Effect of Ramadan fasting on serum lipid profiles in normal and hyperlipidemic subjects

Soltanali Mahboob, PhD, Reza Sattarivand, MSc, Mohammad Nouri, PhD, Seidrafie Arefhosseini, MSPH.

ABSTRACT

Objective: This study was undertaken to investigate the effects of Ramadan fasting on lipid profiles in normal and hyperlipidemic subjects.

Methods: Fasting blood samples were obtained from 35 male volunteers aged 19-33 years, half an hour before sunset on the first day as a baseline and the last day of Ramadan. The lipids and lipoprotein contents of the samples were determined and the results obtained were compared using Student's paired t-test.

Results: The results showed a significant decrease in serum total cholesterol, triglyceride and low density lipoprotein-cholesterol level as well as total cholesterol/high density lipoprotein-cholesterol and low density lipoprotein-cholesterol/high density lipoprotein-cholesterol ratios in the hyperlipidemic subjects together with a marked increase in high density lipoprotein-cholesterol levels (P<0.05). However, in the normal subjects, only low density lipoprotein-cholesterol levels and total cholesterol/high density lipoprotein-cholesterol ratios were found to decrease significantly during Ramadan fasting (P<0.05). In the group who had decreased their mean daily energy intake more than 500 kcal/day during Ramadan fasting, there was a significant decrease in the serum triglyceride and low density lipoprotein-cholesterol levels as well as total cholesterol/high density lipoprotein-cholesterol and low density lipoprotein-cholesterol/high density lipoprotein-cholesterol ratios. Whereas in the other group, only low density lipoprotein-cholesterol levels with low density lipoprotein-cholesterol/high density lipoprotein-cholesterol ratio were decreased.

Conclusion: The results obtained indicate positive effects of Ramadan fasting on blood lipid profiles, especially in hyperlipidemic subjects and in subjects in whom the reduction of mean daily energy intake was more than 500 kcal/day.

Keywords: Fasting, lipid profiles, hyperlipidemia.


Although there are some reports concerning the effects of Ramadan fasting on blood lipid levels, the results published are often insufficient and contradictory. Gumaa et al. reported an increase in triglyceride (TG), total lipid and keton body levels with a decrease in the level of total cholesterol (TC). According to Fedail et al., cholesterol level increased during Ramadan fasting, however, the TG level is not affected. El-Hazmi et al. demonstrated that TG and TC levels decrease after the first week of Ramadan, followed by an increase at the end of this month. The results reported by Soulaïman et al. showed no change in the TG/TC and low density lipoprotein-cholesterol (LDL-C)/high density lipoprotein-cholesterol (HDL-C) ratios, whereas Maislos et al. demonstrated a significant increase in HDL-C level with no change in TC/HDL-C and LDL-C/HDL-C ratios. Shoukry also reported an increase in the lipid levels with no change in the HDL-C concentrations. Many factors such as sex, age, obesity, smoking...
and dietary pattern could affect blood lipids, so it is advised that in studies dealing with the effect of fasting on lipid profiles, these factors should be taken into account. Therefore, the present study was conducted to evaluate the effects of Ramadan fasting on lipid profiles in the subjects matched in the above factors.

Methods. The subjects of this study were 35 male volunteers with a mean age of 25 years (ranging from 19 to 33). They were non-smokers and none of them were taking any medication known to affect the lipid metabolism. All subjects undertook ordinary activities during Ramadan. At the time of the study, the period of Ramadan was from February 5th to March 4th. The blood samples were taken on the first and the last day of Ramadan, half an hour before sunset and eating the main evening meals (an average fast of 12 hours). The first day samples were used as the baseline values, and each subject served as his own control. The dietary data was collected 9 times: in the first 3 days, on the days of 13th to 15th and in the last 3 days of Ramadan. Serum TG and TC were measured by Hitachi-704 Autoanalyzer. HDL-C and LDL-C concentrations were spectrophotometrically analyzed by the standard enzymatic method using Randox kits. According to baseline serum lipid levels, the subjects were divided into 2 groups of normal and hyperlipidemic. The data was analyzed using SPSS software and comparison between the means was made using the Student's paired t-test. The p<0.05 was considered as significant.

Results. The results obtained indicated a significant decrease in the total daily energy intake during Ramadan fasting (2295 kcal at the end of Ramadan compared with 2930 kcal at the beginning). There was also a significant decrease in the body weight from 67.55 kg to 66.36 kg during the fasting period. The mean values of serum lipids are presented in Table 1. In the hyperlipidemic groups, a significant decrease in TG, TC and LDL-C levels was observed with a marked increase in HDL-C level. In both groups, the TC/HDL-C ratio was decreased significantly, however, the extent of reduction in hyperlipidemic subjects was 5.7 fold more than that found in the normal subject group. In order to evaluate the effect of energy intake on lipid profiles, the individual mean energy intake (IMEI) changes were calculated as the difference between IMEI values obtained for each subject at the beginning and at the end of the study. Accordingly, the subjects were classified into 2 groups: those subjects whose IMEI values were ≥500 kcal (group 1), and those whose IMEI values were <500 kcal (group 2). The results obtained are shown in Table 2. In group 1, Ramadan fasting was associated with a

<table>
<thead>
<tr>
<th>Biochemical parameters</th>
<th>Normal subjects</th>
<th>Hyperlipidemic subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>End of Ramadan</td>
</tr>
<tr>
<td>Triglyceride (mg/dl)</td>
<td>83.50±30.64</td>
<td>76.54±17.59</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>173.05±15.89</td>
<td>172.10±25.37</td>
</tr>
<tr>
<td>HDL-cholesterol (mg/dl)</td>
<td>49.53±7.48</td>
<td>51.35±11.71</td>
</tr>
<tr>
<td>LDL-cholesterol (mg/dl)</td>
<td>106.53±13.18</td>
<td>92.97±30.32*</td>
</tr>
<tr>
<td>TC/HDL-C</td>
<td>4.21±0.79</td>
<td>3.87±0.93*</td>
</tr>
</tbody>
</table>

* Differences between baseline and end of Ramadan are statistically significant. (p<0.05)

<table>
<thead>
<tr>
<th>Biochemical parameters</th>
<th>Group with mean daily energy reduction ≥ 500 kcal</th>
<th>Group with mean daily energy reduction &lt; 500 kcal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>End of Ramadan</td>
</tr>
<tr>
<td>Triglyceride (mg/dl)</td>
<td>119.13±69.31</td>
<td>91.39±43.51*</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>197.13±36.4</td>
<td>186.00±35.17</td>
</tr>
<tr>
<td>HDL-cholesterol (mg/dl)</td>
<td>41.35±9.19</td>
<td>49.39±12.42*</td>
</tr>
<tr>
<td>LDL-cholesterol (mg/dl)</td>
<td>129.87±35.31</td>
<td>114.09±37.08*</td>
</tr>
<tr>
<td>TC/HDL-C</td>
<td>4.97±1.34</td>
<td>3.95±1.08*</td>
</tr>
<tr>
<td>LDL-C/HDL-C</td>
<td>3.28±1.03</td>
<td>2.46±1.01*</td>
</tr>
</tbody>
</table>

* Differences between baseline and end of Ramadan are statistically significant. (p<0.05)
significant decrease in the levels of TG, LDL-C, and LDL-C/HDL-C, TC/HDL-C ratios with a marked increase in the HDL-C level. However, in group 2, only the LDL-C level and LDL-C/HDL-C ratio were significantly decreased (Table 2).

Discussion. In the present study there was a significant decrease in the daily energy intake due to the reduction in food intake. This could be the reason for the reduction observed in body weight during Ramadan fasting. These results are in agreement with those of many other investigators.7-10 According to the results reported by Dattilo et al11 following analysis of 70 studies, the loss of body weight is associated with a reduced concentration of lipids in the population studies. These findings have also been observed during Ramadan fasting. Adlounie et al12 reported a fall in serum TC and TG levels which was associated with a loss of body weight. According to Dattilo et al11 and Dennis,19 the body weight reduction is accompanied with a decrease in TC, TG, LDL-C and VLDL-C levels. The decrease in serum TG has been attributed to its use as a source of energy during Ramadan fasting.14-17 This may be due in part to the various dietary habits in the different Islamic countries. For instance, a decrease of daily energy intake during Ramadan has been reported in Indian Muslims15 however, in Saudi Arabian16 and Moroccan populations11 there is an increase in daily energy intake during Ramadan fasting. In Tunisian subjects, no change in the total energy intake has been reported.17

In the present study, a marked increase was found in serum HDL-C concentration which is in agreement with data reported by other investigators.11,18 Adlounie et al12 indicated an increase in HDL-C levels associated with a decrease in both TC/HDL-C and LDL-C/HDL-C ratios which could be as a result of body weight loss, or the change in the meal frequency. Recently, Maislos et al18 also found a marked increase in HDL-C levels during Ramadan fasting with no significant change in the levels of TG, TC, LDL-C, VLDL-C and lipoprotein (a) levels. These findings have been attributed to inductive effects of eating one large evening meal a day on lipid profiles. There is also some evidence indicating that body weight loss is associated with an increase in lipoprotein lipase activity, which may increase the hydrolysis of VLDL-C and transfer of lipid to HDL-C.11 Lipid profiles are also affected by other factors including, age, sex and smoking. Using meta analyses, Dattilo et al11 reported that during weight loss, the reduction in the LDL-C levels in the younger subjects is 4 times as much as in the older subjects. It has been shown also, that during weight loss, an increase in HDL-C and decrease in TG levels in males is more significant than in females.31 Serum HDL-C concentrations have been reported to be lower in cigarette smokers than in non-smokers,19-21 This increase in HDL-C concentration during weight reduction is attenuated with smoking. Therefore, it is necessary to pay attention to the effects of these factors on lipid profiles in any Ramadan fasting study. The lack of enough attention to these matters could be the reason for some controversy observed in some published results. Accordingly, all subjects used in the present study, were young and nonsmoking males, and the results obtained were in agreement with the effects of these parameters on the lipid variation.

In conclusion, the results indicate the beneficial effect of Ramadan fasting on lipid profiles especially in the hyperlipidemic subjects, and when there is more than a 500 Kcal/day reduction in the individual mean energy intake during the period of fasting.

References