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Experience with Diabetic Adolescents Observing Ramadan Fasting

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Abstract

Background and Aims: Fasting during the holy month of Ramadan is an obligatory duty for all healthy adult Muslims. Fasting can be a major challenge for adolescents with type 1 diabetes mellitus (T1DM) as they have to keep good glycemic control to avoid complications. Limited data was published regarding the safety of fasting Ramadan in adolescent patients with T1DM. We have therefore conducted this study addressing the question “Can adolescents with T1DM fast safely during the Holy month of Ramadan, without getting significant hypo/hyperglycemia?” **Patients and Methods:** This is an observational, prospective, single center study, conducted during Ramadan 2013. Twenty-three patients were observed (7 males, 16 females). Median age was 14 years. All of them had T1DM, and were planning to observe the fast during Ramadan. They were provided with dairies to be filled by the parents or the adolescents themselves (with parental supervision), indicating the days they fasted/didn't fast, and the reasons for not fasting e.g. hypoglycemia, hyperglycemia, menstrual period, sickness or other reasons. Patients were also asked to record the blood glucose readings and their insulin doses on daily basis. They were asked to bring their folders back to the Diabetic clinic after Ramadan. Outcome measures obtained included the percentages of the days fasted/not-fasted, the reasons for not fasting, HbA1c changes, and a comparison between patients on multiple daily injections and those on insulin pump. Moreover, we studied the relationship between the number of days not-fasted due to diabetes related issues and the HbA1c before Ramadan. **Results:** Patients were able to fast 79.9% of the total days eligible for fasting, while 20.1% of the days were not fasted due to either hypoglycemia (29.1%), hyperglycemia (19.4%) or other reasons (51.5%). None of the patients developed severe hypoglycemia or diabetic ketoacidosis. There was a mild increment in mean HbA1c after Ramadan (from 8.3% to 8.5%). The patients on insulin pump tended to fast more days than those taking multiple daily injections (82.8% versus 77.3% out of the total eligible days). Patients who had able to fast more days without diabetes related problems tended to have had a marginally better glycemic control before Ramadan (8.3% versus 8.7%). **Conclusions:** Adolescent patients with T1DM wishing to fast during the holy month of Ramadan may contemplate doing this under medical supervision. The use of insulin pump therapy may help patients to fast more easily and have better control. Adequate education and good glycemic control prior to Ramadan is associated with better outcome.

Key words: Type 1 Diabetes Mellitus, Ramadan Fasting, Multi-dose Insulin, Insulin Pump, Hypoglycemia, Hyperglycemia

Introduction

Fasting during the holy month of Ramadan is an obligatory duty for all healthy adult Muslims (1). Ramadan being a lunar-based month varies in duration between 29 and 30 days. Those who observe the fast during this month abstain from eating, drinking, use of oral medications, smoking and sexual intercourse from predawn to just after sunset. There are no restrictions on food or fluid intake between sunset and dawn. During this month, most people consume two meals a day with a varying calorie content depending on local customs. The two main meals are commonly known as *Iftar* and *Suhur* as they tend to retain their original names in Arabic. The *Iftar* (breaking the fast) is taken after sunset, and *Suhur* (predawn meal) usually taken just before dawn (2,3).

People with chronic medical conditions are exempted from fasting if they risk worsening of disease or delaying recovery or cure (1-3). Diabetes mellitus attracted a lot of interest from physicians and religious scholars with fairly clear and specific guidance on who may fast and those who should refrain from fasting (1-3). The predictable potential risks from fasting during Ramadan include hypoglycemia, hyperglycemia, ketoacidosis and dehydration (2-3). However, by far the risk of hypoglycemia during the daytime is the most disliked complication as its treatment by intake of carbohydrates means premature breaking of the fast which induces a sense of guilt and failure by the faithful patients. Despite the widely recognized risks, many diabetic patients insist on fasting during Ramadan due to strong spiritual drive and peer effect (4). Thereby

creating a challenge and possibly a burden on themselves and their physicians (5).

In a religious context, adolescents are counted adults once they go into puberty. Limited data were published with specific focus on adolescents with diabetes mellitus (DM). This group has specific peculiarities. As many of them would have type 1 diabetes mellitus (T1DM), and would be on insulin therapy, their control could be far from ideal, and fasting can be a major challenge for them. In principle, the role of the physicians is two fold; primarily to ascertain the safety and feasibility of fasting for a given patient thus informing the patient's own choice and secondarily, develop or modify and prescribe most suitable therapeutic regimens to their patients who decide to observe the fast (5).

In view of the limited data on fasting in adolescents (6,7), we have conducted this exploratory observational, prospective, single center study to examine the feasibility and safety of adolescents with T1DM wishing to observe the fast during holy month of Ramadan with view to evaluate how best they can be helped avoid getting severe hypoglycemia and/or significant hyperglycemia in real life clinic settings.

Patients and Methods:

Study design and Settings

The study design was a prospective, observational, single center study. The study was approved by the Institute Review Board of Sheikh Khalifa Medical City, Abu Dhabi, UAE. The center for diabetes and endocrinology at Sheikh Khalifa Medical City is a tertiary referral center with an established diabetes care services for children, adolescents and adults delivered by consultants and specialists in diabetes care in pediatric and adult medicine supported by certified and or experienced diabetes nurse educators and diabetic dietitians. The center has long track record of management of diabetes using multiple dose insulin (MDI) and continuous subcutaneous insulin infusion (CSII/insulin pump therapy) and runs both scheduled clinic appointments and emergency drop in services by both physicians and diabetes nurse educators. Services are free being secured by either a government mandate or an insurance cover.

Participants and study protocol

The participants were recruited from the cohort of adolescent patients with T1DM between the ages of 11-18 years, who are being routinely followed in the Diabetic Center of Sheikh Khalifa Medical City, Abu Dhabi, under either pediatric or adult physicians. Fifty two patients and/or their parents were identified and contacted by phone or during their routine clinic visits

to explain the study a few months prior to Ramadan. Thirty eight patients accepted to participate in the study, and these were invited to the diabetic center where they signed the written informed consent and received a one hour long educational tutorial on how to fast safely during Ramadan. Patients were provided with a specially designed A4 dairy to be filled by the parents or the adolescents themselves (with parental supervision), indicating the days they fasted/didn't fast, and the reasons for not fasting e.g. hypoglycemia, hyperglycemia, menstrual period, sickness or other reasons. Patients were also asked to record the blood glucose readings and their insulin doses on daily basis. They were asked to bring their folders back to the diabetic clinic after Ramadan during their scheduled routine visits. Fifteen patients didn't return their dairies; therefore, the final analysis is based on 23 patients who returned completed dairies.

Outcome measures

The holy month of Ramadan for the study year (2013) was 29 days, and based on the 23 patients who were entered in the analysis, the "total number of days eligible for fasting" defined as the product of [29 days x 23 patients] was calculated as 667 patient.day. The proportion of fasting was calculated as percentage of the total days eligible for fasting. Data for breaking the fast on basis of hypoglycemia, hyperglycemia or other unrelated reasons were examined. The changes of HbA1c values before and after Ramadan were observed. Comparison of the outcomes of the subgroups of patients on MDI and insulin pump therapy was attempted. The impact of previous glycemic control status indicated by the HbA1c (up to 6 months before the start of Ramadan) on the potential for fasting was elucidated as well.

Results

Clinical characteristics

All patients had an established diagnosis of T1DM. Of the 23 patients reported, 16 were females, and 7 were males. Their mean age was 14 years (ranging 11-18 years). 12 patients were on MDI, and 11 patients were on insulin pump therapy.

Fasting feasibility

Of the total eligible fasting days (667 day.patient), 533 day.patient were fasted representing 79.9% of the total. The reminder 134 day.patient represented 20.1%. The days that were not fasted were attributed to hypoglycemia in 39/134 day.patient (29.1%), hyperglycemia in 26/134 day.patient (19.4%), whilst over half of the non-fasted days 69/134 (51.5%) were attributed to non-diabetes related reasons (Table 1).

Table 1. Calculations and results of various fasting metrics.

Details	Calculations	Result
Days eligible for fasting	29 X 23	667 pt.day
Days fasted	533/667 X 100	79.9 %
Days not fasted	134/667 X 100	20.1 %
Days not fasted due to hypoglycemia	39/134 X 100	29.1 %
Days not fasted due to hyperglycemia	26/134 X 100	19.4 %
Days not fasted due to other reasons	69/134 X 100	51.5 %

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Treatment modality and fasting safety

A comparison between patients on MDI and patients on insulin pump is shown in Table 2. Patients on insulin pump had to break the fast less frequently due to hypo/hyperglycemia compared to those who were on MDI and the increment in HbA1c values after Ramadan was less among them as well.

Pre-Ramadan control and fasting ability

There was a mild increment in HbA1c values after Ramadan. The mean HbA1c value increased from 8.3% before Ramadan, to 8.5% after Ramadan. Patients who fasted all eligible days were compared to those who broke the fast on 5 and more days, as shown in Table 3. These data suggest that those who didn't break the fast at all tended to have better HbA1c before Ramadan than those who broke 5 days and more.

Discussion

Fasting during Ramadan involve alternating periods of absolute fasting and refeeding within a 24-h period. This alternating pattern produces two contrasting metabolic environments within the same day (2-3). There are special aspects relating to the eating patterns observed during Ramadan. First, eating patterns change dramatically during Ramadan with a tendency for grouping most of the calories consumed during a day over 4-8-h. Second, the amount of carbohydrates and fat consumed during Ramadan is on average increased in comparison with that of a non-fasting day.

Fasting is a religious, spiritual and social activity in our society. Many Muslim adolescents start their fasting trials around the age of 10-11 years, and this is usually a new, challenging and interesting experience for them. However, for the diabetic patients, the challenge is even more, as they want to be able to do what their healthy peers can do, and at the same time, they have to try to maintain a good control of their blood glucose levels as much as possible (5).

Parents of the adolescents with T1DM are always concerned about the effect of fasting on their health. Many physicians tell these patients that they shouldn't fast at all (1-3, 8-10). We still lack the evidence about the ability of these adolescents to fast safely (6,7) as most of the studies and recommendations are based on the adult populations (8-10). Very few studies were done to evaluate the ability of pediatric patients with T1DM to fast safely during Ramadan, and further research in this area is needed

Table 2. The fasting abilities, reasons for breaking the fast, and the diabetic control before and after Ramadan are shown separately in patients on multiple daily injections and insulin pump.

Parameters	Multiple Daily Injections N = 12	Insulin Pump Therapy N = 11
Fasting days		
Days eligible for fasting	29 X 12 = 348	29 X 11 = 319
Days fasted	269/348 X 100 = 77.3 %	264/319 X 100 = 82.8 %
Days not fasted	79/348 X 100 = 22.7 %	55/319 X 100 = 17.2 %
Days not fasted due to hypoglycemia	24/79 X 100 = 30.4 %	15/55 X 100 = 27.3 %
Days not fasted due to hyperglycemia	18/79 X 100 = 22.8 %	8/55 X 100 = 14.5 %
Days not fasted due to other reasons	37/79 X 100 = 46.8 %	32/55 X 100 = 58.2 %
HbA1c changes		
Before Ramadan	Range 5.9% – 10.5% Mean 8.5% n=12	Range 6.6% – 10.6% Mean 8.1% n=11
After Ramadan	Mean 8.7% Range 5.7% – 11.5% n=10	Mean 8.2% Range 6.6% – 11.3% n=10

Table 3. The relationship between number of days not fasted due to hypoglycemia and/or hyperglycemia and HbA1c before Ramadan.

Number of days NOT fasted due to hypo/hyperglycemia	0.0 Days	5 or more days
HbA1c before Ramadan	Range: 5.9% - 10.6% Mean: 8.3% n = 9	Range 7.1% – 10.5% Mean 8.7% n = 6

In our study, we have observed that these patients can fast safely during the holy month of Ramadan. None of the patients in the study had life-threatening complications such as significant hypoglycemia or diabetic ketoacidosis. Patients were able to fast most of the days of Ramadan without any diabetes-related issues. Although some patients developed hypo/hyperglycemia, this is a very common observation in diabetic patients even if they are not fasting. Breaking the fast was mainly due to other reasons such as menses, sickness, etc. The slight increment in HbA1C values after Ramadan can be explained by the increased consumption of carbohydrates and fat during Ramadan compared to the rest of the year, and the tendency of the patients to keep their blood glucose levels on the higher side to avoid going into hypoglycemia while they are fasting during day time as a precautionary similar to those observed in patients with diabetes following experiencing severe hypoglycemia (11).

Patients on insulin pump had to break the fast less frequently due to hypo/hyperglycemia compared to the patients on MDI supporting the theoretical argument made in favor of the use of insulin pumps during Ramadan (11). This is also in agreements with previous adult and adolescent experiences (6,7,12,13). Furthermore, the increment in HbA1C values was less among the patients on insulin pump, which means that these patients could maintain better glycemic control compared to patients on MDI. These results reflect on the advantages offered by usage of the insulin pump during Ramadan. Although such conclusions has to be viewed cautiously due to the small numbers and lack of true statistical significance.

The importance of having good glycemic control prior to Ramadan is also presented in this study as the patients who had better HbA1c values had to break the fast less frequently than those who had worse HbA1c values before Ramadan. This reinforces the role of the physicians and diabetic educators in encouraging the patients to have the best glycemic control far enough before Ramadan if they are willing to fast. Even in other diabetic subgroups poor glycemic control has been proposed as a valid reason to counsel against fasting (8-10).

The study had some limitations. Perhaps, the most important is related to the small number of patients. This resulted from failure of returning of duly completed dairies can explain possibility the statistically not significant results and precluded serious attempts at making subgroup analysis particularly between the MDI and insulin pump subgroups. Patients' tendency to avoid attending clinics during Ramadan was documented previously in diabetes, pediatric and antenatal practices (14-16). Notwithstanding this, the exploratory nature of the present study remains a valuable contribution to the literature (17). Furthermore, detailed pump data and actual insulin doses should have been captured even in such small numbers of patients.

Comprehensive adolescent-specific guidance is needed and future studies are most certainly crucial to help address several relevant questions (18). These studies should perhaps involve more than one center to secure

enough numbers to achieve adequate statistical power to enable comparisons to be made. Such comparisons may include pre and during/post Ramadan events in the same patients and also between subgroups such as those who fast and those who do not fast on one side and those who are on insulin pump therapy versus multi-dose insulin regimens. With adequate numbers, planning and utility of technology (e.g. continuous glucose monitoring) (19,20), questions such as the nature and patterns of glucose excursions and most suitable modification in insulin regimens to avoid the contrasting risks of day time hypoglycemia and night time hyperglycemia. Such studies can only be conducted with a high degree of cooperation from patients and parents, thus educating them on the importance of these studies in informing personal and management decisions doctors and patients. Finally, management of diabetes during Ramadan remains the prime example of a most ethnically-sensitive and culturally-competent issue in our part of the world that needs extensive networking efforts of academics, clinicians and patient advocates to produce evidence based guidelines and disseminate these amongst all relevant people (19, 20).

In conclusion, this exploratory study revealed that adolescent patients T1DM who wish to fast during the holy month of Ramadan may do so safely under experienced medical supervision and readily accessible educators' support. Use of insulin pump therapy would help patients to fast more easily and have better control. Also, adequate education and good glycemic control prior to Ramadan has been associated with better outcome.

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