

# Young people with type 1 diabetes on insulin pump therapy could fast safely during COVID-19 pandemic Ramadan: A telemonitoring experience in Bangladesh

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## Keywords

COVID-19, Ramadan, Type 1 diabetes

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## ABSTRACT

Our aim was to report our telemedicine experience with type 1 diabetes patients using insulin pumps who fasted for Ramadan 2020 during the COVID-19 pandemic. The routine diabetes outpatient care in our Changing Diabetes in Children (CDiC) Pediatric Diabetes Center at the Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders hospital was closed, as there was a lockdown from 26 March in Bangladesh. The diabetes team in our center started telemedicine care for routine follow up of patients. Nine patients who wished to fast for Ramadan contacted our diabetes team over the phone. The mean age was  $19.3 \pm 5.0$  years, and five (55.6%) were female. Most of the patients fasted >20 days. Hyperglycemia and mild hypoglycemia were common complications during fasting. There was no episode of severe hypoglycemia or diabetic ketoacidosis, and none of the patients required admission. During the COVID-19 crisis in Bangladesh, patients with type 1 diabetes using an insulin pump could fast safely for Ramadan with the support of the telemedicine service by the diabetes team.

## INTRODUCTION

Fasting during the month of Ramadan, the ninth month of the Islamic lunar calendar, is obligatory for all healthy adult and adolescent Muslims from the age of 12 years<sup>1</sup>. Islam has allowed many categories of people to be exempted in specific situations where fasting might pose a danger to their health<sup>2</sup>. Although patients with type 1 diabetes are medically exempt, many insist on fasting during Ramadan. The Epidemiology in Diabetes and Ramadan study showed that almost half of the patients with type 1 diabetes mellitus insisted on fasting during Ramadan<sup>3</sup>.

Ramadan is associated with a higher risk of hypoglycemia, hyperglycemia and increased glycemic variability<sup>4</sup>. The use of insulin pumps can facilitate insulin adjustment, and the prevention of hypoglycemia and hyperglycemia during Ramadan. Insulin pump therapy might help in controlling blood glucose during fasting, and its continuous insulin infusion can be modified and adjusted instantaneously to avoid hypoglycemia and

breaking the fast. It not only reduces hypoglycemia, but also improves glycemic control, and decreases the episodes of recurrent diabetic ketoacidosis (DKA)<sup>5-7</sup>.

It is a challenge for type 1 diabetes patients to adjust insulin regimens; therefore, to ensure safe fasting, they need regular monitoring and advice from a healthcare team. Telemedicine has been an option for healthcare during the coronavirus disease 2019 (COVID-19) pandemic.

There are limited data on type 1 diabetes patients receiving insulin pump therapy fasting during Ramadan. The introduction of insulin pumps has started in recent years in Bangladesh. More than 20 patients with type 1 diabetes use insulin pumps in our center. We report our telemedicine experience with type 1 diabetes patients using insulin pumps during Ramadan 2020 at the time of the COVID-19 pandemic.

## METHODS

The routine diabetes outpatient care in our Changing Diabetes in Children (CDiC) Pediatric Diabetes Center at the Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine

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and Metabolic Disorders hospital in Dhaka, Bangladesh, was closed, as there was a lockdown from 26 March in Bangladesh. The diabetes team in our center started telemedicine care for routine follow up of patients. Ramadan started on 24 April in Bangladesh, and patients contacted the diabetes team by telephone 1 month before Ramadan. Nine patients who wished to fast for Ramadan contacted our diabetes team. We describe our experience of these patients who were using insulin pump and wished to observe the Ramadan fast during the COVID-19 pandemic.

**Protocol**

Patients with their caregivers were given education and instructions by the diabetes team through telemedicine. Insulin doses were altered as necessary to accommodate the changing meal time. At the start of Ramadan, the basal insulin dose was reduced up to 10–20% according to each individual’s blood glucose level at the time of the sunrise meal (Sohur) and mid-afternoon. The bolus dose was adjusted as per the carbohydrate count and premeal level. Patients were asked to monitor their blood glucose at pre-Iftar, Pre-Sohur, mid-afternoon and at any time during the daytime when they felt symptoms of hypoglycemia. Patients were instructed to break the fast if their blood sugar level was <4 mmol/L or if they experienced

symptoms of hypoglycemia and if their blood glucose level was >16.7 mmol/L<sup>1</sup>. All patients were instructed to call healthcare providers for dose adjustment whenever necessary, or if there was any episode of hypoglycemia or hyperglycemia. The initial dose was adjusted after the first week, and thereafter weekly or even earlier when required. Consent for data to be entered into the database and for analysis was obtained from all patients and parents.

**Statistical analysis**

Data analysis was carried out by Statistical Package for the Social Sciences program version 21 (IBM, Armonk, NY USA). Descriptive statistics are presented as the mean (±SD) score for normally distributed data.

**RESULTS**

The mean age was 19.3 ± 5.0 years, and five (55.6%) were female (Table 1). Most of the patients (6) fasted >20 days. By day 7, adequate fasting control had been attained in three patients. By day 14, the basal dose in two patients had to be increased, as the fasting level was >10 mmol/L. The same dose was maintained, with minor changes, at the end of Ramadan by four patients. By the end of the month, the Iftar dose had to be increased for two patients (Table 2).

In one patient, there were episodes of hyperglycemia during the daytime, so the basal dose during the daytime had to be increased. This patient had to break the fast, as they had hyperglycemia (blood glucose level >20 mmol/L) in the late afternoon. Another patient initially developed hyperglycemia in the morning and after Iftar, but the corrected amount of bolus dose was adjusted and she did not need to break any fast. There was no episode of DKA in these patients.

There were episodes of mild hypoglycemia in three patients. Hypoglycemia was in the morning and also in the mid-afternoon, and they had to break the fast. There was no episode of severe hypoglycemia, and none of the patients required admission.

**Table 1** | Demographic and clinical characteristics of the patients (n = 9)

Characteristics	Mean value/%
Age at diagnosis (years)	11.3 ± 3.7
Current age (years)	19.3 ± 5.0
Sex	
Male	4 (44.4%)
Female	5 (55.6%)
Diabetes duration (years)	7.7 ± 2.9
Duration of insulin pump (years)	2.9 ± 1.5
HbA1c (%) before Ramadan	8.4 ± 1.4

**Table 2** | Basal and bolus doses before and during Ramadan

Characteristics	Pre-Ramadan basal and bolus dose	Pre-Ramadan total daily dose	Post-Ramadan basal and bolus dose	Post-Ramadan total daily dose
Female 12 years	19.7–47	66.7	19.7–47	66.7
Male 14 years	42.3–34.0	76.3	32.4–34.0	66.4
Male 17 years	38–30	68	38–27	65
Female 17 years	19.3–19	38.3	19.2–19	38.2
Female 19 years	67.2–37.8	105	87–33 to 47	120–134
Female 19 years	29.6–29	58.6	29.6–28.4	58
Female 24 years	27.3–10	37.3	23.5–7	30.5
Male 26 years	98–112	210	98–112	210
Male 26 years	28.8–28	56.8	32.5–33	65.5

## DISCUSSION

Before COVID-19, it was thought that telemedicine would only become available in Western countries, because the use of telemedicine leads to significant savings in time and costs<sup>8</sup>. According to the COVID-19 forum on the International Society for Pediatric and Adolescent Diabetes, it is now the reality for all the pediatric diabetes centers around the globe. In the present study population, the majority of the patients could fast for >20 days with the help of a telemonitoring service by the diabetes team. A pilot study found that a telemonitoring-supplemented focused diabetes education group was less likely to experience hypoglycemia compared with education alone in 37 participants with type 2 diabetes who were fasting during Ramadan<sup>9</sup>. In our previous study, we found that among 33 children with type 1 diabetes, just three out of 13 children broke their fast due to the development of hypoglycemia symptoms<sup>10</sup>. A study by Deeb *et al.*<sup>11</sup> showed that the majority of children and adolescents were willing to break their fast on the occurrence of hypoglycemia regardless of the timing of the day. In the present study population, all were mostly young adults, and they were educated for the past few years for each Ramadan, so they broke their fast whenever they had symptoms of hypoglycemia.

Initially, we reduced the basal dose from 10% to 15%, as some patients had hypoglycemia, but after 1 week we had to increase the basal dose to have good control throughout the daytime. In most studies, the basal insulin rate is reduced (10–15% reduction of basal insulin infusion rate during the hours of fasting), and some suggest up to 40% at the end of the daily fast<sup>12–14</sup>. The lockdown, increased carbohydrates during Iftar, less physical activity and increased stress might have contributed to hyperglycemia followed by a high basal dose during Ramadan for some of our patients.

A few patients had hypoglycemia and broke the fast, and later they reduced the basal dose. Lowering the basal insulin infusion rate temporarily or suspending it can help people with type 1 diabetes to avoid major hypoglycemic events and improve diabetes control during fasting<sup>12,15,16</sup>. The present patients were closely monitored by the diabetes team, which might have helped to reduce the chance of developing hypoglycemia. According to Hawli *et al.*<sup>16</sup> an individualized approach, close monitoring of blood glucose and weekly follow up with the medical team might be most important to prevent acute complications.<sup>16</sup>

None of the present patients developed severe hypoglycemia or DKA. There was no severe hypoglycemia or DKA during Ramadan fasting in any of the pediatric published studies on insulin pump therapy.<sup>11,15–18</sup>

Fasting during Ramadan is feasible for patients with type 1 diabetes using an insulin pump, with adequate counseling and support. During the COVID-19 crisis in Bangladesh, patients with type 1 diabetes using an insulin pump could fast for

Ramadan with the support of the telemedicine service by the diabetes team.

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## DISCLOSURE

The authors declare no conflict of interest.

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