

EFFECT OF RAMADAN FASTING ON GLUCOSE AND LIPIDS CONCENTRATIONS IN WOMEN WITH NON-INSULIN DEPENDENT DIABETES MELLITUS

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ABSTRACT

Muslims must refrain from eating, drinking and sexual relations from sunrise to sunset during the holy month of Ramadan. Our objective in this study is to investigate whether Ramadan fasting has any effect on Body mass index(BMI), blood Glucose and serum lipids concentrations in women patients with non-insulin dependent diabetes mellitus. Sixty six subjects from 03 regions located in the west of Algeria participated in this study. All participating patients were studied a week before Ramadan and at the third week of Ramadan fasting. No statistically significant fluctuations were noted in BMI either during Ramadan or in non-fasting day. The Glucose and HDL cholesterol levels were significantly ($p < 0.05$) higher in the blood or serum of fasting subjects compared to before Ramadan. This statistically significant increase in HDL-cholesterol explain clearly the beneficial effect of Ramadan fasting on diabetics serum lipids. Moreover, serum total cholesterol, triglyceride, LDL cholesterol and VLDL cholesterol levels decreased significantly ($p < 0.05$) during the third week of Ramadan than non fasting day.

INTRODUCTION

Ramadan is the ninth month of the Muslim calendar Islam strictly observed each year by more than one billion Muslims worldwide, during which all healthy adult Muslims abstain from eating, drinking, smoking and having sexual intercourses from sunrise to sunset. Sick or traveling people, as well as breast-feeding or menstruating women, are temporarily except from complying with this obligation. After the condition that precluded fasting resolves, individuals have to complete one month of fasting, even though the Ramadan month is over. The time of observance differs each year because it is a lunar calendar. Fasting from dawn to sunset, a period that varies with the geographical site and the season. In summer months and northern latitudes, the fast can last up to 18 h or more. During Ramadan, Muslims typically eat two meals each

day. The first is taken immediately following the evening call to prayer after sunset, and the other is typically eaten just before the commencement of the daily fast.

In the current state of our knowledge the majority of the studies on the type 2 diabetes (DNID) in relation to the fasting Ramadan month were realized at the sick subjects of male sex but rare is the work undertaken on the opposite sex [Azizi and Rasouli, 1987 and Al-Hader, et al.,1994]. The purpose of this study is to follow the effect of the fasting Ramadan month on the variations of the blood glucose and certain serum lipids in women type 2 diabetic patients treated with Biguanides and aged from 45 to 53 years.

MATERIALS AND METHODS

Patients

The trial population comprised Muslim Women with Type 2 diabetes (according to WHO criteria) who practiced Ramadan fasting [WHO, 1985]. An explanatory session was given by the investigators in both French and Arabic languages, and written consent was received from each willing participant. Sixty six patients treated with Biguanides from 03 Regions (Mostaganem, Mascara and Relizane) located in the West of Algeria participated in this study. Their ages ranged from 45 to 53 years (mean \pm SD =48.73 \pm 2.22) and had a BMI of 27.395 \pm 03.082 kg/m² (mean \pm SD). Patients were excluded from the trial if they had cardiac disease (congestive heart failure, angina pectoris, previous myocardial infarction); impaired kidney or liver function; severe uncontrolled hypertension, severe diabetic complications; or had received therapy with insulin, other investigational drugs reduced lipidic catabolism such as oral contraception and corticosteroids within the 6 months. The study protocol was approved by the ethical committee hospitals of each region.

Study design

The study was performed in October 2003, which coincided with the holy month of Ramadan. All participating patients were studied a week before Ramadan, and at the third week of Ramadan fasting. A 10 ml blood sample was withdrawn from 12 h fasting subjects by venipuncture into dry tubes for the pre-fasting period. To respect the 10–12 h fast in the pre-Ramadan period, the blood sampling during Ramadan must be done at 1300 h. Samples were allowed to clot, and the serum centrifuged, divided into aliquots, and stored at -18 °C until analyzed. On both test days, glucose, triglycerides, high-density lipoprotein cholesterol (HDL-c) and low density lipoprotein cholesterol (LDL-c) were measured

from each of 66 blood samples. During Ramadan, the subjects slept uninterruptedly from 0200 h to 0800 h and their average sleep time was thus 1 h shorter during Ramadan than it had been during the control period. Daily working hours in Ramadan are from 0900 h to 1500 h ; but on the a non-fasting day, work starts at 0800 h and finishes at 1700 h.

Measurements.

Anthropometric measurements were performed on subjects in light clothing and without shoes. Height was measured to the nearest 0.5 cm and body weight was measured on a level balance calibrated daily and recorded to the nearest 0.1 kg. Body mass index (BMI) was calculated as weight (kg) divided by height (in m) squared. Blood samples were drawn after at least 12 hours of fasting for determination of serum levels of glucose, Total cholesterol(Tot-c), high-density lipoprotein cholesterol (HDL-c), and triglycerides(TG) by enzymatic methods using Merck reagent kits and Elan 2000 autoanalyser. High density lipoprotein cholesterol (HDL-c) was measured in the supernatant after precipitation of apolipoprotein B-containing lipoproteins with dextran sulfate and magnesium chloride. LDL cholesterol was calculated with the Friedewald formula [$LDL-c = Tot-C - (TG/5 + HDL-c)$] when triglycerides concentrations were <5.0 mmol/L; subjects with triglycerides levels >5.0 mmol/L were excluded[Freedewald.,1972]. Trained interviewers administered a structured questionnaire to collect information about age, medication and the consumed diet.

Statistical methods

Data were analyzed using the StatBox 6 and are expressed as mean and Standard Deviation (SD). Parametric values were compared with one way ANOVA and Student's t test. The level $p < 0.05$ was considered as the cut-off value for significance.

RESULTS AND DISCUSSION

The results of the study have been summarized in (Table 1). A total of sixty-six patients with type 2 diabetes, aged (mean \pm SD, 48.73 \pm 2.22 years) were randomized and received a medical treatment in Biguanides. The Body mass index (BMI), measured one week before fasting and third week of Ramadan fasting did not change significantly (mean values \pm SD = 27.395 \pm 03.546 vs. 27.568 \pm 03.082 Kg/m²). However, Glucose and HDL cholesterol levels were significantly ($p < 0.05$) higher in the serum subjects of fasting (01.983 \pm 00.171 and 00.671 \pm 00.285 [mean \pm SD] g/L) compared to before Ramadan (01.847 \pm 00.200 and 00.557 \pm 00.165 [mean \pm SD] g/L). Moreover, serum total cholesterol, triglyceride, LDL cholesterol and VLDL cholesterol levels decreased remarkably

($p < 0.05$) during the third week of Ramadan than non fasting day (01.836 ± 00.473 , 01.489 ± 00.213 , 00.906 ± 00.374 and 00.298 ± 00.043 vs 02.101 ± 00.473 , 01.769 ± 0.304 , 01.219 ± 00.527 and 00.356 ± 00.060 [mean \pm SD] g/L).

Table (1): Change in Body Mass Index and Serum Glucose and lipid levels

	Pre-Ramadan	Ramadan	P value
	Mean \pm SD		
Body mass index (Kg/m ²)	27.395 \pm 03.082	27.568 \pm 03.546	0.36636
Glucose level (g/l)	01.847 \pm 00.200	01.983 \pm 00.171	0.00002
Total cholesterol level (g/l)	02.101 \pm 00.473	01.836 \pm 00.473	0.00004
Triglyceride level (g/l)	01.769 \pm 0.304	01.489 \pm 00.213	000001
HDL cholesterol level (g/l)	00.557 \pm 00.165	00.671 \pm 00.285	0.0015
LDL cholesterol level (g/l)	01.219 \pm 00.527	00.906 \pm 00.374	0.00003
VLDL cholesterol level (g/l)	00.356 \pm 00.060	00.298 \pm 00.043	0.00001

HDL= high-density lipoprotein; LDL= low-density lipoprotein; VLDL= very-low-density lipoprotein.

During the month of Ramadan fasting, Muslims world wide consume two meals between sunset and dawn, and there is no restriction on the amount or type of food eaten at night [Laajam, 1990 and Salman et al., 1992]. People may alter their sleeping habits and smoking is limited to night time only. Furthermore, most diabetics reduce their daily activities during this period in fear of hypoglycemia [Laajam, 1990 and Ewis and Afifi 1997]. These factors may certainly explain not only a lack of weight loss, but also a weight gain in such patients. It appears through our study that the experimental sick women with non-insulin dependent diabetes mellitus (NIDM, Type 2 Diabetes) do not present a weight loss during the Ramadan fasting, their Body Mass Index (BMI) levels remains relatively high and maintained fairly close than before fasting period. A review of literature shows controversy about BMI changes in diabetics of male sex during Ramadan. In one group of studies, patients had an increase in their BMI [Rashed 1992 and Klocker et al., 1997]. In another group, there were no change [Laajam, 1990 ; Sulimani et al., 1991 ; Ewis and Afifi 1997 and Uysal et al.,

1997] or decrease [**Azizi and Rasouli 1987 ; Mafauzy et al., 1990 ; Athar and Habib ,1994 ; Al- Nakhi et al., 1997 and Khatib , 1997**] in BMI. According to (**El Ati et al., 1995**), the reduction in the insulin concentration during fasting can be an adaptive mechanism with the safeguarding of the standard weight[**El Ati et al., 1995**]. In addition, it is well established that the treatments with the Biguanides are often prescribed to the Type2 diabetes showing an overload of weight [**Ralph and DeFronzo , 1999**].

In most cases, no episode of acute complications (hypoglycemic or hyperglycemic types) occurs in patients under medical treatment with the Biguanides, and only a few cases of biochemical hypoglycemia without clinical hazards have been reported. Our results suggest the possibility that increased blood glucose levels at the third week of Ramadan may be related to increased gluconeogenesis. These results are in line with those of [**Nagra and Gilani, 1991**] who reported a 10 per cent increase in glucose level towards the end of Ramadan in adults males and attributed it to gluconeogenesis. The glycemia levels noted during the fasting undoubtedly results from a hepatic overproduction of glucose following an activation of the gluconeogenesis in order to compensate for the fall of the glycogenolyse [**Meyer et al., 1998**]. Other studies have shown a significant decrease in blood glucose towards the end of the month fasting and explains it by a take of the subjects of meals hypocaloric [**Malhotra et al., 1989**]. The finding are also contrary to those announced by **Muazzam and Khalique [1959] ; Angel and Schwartz [1975] and Iraki et al., [1997]** who found non significant change in blood glucose during this period. These differences may generally be attributed to the amount or type of food consumption, changes in body weight, regularity of taking medications and decreased physical activities during the fast [**Gwinup, et al., 1963 and Kouen, et al., 1987**] . From these studies, one may assume that during fasting days which follow a rather large meal taken before dawn (Sahur), the stores of glycogen, along with some degrees of gluconeogenesis maintain serum glucose within normal limits.

As seen in this study, LDL-cholesterol was lower in the serum of 21 day Ramadan compared to levels before Ramadan. Also, HDL-cholesterol levels were higher in the serum subjects of end Ramadan compared to levels before Ramadan. Our results are in agreement with those reported by **Leak and Rankin (1990) ; Maislos et al., (1993) ; Aldouni et al., (1998) ; Toda and Morimoto (2000) and Temizhan et al., (2000)** in healthy persons . Few studies have reported increases in high density lipoprotein(HDL) cholesterol in diabetics during Ramadan

[Dehgan et al., 1994 ; Khatib , 1997 and Uysal, 1997]. One report indicates an increase in low density lipoprotein(LDL)cholesterol and decrease in HDL-cholesterol [Bougerra, et al., 1997] .These variations certainly result from the differences in the habits food and the composition of the meal consumed by the studied populations. Recent data reported by Iacono and Dougherty, [1991] have shown that ingestion of poly unsaturated fatty acid (PUFA) in fat diet reduces LDL-cholesterol without affecting HDL-cholesterol, when the PUFA percentage is not higher than 11 per cent of total energy intake. It appears that The increase of HDL-c values during the third week of fasting coincides with the reduction of blood VLDL-c levels; the increase in the hydrolysis of hepatic VLDL-c undoubtedly favored the synthesis of the HDL-c at the diabetics [Basdevant, 1994]. The previous data concerning HDL-cholesterol explain clearly the benefic effect of Ramadan fasting on diabetics serum lipids.

Serum total cholesterol and triglyceride levels decreased significantly ($p < 0.05$) towards the end of the study. Most patients with (NIDDM) show no change or slight decrease in concentration of total cholesterol and triglyceride [Dehgan et al., 1994 ; Al-Hader 1994 ; Ewis and Afifi , 1997 and Uysal et al., 1997]. Concerning the healthy subjects it seems that total cholesterol levels increased during Ramadan fasting whilst triglyceride levels were unaffected [Fedail et al., 1982]. In another study have reported increased levels of serum cholesterol or triglycerides levels at the end of Ramadan fasting [Gwinup, 1963 ; Irwin and Feeley , 1967 ; Gumaa et al., 1978 ; Fedail et al., 1982 ; Shokry, 1986 and El-Hazmi et al., 1987]. In all, changes in blood lipids observed seem to be variable and depend probably on the quality and quantity of food consumption and the degree of weight changes. It has been recently shown that consumption of low fat diet induces a decrease of serum cholesterol concentration only when accompanied by body weight loss [Lichtenstein, 1994]. In fact, some studies have suggested a correlation between loss of weight and decrease in total cholesterol levels [Sakr, 1975]. In addition, the increase in the glucose levels during the fasting undoubtedly reduced lipidic catabolism with like resultant a weak triglyceride mobilization of periferic tissues towards plasmatic circulation. These results may be also explained by different food habits at the studied populations and the type of food consumed during Ramadan as there is a tendency towards increased intake of carbohydrate and fat.

CONCLUSIONS

In conclusion, It appears that the holy month of Ramadan fasting was not harmful on the health of diabetic women, on the contrary, it showed a beneficial effect on the evolution of certain studied lipidic parameters such as : HDL-c and LDL-c. It would be extremely interesting to know if the Ramadan fasting affects the atherogenic lipoproteinic particles (LP B, LP B:E, LP B:CIII, etc.), particularly in obese diabetic patients.

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أثر صيام شهر رمضان في اختلاف تركيز الجلوكوز ومستوي الدهون عند

النساء المصابات بداء السكري غير المرتبط بالأنسولين

ايت سعادة . ج ، سلسلات ع.غ ، بلقاسمي ل. ، شقرون ل.

جامعة ابن باديس، مستغانم - الجزائر

أثناء شهر رمضان المعظم يتمتع المسلمون يوميا عن الأكل و الشرب و حتى العلاقات الجنسية من طلوع الشمس حتى المغيب. من بين الأهداف المسطرة من خلال هذا البحث العلمي هو دراسة اثر الصوم في تغيير قيمة الكتلة الجسمية (IMC)، كمية الجلوكوز في الدم و بعض العناصر الليبيدية عند النساء المصابات بداء السكري غير المتعلق بالأنسولين. أجريت التجربة على ستة وستون (٦٦) امرأة أخذت من ثلاثة مناطق متواجدة في الغرب الجزائري. تمت الدراسة على هؤلاء المرضى في الأسبوع الأول قبل شهر رمضان و بعد الأسبوع الثالث من هذا الشهر. أكدت الدراسة الإحصائية عدم تغير لقيم الكتلة الجسمية الوسطى أثناء و قبل شهر رمضان. أما بالنسبة للقيم الوسطى للجلوكوز و HDL كلسترول كانت مرتفعة ارتفاعا ملحوظا ($P<0.05$) أثناء الصوم مقارنة بالمرحلة الأولى، تبين من الارتفاع الأخير ل : HDL كلسترول أن للصوم أثر ايجابي في تطور بعض العناصر الليبيدية الدموية عند هؤلاء المرضى. بالإضافة على ذلك شوهد في المصل انخفاضا ملحوظا ($P<0.05$) لقيم : الكولسترول الإجمالي، ثلاثي الكولسترول، LDL كلسترول و VLDL الكولسترول و هذا في الأسبوع الثالث من شهر رمضان مقارنة عنه بالأيام العادية.

الكلمات المفاتيح : الصوم، شهر رمضان، داء السكري غير المرتبط بالأنسولين.