Contents available at ScienceDirect

Diabetes Research and Clinical Practice

journal homepage: www.elsevier.com/locate/diabres

Attitude, complications, ability of fasting and glycemic control in fasting Ramadan by children and adolescents with type 1 diabetes mellitus

Asma Deeb [a,*], *Nabras Al Qahtani* [a], *Mariette Akle* [a], *Himanshi Singh* [b], *Rifah Assadi* [b], *Salima Attia* [a], *Hana Al Suwaidi* [a], *Tara Hussain* [a], *Nico Naglekerke* [c]

[a] *Paediatric Endocrinology Department, Mafraq Hospital, AbuDhabi, United Arab Emirates*
[b] *Medical School, Gulf University, Ajman, United Arab Emirates*
[c] *Institute of Public Health, Emirates University, Al Ain, United Arab Emirates*

ARTICLE INFO

Article history:
Received 17 September 2016
Received in revised form
6 January 2017
Accepted 20 January 2017
Available online 1 February 2017

Keywords:
Type 1 diabetes
Ramadan
Fasting
Children
Hyperglycemia
Hypoglycemia

ABSTRACT

Objectives: Sick individuals and children are exempted from fasting Ramadan. Fasting by *type 1 diabetes* patients might predispose to acute complications. There are no guidelines on fasting safety or its impact on diabetes control in children and adolescents. We aim to assess patients' attitude towards fasting, frequency of complications and impact on glycemic control in children with *type 1 diabetes*.

Research design & methods: 65 children with type 1 diabetes were enrolled. The study involved 2 hospital visits. Questionnaires were filled in each visit and HbA1c was recorded. Log books indicating symptomatic hypoglycemia and hyperglycemia leading to breaking fast were obtained.

Results: Majority of subjects were willing to fast and 75% were encouraged by parents to do. 57% and 26% fasted more than half and all through the month respectively. 52% had, at least, one episode of hypoglycemia and 29% had hyperglycemia with one episode of ketoacidosis. All patients broke fast in response to symptomatic hypoglycemia/hyperglycemia. There was no significant difference between the frequency of complications in the pump or the Multiple Daily Injection (MDI) groups. Mean HbA1c increased from 70 mmol/mol to 73 mmol/mol. The difference was not statistically significant.

Conclusion: Children and adolescents with type 1 diabetes are keen to fast Ramadan and they are able to fast a significant number of days. Hypoglycemia and hyperglycemia are not uncommon with no difference between Pump or in MDI users. Breaking fast on occurrence of complications makes fasting safe. Glycemic control might deteriorate during the month and the following Eid.

* Corresponding author. Fax: +971 2 5012199.
E-mail address: adeeb@seha.ae (A. Deeb).
http://dx.doi.org/10.1016/j.diabres.2017.01.015
0168-8227/

1. Introduction

About 1.9 billion Muslims worldwide celebrate the ninth month of the Hijri calendar notable for Ramadan fasting, which is one of the 5 pillars of Islam. The purpose of fasting in Islam is to gain self-constrain, arouse God consciousness, and to better understand the plight of the poor, hungry and sick. The duration of fasting varies based on geographical location and season, but it is mandated to be between Dawn and Dusk, during which eating and drinking is prohibited, [1].

It is obligatory for every healthy adult Muslim to indulge in fasting during the holy month of Ramadan, however, it is not intended to bring excessive difficulty or cause any adverse effect on the individual. Certain groups or categories of people are exempted from fasting. These include; individuals having a chronic disease, pre-pubertal children, mentally challenged individuals, individuals whose acute illness can be adversely affected if they fast, women who are menstruating, nurturing, or those individuals who are travelling, [1,2]. Although exempted, many of these individuals still undergo fasting with other Muslims based on choice or as psychologically and spiritually led, [3]. Considering the risk of complication in individuals with *type 1 diabetes*, they are often advised not to fast. However, it was observed that the majority of children and adolescents having *type 1 diabetes* prefer to fast in order to feel equal with their peers who are fasting, [3].

Ramadan imposes significant daily routine changes. These include, changes in meal timings, type of food consumed, timing of regular medications and daily lifestyle. All these changes have a direct impact on the glucose levels among people with diabetes, [2]. During Ramadan fasts, individuals usually take a meal early in the morning, prior to Dusk (Sohoor), and then, a main meal at Dawn (Iftar). Apart from these 2 meals, various eating habits are practiced by different people. Proper planning of insulin dosages and timings is crucial to maintain glycemic control and to avoid acute complications. In spite of the major changes in the overall daily routine in Ramadan, still, many children and adolescents with *type 1 diabetes* do fast, and very little is known about the safety or the metabolic effects of fasting on this group of patients, [4]. This attitude always increases the burden on patients and challenges the advising health care professionals, [5].

Unplanned fasting may predispose an individual with diabetes to hypoglycemia and hyperglycemia with or without ketosis, [6,7]. Fear of these complications may influence the attitude of young people or that of their parents' towards fasting. Some studies in the adult population classified patients with *type 1 diabetes* as a high-risk group of developing severe complications and the concluding recommendation were a strong advice against fasting, [8]. Parents of the children and adolescents with diabetes are concerned about the safety of fasting. Many physicians advise these patients against fasting, [6,7]. There is a major lack of evidence about the safety of Ramadan fasting by older children and adolescents with diabetes. Most of the available data are based on adult studies with very little done in the paediatric age group. The main objective of this study is to explore the attitude and the expectations of patients' and parents' towards Ramadan fasting in children and young people with diabetes. We also aim to examine the safety and the extent of complications arising due to fasting, and to explore the impact of fasting on diabetes control among children and adolescents with *type 1 diabetes*.

2. Research design and methods

Patients with *type 1 diabetes* mellitus, whose age ranges between 10 and 18 years and were visiting the diabetes clinic during the study period, were approached to participate in the study. The study was undertaken in the Diabetes Center at Mafraq hospital within a period of 4 weeks before and 4 weeks after the month of Ramadan of the year 2015. The study involves 2 hospital visits. The first visit was 2–4 weeks before Ramadan (visit 1) and the second 2–4 weeks after (visit 2). The study is explained to the patients verbally and they are given a written information sheet to read. Written consent is obtained from participants who are above the age of 12 counter-signed by their parents/guardians. For patients between 10 and 12 years, their verbal assent was obtained and parents signed the consent form. In the first visit, the study is explained and the consent form is signed. Enrolled patients are given log books and are asked to mark the days they fasted. Patients were asked to highlight any symptomatic hypoglycemia or hyperglycemia with or without ketosis and the frequency of breaking their fast due to that event. Patients were asked to bring the log books on their second visit. Visit 2 is scheduled after 10–12 weeks from visit 1, and a phone call or a text message reminder was sent by study staff to all patients prior to visit 2.

Questionnaire I (Pre Ramadan Questionnaire) is explained to patients and parents, and answers are obtained. Questionnaire I includes one question to the parent and 4 questions to the participants (Table 1). Capillary HbA1c is obtained from all patients at visit 1.

Visit 2 is planned after 10–12 weeks of visit 1 (2–4 weeks after Ramadan). In visit 2, questionnaire II (Post Ramadan Questionnaire) is explained to the subjects who answer the questions (Table 2). Log books are examined with patients to verify questions and HbA1c is obtained from all participants.

3. Questionnaires validation

Questionnaires were designed by a clinical psychologist (MA) and a paediatric endocrinologist (AD). They were validated through its usage in adolescents attending the clinic but are not involved in the study. The questionnaires were also validated by running through the clinic staff of doctors and nurses not involved in the study. Ethical approval was obtained from the Mafraq Hospital Research and Ethics Committee to undertake the study.

4. Data collection and collation

Each participant was allocated a study number and data from all questionnaires were collated on a spreadsheet for data analysis. Data including, age, gender, duration of diabetes