- Diabetes and Ramadan International Alliance (IDF- DAR) guideline for the risk of fasting before Ramadan.
	Methods: A total of 317 diabetic patients attending the endocrinology clinic at Ghaem Hospital, Mashhad, Iran, participated in this cross-sectional study. The American Diabetic Association (ADA) criteria were applied to diagnose diabetes. Various parameters, including diabetes type and duration, complications, and risk factors were recorded to determine IDF-DAR-based risk. Then patients were stratified into high (IDF-DAR>6), medium (IDF-DAR: 3.5-6) and low (IDF-DAR: 0-3) risk groups accordingly.
	Results: Out of the 317 patients included in the study, 115 (36.3%) patients were categorized as low risk, 127 (40%) as moderate-risk, and 75 (23.7%) as high-risk groups.
	Conclusions: According to the IDF-DAR guideline, majority of the patients fell into the low and moderate risk categories, suggesting that they should not be entirely exempted from fasting during the holy month of Ramadan. However, the validity of this patient stratification in various fasting populations needs to be evaluated through prospective longitudinal studies.

Introduction

Diabetes mellitus (DM) is a prevalent metabolic disorder with a heavy socioeconomic burden on public health. The prevalence of DM has increased throughout the recent decades in most developed and developing countries [1-5]. According to the International Diabetes Federation (IDF), the number of people affected by diabetes, without implementing effective prevention measures, is estimated to rise to 783 million by 2045 [4]. Diabetes ranks among the ten leading causes of death and its prevalence has increased by over 70% since the year 2000 [6].

The fasting practice during the month of Ramadan is considered as one of the five pillars of Islam. The obligatory period of fasting typically lasts between 29-30 days and is applicable to all healthy Muslim individuals who have attained puberty. Adherents to this practice are expected to abstain from all food and drink from the time of dawn to sunset, while also refraining from additional activities such as taking oral medications, sexual activity, or smoking.

Pregnant women, geriatrics, children, and disabled individuals may be exempted from fasting, otherwise, fasting in certain vulnerable people such as those with uncontrolled DM and those experiencing co-morbidities may increase the likelihood of complications [7]. Fasting complications in diabetic patients may include hyper- and hypoglycemia, diabetic ketoacidosis, hypovolemia, and thrombosis [8].

On the other hand, it has also been proposed that fasting in type 2 DM patients may reverse insulin resistance and improve the glycemic control status [9]. The eligibility of diabetic patients for Ramadan fasting practice used to be defined based on expert opinion rather than medical evidence. However, the introduction of the first edition of the International Diabetes Federation- Diabetes and Ramadan International Alliance (IDF-DAR) guidelines 2016, a practical tool to help healthcare professionals (HCPs) to safely and scientifically guide people with diabetes who tend to fast during the holy month of Ramadan [7]. Considering the increasing population of

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people with diabetes in the Middle East and North Africa (MENA) as well as Southeast Asia, necessitates employing the evidence-based guidelines (EBM) in supporting patients with DM who wish to fast during Ramadan [4].Hence, researches pertaining to diabetes and Ramadan have increased greatly in the last five years [10]. According to the IDF-DAR guideline [11], patients with DM are classified into three groups based on their risk factors: low, medium, and high-risk for possibility of fasting. Given that fasting may lead to unfavorable complications in diabetic patients, the present study has aimed to stratify diabetic patients based on IDF-DAR guideline for the risk of fasting before the Ramadan.

Methods

This cross-sectional study was conducted on all eligible diabetic patients (n=317) who were referred to the endocrinology clinic at Ghaem Hospital, Mashhad, Iran, from 2022 to 2023. The study protocol was approved by the Ethics Committee of Mashhad University of Medical Sciences (# IR.MUMS.MEDICAL.REC.1401.619).

The American Diabetic Association (ADA) criteria were applied to confirm the diagnosis of diabetes. A comprehensive collection of demographic and clinical information including detailed medical history, comorbidities, and diabetic risk factors were recorded in a relevant checklist.

Table 1. Risk score for diabetic patients that tend to fast during Ramadan. (Adopted from Diabetes and Ramadan: Practical guidelines 2021. Diabetes Res Clin Pract. 2022 Mar; 185:109185. doi: 10.1016/j.diabres.2021.109185.)

Risk Element	Risk Score	Risk Element	Risk Score
1. Diabetes type and duration		**8. MVD Complications/Comorbidities**	6.5
Type 1 diabetes 1	1	Unstable MVD	2
Type 2 diabetes	0	Stable MVD	0
		No MVD	
2. Duration of Diabetes		**9. Renal Complications/Comorbidities**	6.5
A duration of ≥ 10	1	eGFR < 30 mL/min	4
A duration of < 10	0	eGFR 30–45 mL/min	2
		eGFR 45–60 mL/min	0
		eGFR >60 mL/min	
3. Presence of hypoglycaemia		**10. Pregnancy**	
Hypoglycaemia unawareness	6.5	Pregnant not within targets	6.5
Recent Severe hypoglycaemia	5.5	Pregnant within targets	3.5
Multiple weekly Hypoglycaemia	3.5	Not pregnant	0
Hypoglycaemia<1 time per week	1		
No hypoglycaemia	0		
4. Level of glycaemic control		**11. Frailty and Cognitive function**	
HbA1c levels > 9%	2	Impaired cognitive function or Frail	6.5
HbA1c levels 7.5–9%	1	> 70 years old with no home support	3.5
HbA1c levels < 7.5%	0	No frailty or loss in cognitive function	0
5. Type of treatment			
Multiple daily mixed insulin Injections	3		
Basal Bolus/Insulin pump	2.5	**12. Physical Labour**	
Once daily Mixed insulin	2	Highly Intense physical labour	4
Basal Insulin	1.5	Moderate Intense Physical Labour	2
Glibenclamide	1	No physical labour	0
Gliclazide/MR or Glimepride or Repeglanide	0.5		
Other therapy not including SU or Insulin	0		
6. Self-Monitoring of Blood Glucose (SMBG)		**13. Previous Ramadan Experience**	
Indicated but not conducted	2	Overall negative experience	1
Indicated but conducted sub-optimally	1	No negative or positive experience	0
Conducted as indicate	0		
7. Acute complications		**14. Fasting hours (location)**	
DKA/ HHS in the last 3 months	3	≥ 16 h	1
DKA/ HHS in the last 6 months	2	< 16 h	0
DKA/ HHS in the last 12 months	1		
No DKA or HHS	0		

DKA—Diabetic Ketoacidosis. HHS— Hyperosmolar Hyperglycaemic Syndrome/. Hyperglycaemic Hyperosmolar Nonketotic Coma (HONC). MVD—Macrovascular disease (Cardiac-cerebral or peripheral). EGFR—estimated glomerular filtration rate.

The IDF- DAR guideline-based factors such as the type and duration of diabetes, the presence of hypoglycemia, the characteristics of hyperglycemia, self-monitoring of blood glucose (SMBG), acute and chronic complications, pregnancy, frailty and cognition function, physical labor, previous Ramadan experience, and type of diabetic treatment were recorded (Table1) [11].

Then the patients were stratified based on the calculated risk score. Risk scores of 0-3, 3.5-6, and >6 were defined as low, moderate, and high risk, respectively. Patients with missing information for risk stratification based on IDF-DAR guideline were excluded.

Normal distribution of data was checked using the Kolmogorov–Smirnov test. Descriptive statistical analysis including mean±Standard Deviation (SD) and frequency (Percent) as well as inferential tests including independent t-test/Mann-Whitney, Chi-square, and/or Fisher's exact test were used. All statistical analyses were conducted using SPSS software version 22.0 (Chicago, IL, USA) and a $P< 0.05$ was considered statistically significant.

Table 2. The baseline characteristic of participant in total and stratified based on the IDF-DAR criteria are presented in Table 1. Based on the IDF-DAR risk stratification criteria

Variable		Total n=317	IDF-DAR risk stratification			P-value
			Low n=115 (36.3)	Moderate n=127 (40.0)	High n=75 (23.7)	
Age		58.58±11.76	55.77±10.34	59.59±11.89	60.86±12.79	0.006
Gender	Male n (%)	108 (34.8)	30 (26.3)	55 (43.3)	23 (30.7)	0.017
	Female n (%)	209 (65.2)	85 (73.9)	72 (56.7)	52 (69.3)	
Diabetic type	I	22 (7.14)	1 (0.9)	4 (3.1)	17 (22.7)	<0.001
	II	295 (92.6)	114 (99.0)	123 (96.9)	58 (77.3)	
Diabetic duration (years)		10.54±8.14	6.93±5.59	10.62±7.25	15.56±9.46	<0.001
Diabetic duration	<10 y	152 (47.8)	80 (69.6)	50(39.4)	22(29.3)	<0.001
	>10 y	165 (52.2)	35 (30.4)	77(60.6)	53 (70.7)	
Hypoglycemia		84 (27.1)	9 (7.9)	41 (32.3)	34 (45.3)	<0.001
SMBG		230 (72.6)	106 (92.2)	83 (65.4)	41 (54.7)	<0.001
History of DKA/HHS		12 (3.7)	4 (3.5)	4 (3.1)	4 (5.3)	0.664
Cardiovascular disease		60 (19.3)	14 (12.3)	25 (20.0)	21 (28.0)	0.025
Chronic complication (CVD and GFR)	No	288 (90.7)	114 (99.1)	118(92.9)	56(74.7)	<0.001
	Stable CVD/eGFR 45-60	24 (7.8)	1(0.9)	9(7.1)	14(18.7)	
	eGFR 30-45	1 (0.3)	0 (0)	0 (0)	1(1.3)	
	UA/HF/eGFR≤30	4 (1.2)	0 (0)	0 (0)	4 (5.3)	
Frailty and Cognitive Function		53 (16.9)	4 (3.5)	24 (18.9)	25 (33.3)	<0.001
Pregnancy		2 (0.9)	0 (0)	2 (1.6)	0 (0)	0.346
Physical labor (intensive)		4 (1.2)	1 (0.9)	2 (1.6)	1 (1.3)	0.999
Previous Ramadan Experience (negative)		67 (20.9)	19 (16.5)	30 (23.6)	18 (24)	0.315
Hypertension		130 (41)	46 (40.4)	50 (39.7)	34 (45.3)	0.711
Diabetic drugs	insulin secretory Oral agents	127(39.7)	44 (38.2)	71 (55.9)	12 (16)	<0.001
	Insulin	68 (25.2)	0 (0)	22 (17.3)	56 (74.7)	
	others	112(35.1)	71(61.7)	34(26.8)	7(9.3)	
FBS		160.57±56.44	142.07±44.75	164.54±52.74	185.38±69.84	<0.001
Hba1c		8.07±1.65	7.05±1.22	8.17±1.61	9.03±1.47	<0.001
CR		0.98 ±0.36	0.93±0.24	1.02±0.44	0.96±0.27	0.298
LDL		84.23±32.87	86.59±30.97	81.00±31.31	83.65±35.78	0.452
HDL		45.19±12.56	44.70±10.98	45.00±13.09	46.38±13.97	0.687
TG		149.35±68.26	148.78±53.67	147.17±67.64	151.77±87.54	0.916
AST		21.94±10.23	22.53±11.32	22.06±10.44	20.63±8.07	0.654
ALT		25.23±16.39	27.55±19.09	26.19±17.39	20.71±8.19	0.107
Microalbuminuria		33.47±48.89	27.18±37.95	34.97±52.51	34.00±50.44	0.807

Results

The baseline characteristics of participants are presented in Table 2. The patients (n=317) were assigned into three categories according to their risk level: low-risk (n=115), moderate-risk (n=127), and high-risk (n=75) groups.

The mean age was found to differ significantly amongst the risk groups with the mean age being highest in the high-risk group (60.86±12.79

years) and lowest in the low-risk group (55.77±10.34 years) (P=0.006). There were significant differences in gender distribution amongst the risk groups, with the highest proportion of males being in the moderate-risk group (43.3%) (P=0.017).

Our results revealed that patients with type I diabetes were significantly belonged to the high-risk group (22.7%) when compared to both the low-risk (0.9%) and moderate-risk (3.1%) groups, with a significant statistical difference (P<0.001).

The highest proportion of participants who were on insulin alone were found in the high-risk group (74.7%), whereas the moderate-risk group had the highest proportion of participants taking insulin secretory oral agents (55.9%). On the other hand, the low-risk group had the highest representation of individuals taking other diabetic medications (61.7%) (P<0.001). Additionally, participants in the high-risk group exhibited the highest mean levels for HbA1c, FBS, and cholesterol levels, while those in the low-risk group had the lowest levels (P<0.05).

Discussion

The important challenge with diabetic patients and fasting practice in Ramadan is to define which patient is eligible for fasting and who can be exempted. The present study has aimed to stratify diabetic patients based on IDF-DAR guideline for the risk of fasting before the Ramadan.

Among a total of 317 diabetic patients, 115 were found to be in low-risk, 127 in moderate-risk, and 75 in high-risk groups.

According to a large multicenter study conducted in 13 Islamic countries, it was found that 42.8% of patients with type-1 and 78.7% of patients with type-2 diabetes practiced fasting during Ramadan. However, it was noted that some of these patients did not consult their physicians before starting their fasting practice, nor did they adjust their drug dosages and timing or monitor their blood glucose levels even when they developed acute complications. Also, a higher rate of acute complications was reported in fasting patients with diabetes and several deficiencies in the care and awareness of such patients were identified [12].

From this point of view, our study was consistent with the baseline point of the prospective study conducted by Nagi Mohammed et al. on

validating the accuracy of the IDF-DAR risk stratification tool in predicting adverse outcomes in patients with diabetes [13].In line with our results, the majority of patients were stratified in low (339 (51.4%)) and moderate (173 (26.3%)) risk groups. As expected, hypoglycemia was reported in the low, moderate, and high risk groups by 6.3%, 21.9% and 35.0%, respectively. Also, severe hypoglycemia was observed in 3(2.1%), 3(1.8%), and none (0%) patients in the high, moderate, and low risk groups, respectively. Based on the results, they concluded that new IDF-DAR risk assessment can be a reliable tool to predict both the ability to fast during Ramadan and the likelihood of hypoglycemia or hyperglycemia.

In light of these information, a risk assessment conducted in this study revealed that 127 (40%) patients were at moderate risk and require extra education and percussion for fasting. The remaining 115 (36.3%) low risk patients can proceed with caution during fasting. Recent studies have shown that a large proportion of patients with diabetes (50-80%) lack proper knowledge and skills to effectively manage their condition [14-15]. Some studies have found that individualized Ramadan education can significantly reduce diabetes complications [16-17]. A study by A.B.M. Kamrul-Hasan showed that the risks of hypoglycemia and hyperglycemia were significantly higher in the high-risk group compared to the low-risk group [18].

Current consensus suggest that diabetic patients who plan to fast should discuss their risk score for fasting based on their comorbidities, glucose status, and risk of adverse events [9, 19, 20].In our study, 27.1% of diabetic patients had a history of hypoglycemia, which is a significant barrier to fasting. Fortunately, 72.6% of cases recorded self-monitoring blood glucose levels before Ramadan, which can help ensure safe fasting. Additionally, 19.3% of our patients had established cardiovascular diseases and were advised against fasting to prevent adverse events.

Ideally, individuals should be educated to plan for fasting during Ramadan at least 4–6 weeks in advance to allow for nutritional and medication adjustments, especially for medications that may induce hypoglycemia (such as insulin or sulfonylurea) [21].Patients taking medications that increase the risk of hypoglycemia should be encouraged to regularly monitor their blood

glucose levels during fasting and advised to break their fast once hyperglycemia (blood sugar >300 mg/dl) or hypoglycemia (blood sugar <70 mg/dl) happens [11].

Diabetic patients are recommended to consult healthcare professionals to evaluate their blood glucose control and other metabolic parameters through laboratory tests before fasting.

Lack of patients' follow-up after fasting is the main limitation in the current study that should have been taken into account when interpreting the results.

Conclusions

Majority of the patients in the present study fell into the low and moderate risk categories, suggesting that they should not be necessarily exempted from fasting during the holy month of Ramadan. However, it is crucial to identify the patients who are at a higher risk of fasting associated complications. However, the validity of this patient stratification in various fasting populations needs to be evaluated through prospective longitudinal studies.

Statements

Conflicts of Interest

The authors declare that they have no competing interests.

Author's Contributions

ZMK, designed the study. ZMK, MAY contributed in data gathering and ZMK, HMM, MAY interpreted the results. ZMK, HMM, MAY, wrote and edited the manuscript. All authors read, commented and approved the final manuscript.

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