

## Ramadan and Type 2 Diabetes in Bangladesh

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### Abstract

Ramadan is the Holy month of the Muslims when they are required to fast from dawn to sunset. The present study was aimed at exploring the effects of fasting in the Ramadan on body mass index (BMI), waist circumference (WC), total cholesterol, triglyceride (TG), creatinine, and acute complications in patients with type 2 diabetes in Bangladesh. This prospective study was carried out among 92 types 2 diabetes patients (age 47±9 years, mean±SD), selected randomly from a tertiary-care hospital of the Diabetic Association of Bangladesh (BADAS). Significant changes were observed in the pulse rate ( $p=0.001$ ) and BMI ( $p=0.001$ ) in type 2 diabetes during Ramadan. Fasting blood glucose ( $p=0.001$ ), fructosamine ( $p=0.001$ ), TC ( $p=0.003$ ), HDL-C ( $p=0.004$ ), TG ( $p=0.04$ ), and creatinine ( $p=0.01$ ) were significantly higher in all the patients during fasting. Fasting during Ramadan is associated with a deterioration of metabolic control in diabetic patients. However, fasting did not cause any irreversible damage to renal function; so, fasting is safe for type 2 diabetes in Bangladesh during Ramadan.

**Key words:** Blood glucose; Triglyceride; Body mass index; Fasting Ramadan; Hypoglycaemia; Type 2 diabetes; Bangladesh

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### INTRODUCTION

Fasting during Ramadan is one of the most significant worships in Islam. In this month, all healthy adult Muslims—both males and females—are required to abstain from taking foods, fluids, oral medication, smoking, and sexual intercourse from dawn to sunset.

The time of fasting differs each year because it is a lunar calendar, and as such, fasting from dawn to sunset occurs at a period that varies with the geographical site and the season. In the summer months and northern latitudes, the fast could last up to 18 hours or more.

The practices and the food behaviors of the people are not similar during the month of fasting compared to the other months of the year. These modifications are accompanied by the changes in the rhythm of life and disturbances of the cycle of sleep. During Ramadan, the Muslims typically eat two meals each day. The first meal is taken immediately following the evening call to prayer after sunset, and the second meal is typically taken just before the commencement of the daily fast.

Diabetes mellitus (DM) itself adversely affects the psychological state of patients because of the changes in glucose metabolism, needs for discipline and compliance, fear of long-term complications and threat of hypoglycaemic attacks, and the possibility of dehydration and becoming coma. Some believe that Ramadan fasting is a dangerous and unhealthy practice (Afifi, 1997) whereas others advance that this physiological rest is essential for a good and healthy life-style (Fakhrazadeh et al., 2003) for DM.

Fasting during Ramadan has been shown to have some effects on the circulating levels of several biochemical markers known to be associated with vascular and metabolic disorders including lipid profile (Zadegan et al., 2000; Khaled & Belbraouet, 2009; Saleh, Elsharouni, Cherian, & Mourou, 2005). The changes in lipid profile may vary depending on the quality and quantity of food intake and physical activity (Alkandari, 2012). Moreover, there are regional disparities in dietary habits depending on cultural rituals, often practiced during Ramadan, among Muslim societies. Consequently, such disparities may affect various components of metabolic importance (Barkia et al., 2011). However, no study has been conducted to assess the changes in clinical and biochemical parameters among Bangladeshi diabetes patients. Therefore, the present study was carried out to explore the effects of fasting during Ramadan on health status among type 2 diabetes patients who attended a tertiary-care hospital in Dhaka.

## METHODS

This prospective study was conducted during 2006 among 120 type 2 diabetes patients who had no severe diabetic complications; pregnancy; did not receive therapy with insulin or oral hypoglycaemic agent (OHA), other investigational drugs which reduce lipid catabolism within the last six months, and the patients were selected randomly from the OPD of BIRDEM, a tertiary-care hospital of the BADAS. Finally, 92 (76.7%) of the 120 patients were included in the study. The remaining 28 (23.3%) patients were lost from the study due to their unwillingness and lack of commitment and time. Two samples (10 mL each) of blood were collected from each patient at two visits: before the start of Ramadan and at the fourth week of Ramadan. The first blood sample was drawn from 12-13-hour fasting patients by venipuncture into dry tubes before Ramadan. To respect the 12-13-hour fasting in the pre-Ramadan period, the blood sampling during Ramadan must be done during 15:00-16:00 hours. After 10-15 minutes, the sample blood was centrifuged for five minutes at 3,000 rpm to obtain serum. The serum was frozen at -70 °C until it was analyzed. Serum glucose,

fructosamine, TC, TG, HDL-C, and creatinine were analyzed by using standard techniques. During Ramadan, the dietary pattern changes. The HbA<sub>1c</sub> test is, thus, not appropriate if there has been a change in diet or treatment within a shorter time than six weeks. In such cases, the alternative fructosamine test is used for indicating average control in the preceding 2-4 weeks. Body-weight, height and WC were carried out by using appropriate tools and all clinical data were collected from the record book. Statistical tests were considered significant at *p* values of  $\leq 0.05$ . Results were expressed as mean  $\pm$ SD and analyzed by Student's *t*-test and paired *t*-test. The SPSS software (Windows version 16.0) was used for the analysis and interpretation of data. Ethical approval was obtained from the ethics and research review committees of the BADAS.

## RESULTS

The study included 92 types 2 DM (M:F-61:31). Their mean age was 47 $\pm$ 9 years. Of the patients, 87% were from urban areas, 30% were illiterate, and 42% passed secondary and higher secondary school certificate examinations. Before Ramadan, the pulse rates of the patients were significantly high (76.9 $\pm$ 8.6 beats/min) compared to during Ramadan (72.2 $\pm$ 6.9 beats/min, *p*=0.001). BMI and WC showed a significant (*p*<0.05) decrease in the diabetes patients during fasting compared to the period before Ramadan. During Ramadan, the fasting glucose level was significantly (*p*=0.001) higher (from 4.7 $\pm$ 0.8 to 5.5 $\pm$ 1.1 mmol/L) among all the study patients. The level of fructosamine was also found significantly higher (128.0 $\pm$ 37.9 vs 145.0 $\pm$ 31.8  $\mu$ mol/L, *p*=0.001) among the patients during Ramadan. The serum cholesterol (from 198.0 $\pm$ 38.6 to 210.0 $\pm$ 40.9 mg/dL, *p*=0.003), HDL-C (from 34.2 $\pm$ 8.5 to 36.7 $\pm$ 9.4 mg/dL, *p*=0.004), triglyceride (from 171.4 $\pm$ 84.7 to 195.0 $\pm$ 101.0 mg/dL, *p*=0.04) and creatinine (from 1.1 $\pm$ 0.21 to 1.2 $\pm$ 0.19 mg/dL, *p*=0.01) level were significantly higher during Ramadan compared to before Ramadan among the patients (Table 1). About 19% and 9% of the patients faced dehydration and hypoglycemia respectively during Ramadan (Figure 1).

**Table 1**  
**Variations in Clinical, Anthropometric and Biochemical Parameters in Male and Female Patients With Type 2 Diabetes During and Before Ramadan Fasting**

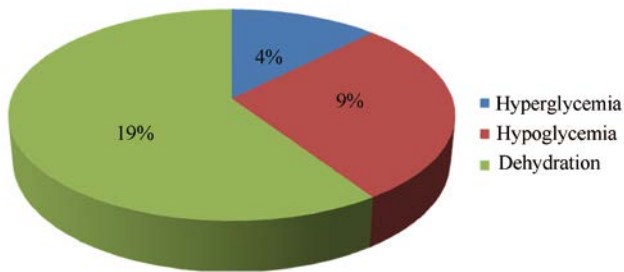
Parameter	Before ramadan			During ramadan			Period (n=92)		
	M (n=61)	F (n= 31)	<i>p</i>	M (n=61)	F (n=31)	<i>p</i>	Before ramadan	During ramadan	<i>p</i> value
Pulse (beats/min)	77.4 $\pm$ 7.7	75.7 $\pm$ 10.0	0.36	70.9 $\pm$ 5.7	74.6 $\pm$ 8.4	0.03	76.9 $\pm$ 8.6	72.2 $\pm$ 6.9	0.001
SBP (mmHg)	125.7 $\pm$ 10.2	128.3 $\pm$ 14.6	0.31	126.1 $\pm$ 12.3	126.7 $\pm$ 15.1	0.83	127.0 $\pm$ 11.89	126.0 $\pm$ 13.2	0.85
DBP (mmHg)	78.9 $\pm$ 5.2	77.7 $\pm$ 6.6	0.35	76.4 $\pm$ 9.4	77.4 $\pm$ 7.4	0.62	79.0 $\pm$ 5.8	77.0 $\pm$ 8.8	0.07
BMI (kg/m <sup>2</sup> )	23.9 $\pm$ 3.2	25.5 $\pm$ 3.4	0.02	23.5 $\pm$ 3.3	25.2 $\pm$ 3.4	0.02	24.5 $\pm$ 3.4	23.1 $\pm$ 3.4	0.001
WC (cm)	35.5 $\pm$ 7.8	34.7 $\pm$ 2.6	0.56	34.2 $\pm$ 3.1	33.8 $\pm$ 3.5	0.63	34.7 $\pm$ 3.1	34.1 $\pm$ 3.2	0.009

To be continued

Continued

Parameter	Before ramadan			During ramadan			Period (n=92)		
	M (n=61)	F (n= 31)	p	M (n=61)	F (n=31)	p	Before ramadan	During ramadan	p value
FBG (mmol/L)	4.8±0.8	4.6±0.7	0.37	5.5±1.2	5.4±1.2	0.86	4.7±0.8	5.5±1.1	0.001
Fructosamine (µmol/L)	125.3±35.3	132.4±43.1	0.40	145.4±34.8	143.1±25.3	0.71	128.0±37.9	145.0±31.8	0.001
S cholesterol (mg/dL)	200.4±39.0	193.0±37.8	0.38	210.2±41.2	209.3±41.0	0.92	198.0±38.6	210.0±40.9	0.003
HDL- C (mg/dL)	32.4±7.8	37.6±8.7	0.005	35.2±9.1	39.7±9.5	0.03	34.2±8.5	36.7±9.4	0.004
TG (mg/dL)	183.0±83.5	148.3±83.7	0.06	200.5±100.2	185.7±105.4	0.51	171.4±84.7	195.0±101.0	0.04
Creatinine (mg/dL)	1.1±0.1	1.0±0.2	0.0001	1.2±0.1	1.08±0.1	0.002	1.1±0.21	1.2±0.19	0.01

Note. Results are expressed as mean±SD. Student’s *t*-test and paired *t*-test were performed at the test of significance.  $p \leq 0.05$  was taken at level of significance. BMI=Body mass index; DBP=Diastolic blood pressure; F=Female; FBG=Fasting blood glucose; HDL-cholesterol=High density lipoprotein; M=Male; SBP=Systolic blood pressure; TG=Triglyceride; WC=Waist circumference



**Figure 1**  
**Pattern of Complications Among Patients During Ramadan**

## DISCUSSION

During the month of Ramadan fasting, Muslims worldwide consume two meals between sunset and dawn, and there is no restriction on the amount or type of food taken at night. People may alter their food and sleeping habits. Furthermore, most diabetes patients reduce their daily activities during this period due to fear of hypoglycemia (Laajam, 1990; Ewis & Afifi, 1997). These factors may certainly explain not only a lack of weight loss, but also a weight gain in such patients. The mean BMI and the abdominal obesity of the patients in this study significantly ( $p < 0.05$ ) decreased during Ramadan. Such a pattern of reduction in BMI and weight among diabetes patients has been shown in Malaysia (Yousu, et al., 2013). The reduction in BMI and abdominal obesity observed in our study may be explained by a mild dehydration due to fluid restriction during Ramadan. However, in a West Algerian study (Saada et al., 2008), fasting during Ramadan did not exert any significant variation in BMI among diabetes patients. The stability of BMI during Ramadan was observed among diabetes patients in a study in Pakistan (Yarahmadi et al., 2003).

Fasting serum glucose and fructosamine of the study patients significantly increased ( $p < 0.05$ ) during Ramadan compared to before Ramadan. The change in glucose level may vary according to type of food taken, diet composition, differences in metabolism such as energy

metabolism, and energy intake regulation. The Muslims, classically, tend to consume a large amount of sugar, dates, and sweets during Ramadan. At the same time, many fasting Muslims tend to be less active during this time.

In the present study, serum total cholesterol, HDL-C, triglyceride, and creatinine level significantly increased during Ramadan fasting. The comparison with previous studies is a difficult task due to their contradicting results. Results of the study showed that the levels of cholesterol remain unchanged during both the periods (Saada et al., 2008). However, findings of other studies suggest that the level of cholesterol increases (Yarahmadi et al., 2003) during Ramadan fasting. Some researchers also found a reduction in triglyceride (Yousu, et al., 2013).

The main drawback of the present study is that it did not take into consideration the dietary pattern. The dietary pattern of Muslims during Ramadan underlies the lipid changes, i.e. the sucrose content of meals, consumption of increased fried foods, and higher intake of fats, particularly saturated fat. The intake of very large meals after many hours of fasting might lead to increase synthesis of endogenous cholesterol. In the case of creatinine, our results are consistent with those of the study by Saada et al. (2008). The level of creatinine in the blood does not depend only on glomerular filtration but also on the digestive absorption of meat products, which probably increase modestly during the Ramadan month.

Less rates of hypos occurred probably because of less physical activity and changes in dietary intake in the fasting month.

This study had a couple of limitations. First, we did not collect details on the actual food items consumed by the patients. Another important limitation was the lack of commitment by some patients for participating in the second phase, and we, therefore, conducted the study among a small sample. Thus, we cannot generalize the results for the whole population of patients who seek treatment for diabetes. In a further study, we will incorporate all the information (including medications),

which will help us to draw a solid conclusion regarding the effects of fasting during Ramadan on diabetes.

In conclusions, we may say that fasting during Ramadan is associated with a deterioration of metabolic control as evidenced by glycemic and lipidemic status in the diabetes patients, and fasting did not cause to an irreversible damage to renal function; so, fasting during Ramadan is safe.

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