



ARAŞTIRMA / RESEARCH

Impact of fasting during Ramadan in patients with type 2 diabetes mellitus

Ramazan'da oruç tutmanın tip 2 diyabetik hastalara etkisi

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Abstract

Purpose: Fasting during Ramadan is a religious obligation for Muslims. Extended fasting can create undesirable acute complications of diabetes such as hypoglycemia or hyperglycemia. In this study we aimed to evaluate the impact of fasting on glucose regulation in diabetic patients who fast during Ramadan.

Materials and Methods: Patients were informed about the possible side effects of fasting for them and those who stated that they will be fasting during Ramadan were called one month after Ramadan. In this retrospective cohort study by telephone interview, the number of fasting days, daily measurements of glucose, the number of acute complications if existed and whether the patients have changed their treatments were asked.

Results: Forty six patients were included in this study. Mean age was 54.3±9.5 yr. The average fasting day was 25.24±2.4. They were categorized according to the risk stratifications. The number of hypoglycemic events was not higher than detected six months prior to the Ramadan. Most of the patients had hyperglycemia rather than hypoglycemia. All of the patients who had hypo-or hyperglycemia did not interrupt their fasting and did not change their medications.

Conclusion: Patients who fasted during Ramadan have a tendency both hypoglycemia and hyperglycemia. To improve glycemic regulation and keep these patients in a safe and acceptable glucose range, Pre-Ramadan education is necessary.

Keywords: : Ramadan, diabetes, hypoglycemia

Öz

Amaç: Ramazan ayında oruç tutmak Müslümanlar için dini bir zorunluluktur. Uzamış açlık bu hastaları hipoglisemi ya da hiperglisemi gibi akut komplikasyonlarla karşı karşıya getirmektedir. Bu çalışmada Ramazan ayında oruç tutan bireylerde açlığın glukoz regülasyonu üzerine etkisini araştırmayı amaçladık.

Gereç ve Yöntem: Hastalar uzun süreli açlığın olası komplikasyonları hakkında bilgilendirildikten sonra Ramazan ayında oruç tutacağını beyan eden bireylerle Ramazan ayı bitiminden 1 ay sonra telefon görüşmesi yapıldı. Telefon görüşmesiyle gerçekleştirilen bu retrospektif kohort çalışmada, kaç gün oruç tuttıkları, günlük glukoz ölçümleri, eğer yaşadılarsa hipoglisemik atak sayısı ve tedavilerini değiştirip değiştirmedikleri soruldu.

Bulgular: Çalışmaya 46 diyabetik hasta dahil edildi. Ortalama yaş 54.3±9.5 saptandı. Ortalama oruç tutulan gün sayısı 25.24±2.4 idi. Hastalar risk sınıflamasına göre gruplandırıldı. Hipoglisemik atak sayısında ramazandan önceki 6 ay içinde saptanan atak sayısına göre fark saptanmadı. Hastalarda hiperglisemi, hipoglisemiye göre daha yüksek sıklıkla tespit edildi. Hipoglisemi ya da hiperglisemi yaşayan bireylerin oruç tutmaya devam ettikleri ve tedavilerininide değişiklik yapmadıkları belirlendi.

Sonuç: Ramazan ayında oruç tutan bireylerde hem hipoglisemi hem de hiperglisemi yatkınlığı mevcuttur. Glisemik regülasyonu düzeltmek ve bu bireyleri güvenli, kabul edilebilir glukoz aralığında tutabilmek için, diyabetik bireylerin Ramazan öncesi eğitimleri ve bilgilendirilmeleri gereklidir.

Anahtar kelimeler: Ramazan, diyabet, hipoglisemi

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INTRODUCTION

Diabetes Mellitus is a chronic disease that is caused by insulin deficiency or insulin resistance. As a result of the defective carbohydrate, protein and lipid metabolisms, acute and chronic complications of disease can develop. Chronic hyperglycemia, hypoglycemia or fluctuations on blood glucose levels increase risk of diabetic complications. These patients should be informed and well-educated by their physicians regularly for the protection of acute and chronic complications of disease.

Ramadan is the ninth month of the Islamic lunar calendar. During this holy month of Ramadan, most of Muslims abstain from drinking, eating, smoking and from oral or parenteral medications from dawn to sunset. Patients have one large meal at sunset and one before dawn called Iftar and Suhoor, respectively. The time of fasting ranges from 12-18 hours a day depending on the season and geographical area during 29-30 days. The patients with chronic diseases, acutely ill patients and mentals are free from fasting. Although they are exempted from fasting; many patients with diabetes choose to fast during Ramadan. The most common recommendations for treatment of diabetes are life style changes and diet. Diabetic patients who abstain from eating and drinking during Ramadan have only two main meals –one in the evening and one at night from sunset until dawn¹. Such a pattern of eating displays many detrimental effects on plasma glucose regulation, Muslims who fast daily during Ramadan should know how fasting affects them. Besides; the patients who have abnormal blood glucose regulation, those with type 1 diabetes mellitus, Gestational diabetes mellitus (GDM), and chronic liver or kidney disease have higher risk of detrimental effects on plasma glucose regulation like hypoglycemia or hyperglycemia attacks.

There are approximately 148 million Muslims with diabetes worldwide¹. The effects of fasting during Ramadan in diabetic patients has been studied many times in different studies over last two decades. There are two major studies in literature called EPIDIAR (The epidemiology of diabetes and Ramadan) and Creed. In addition to other studies these also have underlined the most common risks of fasting in patients with diabetes, such as hypoglycemia, hyperglycemia, diabetic ketoacidosis, dehydration and thrombosis^{2,3}.

Hypoglycemia is the most common and serious complication of fasting. Except from insulin there are many glucose lowering medication options for treatment of diabetes. In the last decade new classes of glucose lowering medications (dipeptidyl peptidase (DPP-4) inhibitors glucagon-like peptide-1 (GLP-1) agonists, and sodium-glucose cotransporter 2 inhibitors (SGLT-2) have been introduced with reduced risk of hypoglycemia⁴. Unfortunately insufficient knowledge of diabetic patients about fasting during Ramadan leads to undesirable complications. The aim of this study was to determine how fasting affects the blood glucose regulation and the frequency and severity of hypoglycemic or hyperglycemic events on fasting diabetic patients during Ramadan.

MATERIALS AND METHODS

This study was conducted in the Department of Endocrinology and Metabolism at Baskent University Dr. Turgut Noyan Teaching and Research Center at June 2017 (Ramadan). This study was approved by Baskent University Institutional Review Board with the project number KA17/168 and informed consent form was obtained from each participant. Risks of fasting were described to all patients, totally 46 subjects who insist on fasting, were selected and the phone numbers of the patients were taken. The patients were asked to measure blood glucose levels at least four times a day especially at pre-Suhoor, at noon, at pre-Iftar and 2 hours after Iftar. Within four weeks after Ramadan, patients were interviewed by telephone by the same physician, whether they continue their treatment, whether they have changed their treatment, how many days they have fasted, whether they experienced hypoglycemia and the number of hypoglycemic event throughout six months before Ramadan were asked to all of these patients. Hypoglycemia was defined as blood glucose level lower than 70 mg/dl and hyperglycemia was defined as blood glucose level over 180 mg/dl.

Body weight (kg) and height (m) of the patients were measured. Body mass index (BMI) was calculated by using weight and height by the mathematical relationship $\text{weight (kg)}/\text{height (m)}^2$, level of education, and ongoing medications were recorded. After an overnight fast of approximately 10-14 hours, fasting blood samples were collected between 08:00 and 09:00 for fasting glucose (FPG),

lipids, A1C levels. Medical therapies of patients were categorized as insulin, oral medication or combined therapy.

Patients were classified into three risk categories according to the IDF-DAR Practical Guidelines. According to risk stratification; Low-moderate risk group consists of healthy subjects with A1C < 8%, treated with lifestyle intervention, metformin, alpha-glucosidase inhibitors, pioglitazone, incretin based therapy and/or short acting insulin secretagogues. Patients who have moderate hyperglycemia with average fasting or pre-meal glucose levels between 150-300 mg/dl or with A1C 8-10 %, with demonstrated micro vascular complications (retinopathy, neuropathy and nephropathy) or macrovascular complications, also those who live alone or are treated with insulin or sulfonylureas, also elderly patients with significant cognition deficits, dementia or those who were treated with drugs that may affect cognition, those who have comorbid conditions, including heart failure, malignancy, stroke, uncontrolled hypertension were classified as the high risk group⁵.

Statistical analysis

All statistical analyses were performed using SPSS for Windows software (ver. 23.0; SPSS Inc., Chicago, IL, USA). The data are expressed as means \pm SD. Descriptive statistics were used to describe the patient demographics and characteristics of diabetes. P value < 0.05 was considered statistically significant. All statistical analyses were performed using SPSS for Windows software (ver. 23.0; SPSS Inc., Chicago, IL, USA).

RESULTS

Demographic variables of all patients were presented at table 1. A total of 46 patients (24 female (52.1 %) and 22 male (47.9%)) were included. All of them had type 2 Diabetes Mellitus. The mean age of the patients was 54.3 ± 9.5 years. With regard to the education level of the patients, 7 of them (15.3 %) had no formal education, 10 of them (21.7 %) had high school or university education, and the remaining 29 (63 %) had primary or secondary school education. Thirtytwo of the patients (69.5%) were unemployed. The mean duration of fasting days were 25.2 ± 2.4 . Twentytwo patients (47.9%) were classified high risk group whereas twentyfour of the patients (52.1 %) were classified in low-

moderate risk group. None of the patients were in very high risk status.

Table 1. Demographic variables of patients

Patients	Value
Gender (number, %)	
Female	24 (52.1 %)
Male	22 (47.9 %)
Age (mean \pm SD)	54.3 \pm 9.5
BMI(mean \pm SD)	29.21 \pm 4.12
HbA1C(mean \pm SD)	8.12 \pm 1.48
Duration of diabetes (mean \pm SD)	5.95 \pm 4.47
Average number of fasting days (mean \pm SD)	25.2 \pm 2.4
Average capillary glucose level (mean \pm SD)	157.3 \pm 37
Risk stratification (number,%)	
Low-moderate	24 (52.1 %)
High	22 (47.9 %)
Education (number, %)	
No formal education	7 (15.3 %)
Primary/secondary	29 (63 %)
High school/university	10 (21.7 %)
Hypoglycemic events (n, %)	
Pre-Ramadan	8 (17.4 %) (6 in high risk, 2 in low-moderate risk)
During Ramadan	9 (19.6 %) (7 in high risk, 2 in low-moderate risk)
Hyperglycemia (number, %)	13 (28 %) 10 in high risk, 3 in low-moderate risk)

BMI: Body mass index, SD: Standart deviation

Total number of documented hypoglycemic events six months before Ramadan were eight (17.4%), two in low-moderate risk group, six in high risk group. During Ramadan number of documented hypoglycemic events were 9 (19.6%); two in low-moderate risk group and seven in high risk group. All of the hypoglycemic events were minor and did not require any medical aid. There is no statistical significance between the number of hypoglycemic events before or during Ramadan.

All of the hypoglycemic events were detected during day time between noon and Iftar. Average number of fasting day was 25.2 ± 2.4 . Although patients had hypoglycemia, they all continued to fast during Ramadan. According to the records, the

hypoglycemic events were detected in 2 patients in insulin treatment group, five patients in oral medication group and two patients in combined therapy group had experienced hypoglycemia. All of the hypoglycemic events before Ramadan were detected in insulin treatment group. The dosage or type of the insulin in patients with hypoglycemia before Ramadan was changed by their physician. The average blood glucose level was 157.3 ± 37 mg/dl during Ramadan. Although we have expected to detect an increase in number of hypoglycemic events during Ramadan, average capillary glucose measurement was higher in 13 patients (28 %), 3 (%) in low-moderate risk group and 10 (%) in high risk group. Two patients who had hyperglycemia also had hypoglycemia during Ramadan and they both were in high risk group.

DISCUSSION

The most frequent reasons of hospital admission were hypoglycemia, hyperglycemia and cardiovascular diseases during fasting in Ramadan for diabetic patients⁶. In the current study we didn't find an increase in number of hypoglycemic events. The number of hypoglycemic events was nine. None of them required hospitalization or medical aid. There is no statistical significance on number of hypoglycemic events between Ramadan and previous six months before Ramadan.

According to the EPIDIAR (Epidemiology of Diabetes and Ramadan) study which is conducted on 12243 cases from 13 Muslim countries reported that approximately 43% of Type 1 Diabetes patients and 79% of Type 2 Diabetes patients fast every year during Ramadan². As we know, due to the sudden change in dietary habits and physical activity the diabetic patients who are fasting during Ramadan have a more tendency to develop hypoglycemia, hyperglycemia, ketoacidosis and dehydration^{7,8,9}. According to some studies, up to seven fold increase in hypoglycemia risk was detected and this risk was more prominent in patients treated with insulin regimen^{10,11}. During Ramadan the number of meals is reduced and amount and composition of meals are changed. During Ramadan, consumption of especially simple carbohydrates in the form of fruit juices and sweet foods are increased.

Many studies show that there are improvements in glycemic control or hyperglycemia rather than hypoglycemia during fasting in Ramadan^{12,13,14}. In

this current study, some of our patients did not monitor their blood glucose levels by glucometer regularly; the mean glucose level was higher than 157.3 ± 37 mg/dl. The most common complication was not hypoglycemia in our cohort. In EPIDIAR study, when fasting, type 1 diabetic patients have three-fold increased risk of hyperglycemia while type 2 diabetic patients have five-fold increased risk of hyperglycemia similar as we detected². In addition to EPIDIAR, there are studies which detected higher rates of hyperglycemia than hypoglycemia^{15,16}. The underlying factors for hyperglycemia are excessive reduction in the dosage of diabetes medications due to fear of hypoglycemia, inadequate dietary regulation during the Iftar and Suhoor meal. Furthermore, prolonged fasting causes excessive breakdown of large amount of glucose leading to hyperglycemia and ketoacidosis¹. Further studies are needed to examine the reasons for these undesirable results.

There is no standard treatment regimen for diabetic patients who want to fast during Ramadan. There are some data which investigate various treatment regimens that would be safe for these patients^{17,18}. But it should be kept in mind that the alterations on medical therapy should be individualized for each patient. The striking point of our study is that all of the patients who had hypoglycemia or hyperglycemia during fasting did not quit fasting. Although this can be explained by the prominence of religious obligation, the inadequate education before Ramadan may lead to this situation.

With usage of educational program in studies, such as the Ramadan Education and Awareness in Diabetes study (READ) and the Ramadan Prospective Diabetes Study, high complication rates would be reduced during fasting. According to the READ study there is significant decrease in the number of hypoglycemic events in diabetic patients that received diabetes education although an increase was detected in a control group that did not receive the educational advice. The importance of educational program was also evaluated in the Ramadan Diabetes Prospective study which also revealed decreased hypoglycemic events in patients that received education^{13,14}.

The most important issue is pre-Ramadan education for patients who decide to fast during Ramadan. Life-style changes, regulation of dietary habits and adjustment of medication (time, type, and dose) is necessary. According to the previous studies,

education targeted programs about dietary behavior and alteration of medications minimize the risk of acute complications including hypoglycemia and hyperglycemia^{7,19}.

In order to have appropriate diabetic regulation and to prevent acute complications during Ramadan, patients should have a visit that is scheduled to exist 2-3 months before Ramadan if they wish to fast. Patients should be informed about the situations they could face during fasting. They should be focused on diabetes education to change their lifestyle and medications. With proper management before Ramadan, the undesirable effects of fasting on these patients might be prevented.

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