

Ramadan fasting induces modifications of certain serum components in obese women with type 2 diabetes

Boumediene M. Khaled, BS, MS, Malika Bendahmane, MS, PhD, Slimane Belbraouet, MS, PhD.

ABSTRACT

Objectives: To examine the effect of fasting during Ramadan on certain serum components such as fasting serum glucose (FSG), glycated hemoglobin (HbA1c), total cholesterol (TC), triglycerides (TGs), high density lipoproteins (HDL-C), and low density lipoproteins (LDL-C) parameters in obese women patients with type 2 diabetes.

Methods: We conducted the study in Petit-Vichy Diabetology Center, Sidi-Bel-Abbès, Algeria from October 2003 to March 2004, on 60 obese outpatient women (BMI = 35.41 ± 3.64 kg/m²), aged 51 ± 10 years, who had diabetes for 5 ± 2.5 years. The patients followed no specific diet, on medications, and presenting no degenerative complications. We carried out the study over 3 periods: before (pre-fasting), during (fasting), and after Ramadan

month (post-fasting).

Results: Comparing Ramadan (fasting period) with non-Ramadan days (pre- and post-fasting periods), we observed significant decreases in FSG (16.72%, $p < 0.001$), in HbA1c (11.3%, $p < 0.005$), and in HDL-C (26.81%, $p < 0.001$) rates, while TC (13.85%, $p < 0.001$), TGs (16.9%, $p < 0.003$), and the LDL-C (22.39%, $p < 0.0001$) levels increased significantly.

Conclusions: These findings show a beneficial effect of fasting during Ramadan on glucose homeostasis, however, we observed an unbalanced profile on lipids.

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During Ramadan, all believers of Islam strictly observe fasting from dawn until sunset, except for certain cases (sickness, pregnancy, lactation, or traveling). Although people with diabetes are exempted from this obligation, some still choose to fast. Studies concerning Ramadan fasting are controversial and not yet well established in diabetic subjects particularly with regards to who could observe fasting without any health risk.¹ Few studies concerning the effect of fasting during Ramadan on serum glucose metabolism showed variations,

which may be due to the amount of diet pattern, medications observance regularity, engorging after the fast is broken, or the decreased physical activity. During fasting, the overweight type 2 diabetic body mobilizes its fat stores to meet daily energy needs. Consequently, the only remained source of glucose will be the gluconeogenesis by keto-acids. In most fasting diabetics under medication, no episode of acute complications such as hypoglycemia occurred during Ramadan fasting month.¹⁻⁴ Concerning fasting serum glucose (FSG) and glycated hemoglobin (HbA1c)

From the Department of Biology (Khaled, Bendahmane), Faculty of Sciences, Djillali Liabès University, Sidi-Bel-Abbès, Algeria and the School of Nutrition (Belbraouet), Université de Moncton, Moncton, Canada.

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Address correspondence and reprint request to: Dr. Slimane Belbraouet, School of Nutrition, Université de Moncton, Moncton, E1A 3E9 Canada. E-mail: belbras@umoncton.ca

values, no significant changes or improvements were reported.⁵⁻¹¹ Until recently, only one Iranian study¹² revealed a significant increase in FSG during Ramadan fasting (11.11 ± 4.18 mmol/l $p < 0.0001$) compared to its onset in type 2 diabetic subjects. However, there were slight indications of increase in HbA1c.¹³⁻¹⁵

For the blood lipid profile, studies reported a slight decrease or no significant change in the total cholesterol (TC) and triglycerides (TGs) concentrations.^{1,9,10,14-16} While Navaei et al¹² reported a significant decrease in these 2 parameters, Khatib et al¹⁰ detected a significant reduction only in TGs component, whereas, they noticed a significant increase in TC level.⁸ An increase or no change in high density lipoproteins (HDL-C) rate was also mentioned in certain studies,^{10,14,15} and a decrease was seldom observed.¹⁶ If we consider the serum low density lipoproteins (LDL-C) parameter, an increase^{8,14,16} or no changes^{10,15} will be reported. Due to these conflicting data, we designed the present study to investigate the effect of fasting during Ramadan month on certain serum components such as FSG, HbA1c, TC, TGs, HDL-C, and LDL-C parameters in type 2 diabetic obese women. We informed all patients following no specially restricted diet regarding the goal of the study and they gave their consent to our ethics committee.

Methods. The study was conducted at Petit-Vichy Diabetology Center, Sidi-Bel-Abbès area, North-West of Algeria, from October 2003 to March 2004. It was carried out on 60 obese female volunteers diagnosed with type 2 diabetes (BMI = 35.41 ± 3.64 kg/m², aged 51 ± 10 years) for 5 ± 2.5 years, and present no degenerative complications.

For the experimental protocol, venous blood samples were drawn after 12 hours overnight fast and were collected over 3 periods. The first sample was taken one month before (pre-fasting), the second at the 3rd week (fasting), and the last one on the 3rd week after the end of Ramadan (post-fasting). The tests were performed in triplicate. The FSG, TC, and TGs concentrations were measured by enzymatic methods using Opera Bayer (Bayer, USA) autoanalyzer, and the HbA1c value was determined after an ion-exchange resin separation. The Human Cholesterol Liquicolor test kit (Human, Germany) was used for the HDL-C measure, while the LDL-C concentration was determined using the Friedewald formula.¹⁷ All samples were analyzed at Sidi-Bel-Abbès Hassani Abdelkader University Hospital Laboratory.

Limitations of the study. Major limitations of this study are the sample size, which should be larger, and male patients should have been included to give more accurate recommendations for the general diabetic

Table 1 -Various blood component levels during the 3 experimental periods.

Blood components	Pre-fasting period	Fasting period	Post-fasting period
BMI (kg/m ²)	35.41 ± 3.64*	34.87 ± 2.92	34.63 ± 3.1
FSG (mmol/L)	8.85 ± 0.97	7.37 ± 0.73†	7.12 ± 1.01
HbA1c (%)	7.35 ± 0.91	6.52 ± 0.85†	6.36 ± 0.7
TC (mmol/L)	5.41 ± 0.79	6.28 ± 1.27†	6.01 ± 1.06
HDL-C (mmol/L)	1.38 ± 0.17	1.01 ± 0.13†	1.14 ± 0.27
LDL-C (mmol/L)	3.12 ± 0.85	4.02 ± 0.96‡	3.58 ± 0.79
TGs (mmol/L)	2.36 ± 1.72	2.84 ± 1.69†	2.48 ± 1.16

*Mean ± SD, †Significant difference ($p < 0.001$ - $p < 0.005$),
‡High significant difference ($p < 0.0001$). BMI - body mass index,
FSG - Fasting serum glucose, HbA1c - glycated hemoglobin,
TC - total cholesterol, HDL-C - high density lipoprotein - cholesterol,
LDL-C - low density lipoprotein-cholesterol

population. Also other parameters particularly Apo A, Apo B, and insulin concentrations should be investigated.

Statistical analysis was performed with StatView 5.0 Software of SAS institute and the results were expressed as mean and standard deviations (mean ± SD). Paired 2-tailed student's t-test was used, and $p < 0.05$ was considered statistically significant.

Results. The various blood component rates analyzed over the 3 periods of fast (fasting, pre- and post-fasting) are indicated in **Table 1**. The main finding was a significant decrease in FSG and HbA1c levels during fasting compared to pre-fasting days (FSG, 16.72%, $p < 0.001$; HbA1c 11.3%, $p < 0.005$). This decrease was maintained till the third week after the end of fasting month. Unfortunately, during Ramadan, the lipid profile showed unbalanced values compared with those of pre- and post-fasting periods. In fact, during fasting, significant increase in serum TC (13.85%, $p < 0.001$), TGs (16.9%, $p < 0.003$), and LDL-C (22.39%, $p < 0.0001$) rates were observed, while the HDL-C level showed a significant decrease (26.81%, $p < 0.001$).

Discussion. The main effect of Ramadan fasting was the improvement of approximately 10-15% of glucose homeostasis: FSG and HbA1c parameters. This improvement was maintained 3 weeks after Ramadan, which is a good sign since we know that for every 1% decrease in HbA1c there is 35% decrease in micro vascular complications risk,^{11,18} which attribute the ameliorating HbA1c values to the decrease of the meals number. Nomani et al¹⁹ suggests

that the serum glucose and HbA1c values depend on the diet composition, energy metabolism, and energy intake regulation. A decrease of energy intake has been recorded during fasting period compared to that of pre-fasting, this was probably due to a reduction of meal frequency, which was approximately 1.5 times (data no shown). On the other hand, we found a deterioration of lipid parameters during fasting comparing to the pre-fasting periods marked by an increase of approximately 13-23% for TC, TGs, and LDL-C concentrations; and in parallel, a decrease of 27% of the HDL-C level was noticed. These observations may be due to the quantity or the quality of consumed meals since our patients try to substitute their sweet foods by more fattening ones. According to the Recommendations of the European Atherosclerosis Society, the increase in TGs level is related to the decrease of HDL-C rate,²⁰ and attributed to lipolytic effect of prolonged fasting.²¹

Finally, there are available reports, which indicated that the overweight non insulin-dependent diabetes mellitus patients who observe fasting in Ramadan encounter no major problems and it seems that fasting during this period induces in type 2 diabetes an improvement of glucose homeostasis. A statistically significant decrease in FSG and HbA1c values suggests a beneficial effect of this type of diet pattern, while the lipid profile is unfavorably altered and may be closely related to the nutritional diet and food habits during this period. We concluded that with careful dietary management, controlled physical activity, and a change in the time of drug administration from morning to evening,^{1,22} diabetic patients who want to observe fasting can do it safely, and should also seek advises on the general impacts of fasting on their health problems.

Before giving any unanimous recommendations for diabetic people who want to practice Ramadan fasting, a prospective long-term controlled study is required by including other serum parameters such as fructosamine, insulin, Apo A, ApoB and others.

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