EFFECTS OF RAMADAN FASTING ON LIPID PEROXIDATION, SERUM LIPOPROTEINS AND FASTING BLOOD SUGAR

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SUMMARY : Fasting (abstaining from all food and drink between sunrise and sunset) in the holy month of Ramadan is one of the religious duties in Islam and most people fulfill this religious duty in our country, Iran. Fasting is a custom in some other religions also, but its length and conditions are different. It seems that the level of some blood components change during this month.

In this study lipid peroxidation was compared before and after one month of fasting by determining malondialdehyde (MDA) and conjugated dienes (CDs), both of which are products of LDL-oxidation. The relationship between fasting and change in serum lipoproteins and fasting blood sugar (FBS) was investigated.

Fifty healthy 30-60 year-old men intending to fast during the holy month of Ramadan were included in the present study. The plasma levels of MDA, CDs; serum levels of triglyceride (TG), cholesterol (Chol), FBS were determined one day before, and final day of the fasting month. MDA and CDs were measured by spectrophotometer, and TG, Chol and FBS enzymatically with ELAN autoanalyzer. The Student's t-test was used to compare pre- and post-Ramadan values.

Results showed that the MDA, TG and Chol levels decreased significantly during Ramadan ($p<0.05$). The levels of FBS decreased too, but this reduction was not significant ($p>0.05$). The level of CDs was increased significantly ($p<0.05$).

Since MDA is significantly decreased during Ramadan, it seems that fasting for a month may have preventive effects on atherosclerosis, considering that LDL-oxidation plays an important role in the production of atherosclerotic plaques.

Key Words: Malondialdehyde, conjugated dienes, Ramadan fasting, blood lipids

INTRODUCTION

Fasting (abstaining from all food and drink between sunrise and sunset) in the month of Ramadan. It is a religious duty in Islam, and is of special importance to Muslims. There is fasting in other religions too, although the number of days a person should fast and other requirements are quite different.

Over the recent years, research has been conducted on the effects of fasting on the human body. The results

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Table 1: Comparison of blood variables ($\bar{X}\pm SD$) before and after 30 days of faasting

Variables	Before fasting Mean ± SD	After fasting Mean ± SD	p*
Total cholesterol (mg/dl)	226.09 ± 34.41	209.59 ± 35.82	<0.0001
Triglyceride (mg/dl)	209.8 ± 71.65	193.00 ± 57.15	0.049
Fasting blood glucose (mg/dl)	92.57 ± 33.73	90.22 ± 22.09	0.42
Malondialdehyde (μm/l)	1.9 ± 0.51	1.73 ± 0.38	0.009
Conjugated dienes (μm/l)	0.43 ± 0.15	0.45 ± 0.15	0.243

*paired t-test

have been somehow contradictory. Adlouni *et al.* (1) showed that fasting caused a significant decrease in the serum total cholesterol, LDL-cholesterol and triglyceride (TG) levels and a distinct increase in the serum HDL-cholesterol during the month of Ramadan. These changes were maintained for a month after Ramadan.

On the other hand, Maislos *et al.* (2) reported no change in the total-cholesterol, LDL-cholesterol, VLDL-cholesterol, although they observed a significant increase in HDL-cholesterol and decrease in the ratios total cholesterol/LDL and LDL/HDL. A study in Isfahan Cardiovascular Research Center, showed a significant reduction in the ratio LDL/HDL, but no change in the total, LDL- and HDL-cholesterol, TG, and fasting blood glucose levels in Isfahani subjects during Ramadan (3). Other investigators have reported either a decrease or an increase in the blood glucose (4-6) and no change in the blood insulin levels (7).

A significant phase in the process of development of atherosclerosis of coronary arteries is oxidation of fatty acids and LDL-cholesterol in the arterial walls. It is the free radicals resulting from the metabolism of smooth muscle cells of the arteries that oxidize the LDL-cholesterol (8). In the process, unsaturated fatty acids in the cell membranes are oxidized into peroxides and the production of strong aldehydes (malondialdehydes) and conjugated dienes (CDs) is increased. Malondialdehyde (MDA) measurement is used as an index to show the extent of lipid peroxidation (9). The objective of the present study was to determine the blood levels of total cholesterol, TG, fasting blood glucose, MDA and CDs in fasting subjects.

MATERIALS AND METHODS

This was a cross-sectional study of fifty subjects chosen from among healthy volunteers between 30-60 years of age. Criteria to healthiness were a normal blood pressure, no history of diabetes, heart disease or any other specific ailment. Blood samples were taken one day before and final day of Ramadan. The samples consisted of a citrated portion to separate plasma and a blood clot to separate serum from. MDA and CDs were measured spectrophotometrically in the plasma and total cholesterol, TG and fasting blood glucose, using ELAN autoanalyzer, in the serum. All measurements were made in the Isfahan Cardiovascular Research Center Laboratories. For quality control, Isfahan Cardiovascular Research Center Laboratory meets the criteria of the central standard laboratory of the Ministry of Health in Iran. Also the samples for blood lipids were sent to the central laboratory, St. Rafael University, Department of Epidemiology, Belgium, under different numbers unknown to the laboratory, and the highly significant correlation between the result from the two laboratories allowed us to use the result for international comparison.

Four subjects had left before the end of the period, therefore the number available for the statistical calculations became 46. The method used was the paired t-test checking the difference between means in each group. Correlations -regressions to determine the relationships among dependent and independent variables ($p<0.05$) were also studied.

RESULTS

As seen in Table 1 by the end of Ramadan the levels of total cholesterol, triglycerides and MDA had decreased significantly ($p<0.05$). The small reduction in the fasting blood glucose and conjugated dienes, however, were not found statistically important. The correlation between the blood components, MDA and CDs before and after Ramadan are shown in Table 2.

Table 2: Correlation among MDA, CDs and some biochemical parameters before and after Ramadan.

Variables	MDA (μm/l)		CDs (μm/l)	
Biochemical Parameters (mg/dl)	Before Ramadan	After Ramadan	Before Ramadan	After Ramadan
Total cholesterol	P= 0.222 r= 0.123	p= 0.161 r= 0.159	p= 0.303 r= - 0.089	p= 0.279 r= 0.101
Triglyceride	p= 0.108 r= 0.197	p= 282 r= 6.093	p= 0.329 r= - 0.077	p= 0.208 r= 0.14
Fasting blood glucose	p= 0.184 r= -0.144	p= 0.311 r= 0.079	p= 0.182 r= - 0.152	p= 0.071 r= - 0.249

p = p value of Pearson correlation

r = correlation coefficient

Correlation of FBS with MDA and CDs was inverse before and after Ramadan, while correlation of cholesterol and TG with MDA and CDs is direct before and after Ramadan but none of them were statistically significant.

DISCUSSION

The findings reported in the literature on the effects of fasting on blood components have not been consistent. Our study showed that FBS decreased slightly (p>0.42). Some workers have observed a small reduction during the first days of fasting, an increase back to the initial levels by the 20th day, and a further decrease to pre-Ramadan values by the 29th day (10). A possible explanation for these findings is a higher consumption of sweet foods and a higher total daily energy intake despite a smaller number of meals. Other studies have reported contradictory results. While Shokry (5) and El-Hazmi *et al.* (6) observed increased FBS levels during Ramadan, Nomani *et al.* (4) found a reduction in FBS. On the other hand, at least in one study the plasma insulin level remained constant in individuals fasting during Ramadan (7). What happens normally is that a few hours post-prandial the body starts utilizing its energy reserves, including liver glycogen. When a person does not eat, first the blood glucose decreases slightly, but afterwards it remains constant due to increased gluconeogenesis and decreased glycolysis in the liver (11). These findings explain, at least to some extent, why blood sugar remains constant during the fasting month of Ramadan.

The findings of the present study also show a statistically significant reduction in total cholesterol (p<0.0001) and a slight decrease in triglycerides (p=0.049). Adlouni *et al.* (1) also reported a significant decrease in total cholesterol and triglycerides in subjects during Ramadan, as well as a significant increase in the level of HDL-cholesterol, the increases lasting for up to one month after Ramadan, LDL-cholesterol decreased. Another study in the Isfahan Cardiovascular Research Center in 1998 revealed a significant decrease in the ratio LDL/HDL during Ramadan but no change in the total, HDL and LDL-cholesterol, triglycerides, or fasting blood sugar (3). Other reports in the literature are also inconsistent.

For example, Maislos *et al.* (2) observed a rise in HDL-cholesterol, a reduction in the ratios total cholesterol/HDL and LDL/HDL, and no change in triglycerides and total, LDL- and VLDL-cholesterol, while Hallak (12) found a decrease in LDL, an increase in HDL, but no change in the total cholesterol.

It is seen that the findings reported in the literature on the effects of Ramadan fasting on blood lipids are inconsistent and, in some cases, even contradictory. Probably variables such as heredity, climate, number of days of fasting, and type of foods consumed come into play. Further research is necessary to clarify these points.

In our study two other variables determined were MDA and CDs-products of lipid oxidation. Ramadan fasting brought about a significant reduction in MDA and non significant change in CDs. The MDA reduction indicates

reduced cholesterol oxidation. Since a significant step in the process of coronary artery atherosclerosis is the oxidation of fatty acids and LDL-cholesterol in the coronary arterial cell walls, it may be concluded that fasting during the month of Ramadan can help in prevention of cardiovascular disease.

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