

## Original Article

## Effects of Ramadan Fasting on Blood Levels of Glucose, Triglyceride and Cholesterol among Type II Diabetic Patients

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### Abstract

**Background:** Ramadan is the Holy month of the Muslims where they are required to fast from dawn to sunset, with liberal access to food and fluids in the evening. Our study was conducted in Ramadan (October-November 2004) to investigate the effect of Ramadan fasting on glucose and lipid profiles among type II diabetic patients.

**Methods:** Our study population was 55 adult diabetic patients (38 female, 17 male) of a mean age of 55.82±16 years. Three samples of blood were taken at three intervals (Before, during and after Ramadan). The Glucose, Triglyceride, Total cholesterol and lipoproteins were determined and the results were compared using student t-test.

**Results:** There was an increase in the glucose level during Ramadan compared to pre Ramadan value (10.36±3.30 versus 9.25±2.91 mmol/L). After Ramadan there was statistically significant decrease of glucose level (8.93±3.3;  $p<0.05$ ). The triglyceride levels showed a slight increase and decrease during and after Ramadan, respectively (1.45±0.65 versus 1.41±0.58 mmol/L). As well, the level of total cholesterol showed a slight increase and decrease during and after Ramadan respectively (5.73±0.67 versus 5.43±1.05 mmol/L). The levels of LDL-C and HDL-C showed similar changes.

**Conclusion:** Our study showed slight increase in the levels of glucose, triglyceride and cholesterol during Ramadan fasting, but with a return to the pre-fasting levels after the end of Ramadan.

**Keywords:** Fasting, glucose, triglyceride, cholesterol, Diabetes mellitus

### Introduction

Ramadan is the ninth month of the Islamic (Hijri) Calendar. During this month all healthy adult Muslims, males or females are expected to abstain from foods, fluids, oral medications, smoking and sexual intercourse from dawn to sunset. The classic Islamic point of view is that Ramadan fasting is good for health and the spiritual purity of Muslims. Fasting is also necessary to obtain the rewards of God. For these reasons many Muslims who are religiously exempted from fasting insist on fasting (in many instances against a medical advice)<sup>(1)</sup>. In particular, the majority of the Muslims diabetic patients insist on fasting even those poorly controlled or with serious complications<sup>(1)</sup>. Thus, we can understand the importance of scientific and

clinical studies on the impact of Ramadan fasting on this group of patients.

Ramadan fasting is known to affect many metabolic processes in the human body<sup>(2-4)</sup>. The physiological aspects of Ramadan are influenced by the combination of food and water deprivation, the periodic nature of fasting and the modification of physical activities during the daytime hours. For healthy Muslims the reported physiological and biochemical changes during Ramadan, although significant, do not reach pathological proportions<sup>(1,4)</sup>. The physiological indices return to normal after the fasting month is over, indicating safety of fasting for the healthy persons.

For sick Muslims, there are increasing number of studies on impact of fasting with varying

results<sup>(1,5,6)</sup>. In particular, patients with metabolic diseases such as diabetes need a special attention to monitor any change that may affect their health in order to suggest the proper care for them during Ramadan.

Diabetes mellitus is a growing health problem in the Sudan, it accounts for some 10% of the total hospital admissions<sup>(7)</sup>.

The aim of this study is to assess the impact of Ramadan fasting on three blood constituents namely glucose, cholesterol and triglyceride among a group of Type II Sudanese diabetic patients.

**Materials and Methods**

This study was conducted at a clinic for chronic diseases (mainly diabetes mellitus and hypertension) run by the second author, during the Ramadan of the year 2004. In this year, Ramadan lasted for 29 days and the fasting hours were 14-15 hours in a moderately warm weather. The population of the study were Type II diabetic patients intended to fast in that year who gave a written or oral consent to participate in the study. The majority of the clinic patients are either housewives or retirees, all with the same level of physical activity. The patients with factors that are known to affect the blood lipids such as alcoholism, obesity, smoking and drugs(e.g. thiazides) or lipid modulating drugs were excluded. A short questionnaire to collect data including age, sex and duration of diabetes was filled.

Three samples of blood (5 ml each) were taken from each patient at three visits: before the start of Ramadan, in the third week of Ramadan and one

month after the end of Ramadan. Samples were drawn by venipuncture under completely aseptic techniques in heparinized tubes. The plasma was separated by centrifugation at 5000 rpm for 10 minutes. The levels of glucose, cholesterol and triglycerides were measured using enzymatic diagnostic kits obtained from (*spinreact*, Spain). Each volunteer served as self – control by comparing his Ramadan with pre-Ramadan results. Results were expressed as mean ± SD and analyzed by student's t-test. To determine the statistical significance of the difference between the means for the pre-Ramadan (control) and the Ramadan samples, with p<0.05 was considered significant.

**Results**

Our study included 55 diabetic patients (38 female, 17 male). Their mean age was 55.82 ± 16 years, ranging from 35-75 years. The mean duration of diabetes was 6.4 ± 3 years (ranging from 2-25 years). A total of 35 patients (60.3%) were controlled with oral hypoglycemic agents, while the rest (20) were on diet.

The laboratory results of blood levels of glucose and lipid profiles are shown in Table (1) and Table (2). The blood glucose level showed an increase during Ramadan, and statistically significant reduction after Ramadan (p<0.05). The triglycerides levels showed a slight increase during Ramadan. Both changes were not statistically significant. The same changes were observed in the level of total cholesterol and lipoproteins (HDL and LDL and VLDL).

**Table 1: Values of blood levels of glucose, triglyceride and cholesterol before and during Ramadan among 55 diabetic patients**

Parameters	Before Ramadan	During Ramadan	Significance of change
Glucose	9.25±2.91	10.36±3.30	Not significant
Triglyceride	1.38±0.61	01.45±0.65	Not significant
Total cholesterol	5.37±1.11	05.73±1.47	Not significant
HDL- cholesterol	1.17±0.54	01.22±0.54	Not significant
LDL- cholesterol	3.72±0.29	04.08±0.93	Not significant
VLDL- cholesterol	0.87±0.29	00.96±0.39	Not significant

\* All values are given in mmol/L  
 NB: P> 0.05 is considered significant

**Table 2: Values of blood levels of glucose, triglyceride and cholesterol during and after Ramadan among 55 diabetic patients**

Parameter	During Ramadan	After Ramadan	Significance of change
Glucose	10.63±3.30	8.93±03.40	P<0.05 significant
Triglyceride	01.45±0.65	1.41±00.58	Not significant
Total cholesterol	05.37±1.67	5.43±01.05	Not significant
HDL- cholesterol	01.22±0.54	1.19±00.48	Not significant
LDL- cholesterol	04.08±0.93	3.91±00.19	Not significant
VLDL- cholestrol	00.96±00.39	00.87±00.21	Not significant

\* All values are given in mmol/L

NB: P> 0.05 is considered significant

## Discussion

Our study showed an increase in the values of blood levels of glucose, cholesterol and triglyceride during Ramadan but with return to the pre-Ramadan levels a few weeks after the end of the fasting. This confirms the finding of previous studies that the biochemical changes during Ramadan are temporary and of no pathological consequences

For healthy subjects, during the 12-14 hours of fasting, the blood glucose remains stable as a result of hepatic glucose output (glycogenolysis) which occurs at a rate of 0.10-0.16 mmol/kg/hour. In our study we reported a significant reduction in the level of glucose after the end of the fasting month. This is different from previous studies on healthy subjects which indicate a slight increase of blood glucose<sup>(8)</sup>. The changes in glucose levels may vary according to type of food taken, and engorging on braking the fast, differences in metabolism, irregularity in taking anti-diabetic medications and the level of glycaemic control before Ramadan<sup>(1)</sup>. Of these, the dietary factor is important. The Muslims, classically, tend to consume large amounts of sugar, dates and sweets during Ramadan. At the same time, many fasting Muslim tends be less active during Ramadan (often sleeping or watching television).

An important factor that deserves discussion is the intense fear of hypoglycemia among diabetic patients intending to fast (and even some of their caretakers). Even more, some patients tend to stop

their medications or break their fast with large amounts of sweets or sucrose-rich fluids. These patients should be reminded that fasting in uncomplicated Type II diabetes, per se, does not lead to hypoglycemia. They can be advised to avoid strenuous or unaccustomed exercise during the fasting hours, and perform self-monitoring of their glucose to get assured of their normoglycaemia.

The levels of triglycerides and cholesterol showed no significant difference. The comparison with previous studies is a difficult task due to their contradicting results. Nevertheless, our results are similar to Sulimani et al (1991)<sup>(6)</sup>. Some researchers found a reduction in cholesterol and triglycerides, while others found an increase in one parameter and a decrease in the other<sup>(2,5)</sup>. The main drawback of these studies is that they did not consider some factors that may affect lipid levels such as age, sex and dietary patterns<sup>(1)</sup>. This may explain some of the differences in the results of these studies. To reach productive results, the future studies must match the investigated groups with these risk factors.

The most common lipid abnormality in Type II diabetes is hypertriglyceridaemia<sup>(9)</sup>. The association between hyperglycemia and hypertriglyceridaemia can be explained by the decrease in adipose tissues and muscle lipoprotein lipase activity<sup>(10)</sup>. On the other hand, the hepatic lipase plays a central role in Low Density Lipoprotein (LDL) and High Density Lipoprotein (HDL) remodeling. High activity of hepatic lipase is associated with small dense LDL

particles and with reduced HDL cholesterol levels<sup>(11)</sup>. The metabolic changes associated with Ramadan fasting might affect all or some of these processes leading to the lipid changes reported in different studies. Some researchers claim that the dietary pattern of Muslims during Ramadan underlies the lipid changes i.e. the sucrose content of meals. Elhazmi et al (1987) stated that the intake of very large meals after many hours of fasting might lead to increase synthesis of endogenous cholesterol<sup>(12)</sup>. However, our results showed that the lipid changes in Ramadan among the diabetic patients are temporary and of no morbid effects. Yet, the caring doctors should be cautious in advising diabetic patients with dyslipidaemia to fast.

In conclusion, the investigated metabolic changes associated with Ramadan fasting among our diabetic group are slight and not statistically significant; temporary and of no pathological consequences. For diabetic patients with prior fair glycaemic control and no complications or co-morbidities, fasting does not seem to involve added risk, should they adhere to their prescribed medications and dietary restrictions (as before Ramadan). Patients should be encouraged to continue their follow up and adjustment of medications.

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