

COVID-19 Lockdown and Hypoglycemia among Patients with Diabetes Fasting the Month of Ramadan 2020

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Abstract

Background: Patients with diabetes are targeted with diabetes education 8–10 weeks before Ramadan to have a safe fasting experience. In 2020, this timing coincided with COVID-19 lockdown when virtual clinics were implemented to secure patient care continuity. **Objectives:** We evaluated hypoglycemia episodes among patients with diabetes fasting in Ramadan 2020 during COVID-19 lockdown. **Patients and Methods:** A cross-sectional study was conducted after the month of Ramadan 2020, using a self-administered online questionnaire and convenient sampling methods. Patients with diabetes aged 14 years and older who practiced fasting in Ramadan were included in the study. Hypoglycemia rate in total and diabetes treatment among observers of Ramadan 2019 and Ramadan 2020 were compared. Predictors of hypoglycemia during fasting Ramadan 2020 were estimated. **Results:** Out of 367 patients with diabetes aged 14 years and older, 326 (88.8%) participants had the ability to fast Ramadan and were included in the study. Comparing patients' experience in Ramadan 2019 and Ramadan 2020, participants reported lower hypoglycemia episodes during Ramadan 2020 than Ramadan 2019, $P = 0.017$. In subgroup analysis based on the type of treatment, patients on noninsulin treatment had statistically significant lower hypoglycemia episodes during Ramadan 2020 than Ramadan 2019 ($P = 0.006$). Patients on insulin treatment had fewer hypoglycemia episodes during Ramadan 2020 than Ramadan 2019, but the difference was not statistically significant ($P = 0.405$). The probability of hypoglycemia during fasting Ramadan 2020 was higher among younger age groups 14–30 years (odds ratio [OR] 7.24, 95% confidence interval [CI] 1.72–30.39), patients aged 31–45 years (OR 7.18, 95% CI 1.97–26.19), patients with longer duration of diabetes (more than 10 years) (OR 2.30, 95% CI 1.01–5.26), and patients on insulin (OR 14.14, 95% CI 1.72–30.39). **Conclusions:** COVID-19 pandemic and lockdown did not affect the diabetes-related experience among participants' fasting Ramadan. The hypoglycemia episodes of patients with diabetes in Saudi Arabia were improved during the pandemic era. This could be related to telemedicine services. More studies are required to support its role in improving health conditions beyond our population's pandemic era.

Keywords: COVID-19, hypoglycemia, insulin, lockdown, pandemics, telemedicine

INTRODUCTION

Since the World Health Organization had announced the outbreak of severe acute respiratory (syndrome coronavirus-2), later named COVID-19 as a pandemic on March 11, 2020,^[1] COVID-19 cases and daily deaths have led to worldwide lockdown and restrictions for social distancing as a measure to limit virus spread.^[2] During the pandemic, to maintain consistent care for patients with diabetes at the same time to limit the spread of infection through social distancing, methods such as telemedicine had been evaluated for their potential role in improving health outcome and proved its benefit.^[3,4] In Saudi Arabia, during the COVID-19 pandemic, the government imposed a quarantine to limit the outbreak from March 8 to June 21, 2020, which had included the period before, during,

and after the month of Ramadan. During the same lockdown timing, the government had implemented virtual clinics and promoted telemedicine.^[5] Ramadan is the lunar month when all healthy adult Muslims fast from dawn to dusk. All healthy Muslim adults must fast in Ramadan each year. They abstain from eating or drinking during day time for the whole

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month. Certain groups of Muslims are exempted from fasting, including high-risk diabetic patients. Despite the exemption, many patients choose to fast, which make a challenge to their health. Patients with diabetes who attempt to fast are at increased risk of hypoglycemia, hyperglycemia, dehydration, and increased thromboembolism.^[6] Targeted diabetes education is recommended before, during, and after Ramadan to reduce the risk of such complications aimed at patients who will practice fasting for a safe fasting experience.^[7,8] The aims of the education are to stratify patient risk of fasting and to make an adjustment to medications to limit complications such as hypoglycemia as recommended by the International Diabetes Federation and Diabetes and Ramadan Alliance guidelines.^[9] In our study, we assessed telemedicine's effect during the lockdown in achieving this goal by reviewing the rate of hypoglycemia among patients with diabetes who attempted fasting Ramadan 2020 and comparing it to their fasting experience in 2019.

PATIENTS AND METHODS

A cross-sectional study was conducted after the month of Ramadan 2020, using a self-administered online questionnaire and convenient sampling methods. Patients with diabetes aged 14 years and older who can practice fasting in Ramadan were included in the study. Filling out the online questionnaire by the participants was considered as consent for participation.

The questionnaire contained three parts. The first part pertained to demographic and personal medical data, including sex, age, type of diabetes, duration of diabetes, type of treatment, diabetes complications, comorbidities, number of blood glucose test performed in months other than Ramadan, and fasting ability. The second and third parts comprised questions about diabetes fasting Ramadan 2019/1440 and 2020/1441. These include the ability to consult a doctor before Ramadan by 2–3 months, measuring blood sugar, continue fasting in Ramadan, able to continue fasting without a problem from diabetes, forced to stop fasting due to hypoglycemia, and having hypoglycemia of <70 mg/dl.

Data analysis was performed using SPSS program version 20 (IBM Corp. in Armonk, NY, USA). Baseline data were presented in descriptive statistics using numbers and percentages. A $P < 0.05$ (two-tailed) was chosen as a level of significance. Patients who were able to fast and not able to fast were compared using the Chi-square test. Hypoglycemia rate and other diabetes-related experiences among participants' Ramadan 2019 and Ramadan 2020 were compared using the McNemar test. Subgroup analysis of hypoglycemia rate based on the type of diabetes treatment among participants' Ramadan 2019 and Ramadan 2020 was done using the McNemar test. Predictors of hypoglycemia during fasting Ramadan 2020 were estimated using a logistic regression model.

RESULTS

Of the 367 patients with diabetes, 246 (67.0%) were female;

77 (21.0%) aged 14–30 years and 48 (13.1%) aged >60 years; 150 (40.9%) had Type 1 diabetes mellitus and 178 (48.5%) had Type 2 diabetes; 172 (46.9%) had diabetes mellitus for >10 years; 145 (39.5%) were only on oral hypoglycemic agents and 126 (34.3%) were only on insulin; 131 (35.7%) had diabetes complication; 171 (46.6%) had comorbidities; on months other than Ramadan, 177 (48.2%) measure their blood glucose <1 time/day and 67 (18.3%) measure their blood glucose >3 times/day; and 326 (88.8%) participants had the ability to fast Ramadan [Table 1].

Fasting ability was significantly lower among younger age group ($P = 0.003$), female gender ($P = 0.022$), patients with Type 1 diabetes ($P = 0.001$), patients on insulin ($P = 0.001$), and those who measure their blood glucose >3 times/day ($P = 0.004$). Fasting ability was not significantly higher in patients with diabetes without comorbidities ($P = 0.973$), diabetes complications ($P = 0.900$), and nor having longer duration of diabetes ($P = 0.129$) [Table 2].

Out of 367 patients with diabetes, 326 (88.8%) participants had the ability to fast and were included in comparing patients experience in Ramadan 2019 and Ramadan 2020. The results showed no significant differences in: patient ability to consult a doctor, the frequency of self-monitoring of blood sugar, or stopping fasting due to hypoglycemia ($P = 0.640$, 1.000, 1.000, and 0.701, respectively). Having hypoglycemia <70 mg/dl among patients fasting Ramadan 2020 was less than Ramadan 2019, and the difference was significant, $P = 0.017$ [Table 3].

Based on the type of treatments, patients on noninsulin treatment had significantly fewer hypoglycemia episodes during Ramadan 2020 than Ramadan 2019 ($P = 0.006$). Patients on insulin treatment had fewer hypoglycemia episodes during Ramadan 2020 than Ramadan 2019, but the difference was not significant ($P = 0.405$) [Figure 1].

Predictors of hypoglycemia during fasting Ramadan 2020 were the younger age group (14–30 years and 31–45 years), longer duration of diabetes (more than 10 years), and insulin management.

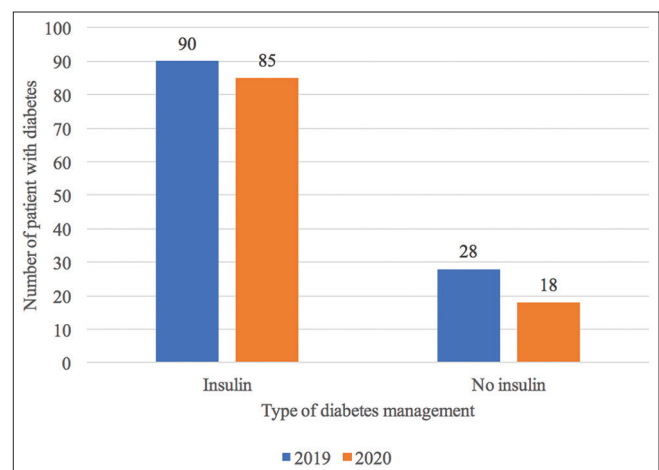


Figure 1: Hypoglycemia during fasting Ramadan 2019 and 2020 among patients with diabetes ($n = 326$)

Table 1: Participants characteristics (n=367)

Characteristics	n (%)
Sex	
Male	121 (33.0)
Female	246 (67.0)
Age (years)	
14-30	77 (21.0)
31-45	108 (29.4)
46-60	134 (36.5)
>60	48 (13.1)
Types of diabetes	
Diabetes mellitus, Type 1	150 (40.9)
Diabetes mellitus, Type 2	178 (48.5)
Gestational diabetes	13 (3.5)
Diabetes other types	26 (7.1)
Duration of diabetes (years)	
<5	105 (28.6)
From 6 to 10	90 (24.5)
>10	172 (46.9)
Types of diabetes management	
Diet	37 (10.1)
Oral hypoglycemic agent	145 (39.5)
Insulin	126 (34.3)
Oral hypoglycemic agent and insulin	59 (16.1)
Diabetes complications	
Yes	131 (35.7)
No	236 (64.3)
Types of diabetes complications (nonmutually exclusive variable)	
Neurological complications	59 (16.1)
Ophthalmic complications	57 (15.5)
Nephrological complications	9 (2.5)
Cardiac complications	8 (2.2)
Diabetic foot	8 (2.2)
Other	8 (2.2)
Comorbidities	
Yes	171 (46.6)
No	196 (53.4)
Number of comorbidities	
0	198 (54.0)
1	101 (27.5)
2	40 (10.9)
3	24 (6.5)
4	4 (1.1)
Number of blood glucose test performed in months other than Ramadan	
<1 time/day	177 (48.2)
1-3 times/day	123 (33.5)
>3 times/day	67 (18.3)
Fasting ability	
Yes	326 (88.8)
No	41 (11.2)

The probability of hypoglycemia during fasting Ramadan 2020 was higher among younger age groups 14–30 years (odds ratio [OR] 7.24, 95% confidence interval [CI] 1.72–30.39), patients aged 31–45 years (OR

7.18, 95% CI 1.97–26.19), patients with longer duration of diabetes (more than 10 years) (OR 2.30, 95% CI 1.01–5.26), and patients on insulin (OR 14.14, 95% CI 1.72–30.39).

DISCUSSION

In this cross-sectional study, patients with diabetes who had been included did not have increased hypoglycemia episodes while fasting in the month of Ramadan 2020 compared to that in 2019. However, the timing of lockdown concurs with the recommended time to provide diabetic patients with targeted education. Studies have shown that such a practice, whether in a group session or one to one, can reduce the risk of hypoglycemia and indeed other possible complications.^[10] The study also shows no negative impact of lockdown on patients' ability to visit their doctors. Most of the patients during this period had been contacted by their healthcare providers through virtual clinics. Telemedicine is a useful adjunct to reduce the risk of hypoglycemia in some studies.^[11]

The rate of hypoglycemia was higher among patients treated with insulin and/or oral hypoglycemic agents more than patients treated with diet alone [Table 4]. It is known that hypoglycemia episodes are higher among patients treated with insulin therapy, mainly Type 1 diabetes. Although fasting in Ramadan for Type 1 diabetes was feasible, patients are advised about the importance of adequate glycemic control before Ramadan and frequent glucose monitoring during fasting.^[12,13] In our study results, hypoglycemia episodes during the lockdown in 2020 were not inferior to that in Ramadan 2019 among patients treated with insulin therapy [Figure 1].

Predictors of hypoglycemia show higher episodes in the younger age group, patients with longer than 10 years of diabetes history, and patients treated with insulin and/or oral hypoglycemic agents. Patients with diabetes are known to have a significant increase in hypoglycemia during fasting, which is higher in patients treated with sulfonylurea and/or insulin and in patients with long duration of diabetes.^[14,15]

Although hypoglycemia is most common among older patients with multiple or advanced comorbidities,^[15] our study's results did not show a significant increase among this group of patients [Table 4]. Although it could be related to the method of data collection, this result could be an indirect indicator of telemedicine's value in providing pre-Ramadan education to those groups of patients. Our results showed that the presence or absence of comorbidities did not affect the decision and capability for patients to fast during the month of Ramadan [Table 2], in a published systematic review of randomized control trials there was minimal diversity in the published results for the safety of fasting among patients with a high risk of fasting.^[16]

CONCLUSIONS

There is no negative effect of lockdown on the Ramadan fasting experience of patients with diabetes. Indeed, patients had even less episode of complications such as hypoglycemia during their

Table 2: Comparison between patients who were able to fast and not able to fast (n=367)

Characteristics	Able to fast, n (%)	Not able to fast, n (%)	Chi-square test P
Age (years)			
14-30	60 (18.4)	17 (41.5)	0.003
31-45	95 (29.1)	13 (31.7)	
46-60	126 (38.7)	8 (19.5)	
>60	45 (13.8)	3 (7.3)	
Sex			
Male	114 (35.0)	7 (17.1)	0.022
Female	212 (65.0)	34 (82.9)	
Comorbidities			
Yes	152 (46.6)	19 (46.3)	0.973
No	174 (53.4)	22 (53.7)	
Diabetes complications			
Yes	116 (35.6)	15 (36.6)	0.900
No	210 (64.4)	26 (63.4)	
Types of diabetes			
Diabetes mellitus, type 1	118 (36.2)	32 (78.0)	0.001
Diabetes mellitus, type 2	174 (53.4)	4 (9.8)	
Gestational diabetes	13 (4.0)	0 (0.0)	
Diabetes other types	21 (6.4)	5 (12.2)	
Years of diabetes			
<5	95 (29.1)	10 (24.4)	0.129
From 6-10	84 (25.8)	6 (14.6)	
>10	147 (45.1)	25 (61.0)	
Number of blood glucose test performed in months other than Ramadan			
<1 time/day	166 (50.9)	11 (26.8)	0.004
1-3 times/day	107 (32.8)	16 (39.0)	
>3 times/day	53 (16.3)	14 (34.1)	
Types of diabetes management			
Diet	35 (10.7)	2 (4.9)	0.001
Oral hypoglycemic agent	143 (43.9)	2 (4.9)	
Insulin	92 (28.2)	34 (82.9)	
Oral hypoglycemic agent and insulin	56 (17.2)	3 (7.3)	

Table 3: Comparing characteristics of patients with diabetes fasting Ramadan 2019/1440 and 2020/1441 (n=326)

Characteristics	2019, n (%)	2020, n (%)	McNemar test P
Consulting doctor before Ramadan by 2-3 months			
Yes	220 (67.5)	225 (69.0)	0.640
No	106 (32.5)	101 (31.0)	
Measuring blood sugar			
Yes	288 (88.3)	289 (88.7)	1.000
No	38 (11.7)	37 (11.3)	
Continue fasting in Ramadan			
Yes	321 (98.5)	322 (98.8)	1.000
No	5 (1.5)	4 (1.2)	
Able to continue fasting without a problem from diabetes			
Yes	279 (85.6)	278 (85.3)	1.000
No	47 (14.4)	48 (14.7)	
Forced to stop fasting due to hypoglycemia			
Yes	259 (79.4)	262 (80.4)	0.701
No	67 (20.6)	64 (19.6)	
Having hypoglycemia			
Yes	118 (55.5)	103 (28.1)	0.017
No	181 (36.2)	223 (68.4)	

Table 4: Logistic regression for predictors of hypoglycemia during fasting Ramadan 2020 (n=326)

Predictor	OR	95% CI	P
Sex (reference: female)			
Male	1.21	0.60-2.42	0.593
Age (reference: >60 years) (years)			
14-30	7.24	1.72-30.39	0.007
31-45	7.18	1.97-26.19	0.003
46-60	2.78	0.86-8.99	0.088
Duration of diabetes (reference: <5 years) (years)			
From 6 to 10	1.98	0.83-4.75	0.125
>10	2.30	1.01-5.26	0.048
Type of diabetes management (reference: Oral hypoglycemic agents)			
Insulin	14.14	5.70-35.12	0.001
Oral hypoglycemic agents and Insulin	4.68	1.95-11.27	0.001
Diet	0.93	0.24-3.59	0.913
Comorbidities (reference: No)			
Yes	1.51	0.74-3.08	0.257
Diabetes complication (reference: No)			
Yes	0.74	0.37-1.47	0.391
Visiting doctor 2-3 months before Ramadan (reference: No)			
Yes	1.97	0.96-4.03	0.064

OR: Odds ratio, CI: Confidence interval

fasting. Telemedicine services may have improved our study's clinical outcome during the pandemic, and implementing telemedicine beyond the pandemic should be encouraged.

Authors' contribution

All authors contributed to the conception of the study, data acquisition and analysis, and drafting and revision of the manuscript. They all approved its final versions.

Compliance with ethical principles

The institutional review board approved the Qatif Central Hospital's study, Qatif, KSA (QCH-SREC0205/2020). The patient provided consent for participation, and all data were reported anonymously.

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Nil.

Conflicts of interest

There are no conflicts of interest.

Data availability

Data are available by reasonable requests to the corresponding author.

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