

Effects of low fat and low calorie diet on plasma lipid levels in the fasting month of Ramadan

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ABSTRACT

Objectives: In Ramadan, which is one month of the Hijra year, Muslims change their eating habits from 3 times to 2 times daily. The aim of this study was to evaluate the effects of fasting with low fat and low calorie diet on anthropometric parameters and plasma lipid profiles in hyperlipidemic men during the month of Ramadan.

Methods: This study was carried out at the Madani Heart Hospital, Tabriz University of Medical Sciences, Tabriz, Iran during the year of 1997. Twenty-eight hyperlipidemic healthy men in a fasting group and 10 healthy men with top normal lipid levels in a non-fasting group were voluntarily enrolled for study. They were encouraged to use low fat and low calorie diet. The study started 20 days before and lasted one month after Ramadan. Laboratory tests including plasma total cholesterol, cholesterol-low density lipoprotein, cholesterol-high density lipoprotein and triglyceride were measured 4

times; 20 days before Ramadan, first day of Ramadan, on the last day of Ramadan and 30 days after Ramadan.

Results: Data analysis in fasting group revealed a significant reduction in energy intake and nutrient materials during Ramadan month ($P<0.05$) and plasma total cholesterol, cholesterol-low density lipoprotein and triglyceride levels decreasing towards the end of Ramadan ($P<0.01$). In the non-fasting group, there were no significant changes in the above-mentioned parameters.

Conclusion: It seems that Islamic fasting in Ramadan with low fat and low calorie diet leads to plasma lipids reduction in hyperlipidemic men.

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Ramadan fasting is one of the pillars of Islam. During Ramadan, Muslims abstain taking food and liquids from dawn to sunset. Limitation of food intake during Ramadan could lead to reduce energy intake. Reports are available which showed the effect of Ramadan fasting on various metabolic factors¹⁻⁵ however, few of the studies⁶⁻⁸ showed conflicting results. Different results have been reported on the effect of dietary fat on changes in blood cholesterol levels^{9,10} Nomani¹¹ suggested there is an increase in blood cholesterol levels with either increasing or decreasing levels of energy

intake in relation to the requirement. Since hyperlipidemia has been considered a risk factor for developing cardiovascular diseases, thus, this study was designed for investigation of Ramadan fasting with low fat and low calorie diet on plasma lipid profile levels in hyperlipidemic men.

Methods. This study has been conducted on 38 healthy men volunteers in the Ramadan month corresponding to the winter of 1997 at Madani Heart

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Hospital, Tabriz University of Medical Sciences, Tabriz, Iran. To eliminate the deteriorating effects which may alter the study, persons on medication to control their blood lipid levels or on any medicines which influence the metabolism of lipid factors and those who smoked more than 5 cigarettes each day were excluded from this study. Hyperlipidemia was defined as an increase in the measures of one or more of the following factors. triglyceride (TG) more than 160, total cholesterol (TC) more than 200, cholesterol-high density lipoprotein (C-HDL) less than 35, cholesterol-low density lipoprotein (C-LDL) more than 130 milligram in deciliter and TC/HDL proportion more than 6.¹² The cases voluntarily were divided in 2 groups: the fasting included 28 hyperlipidemic healthy men and the non fasting group was comprised of 10 healthy men with top normal blood lipid levels. To coordinate meal basket, persons in both groups were trained and encouraged to use low fat (20-25% fat) and low calorie (decreasing up to 500 kcal/day) regimen. The aerobic exercises were also included to be carried out 3 times a week, each time 45-60 minutes. The members of both groups were encouraged to use 3 times diet before and after the holy month. In Ramadan month, the fasting group was encouraged to reduce one term of their normal meal taking calorie. During the study, the blood samples of fasting group were taken in the evening time and non-fasting in the morning after 12-14 hours of abstention of any foods or liquids. Before and after Ramadan, the members of group one, were asked to abstain any food and drinking (religious percept fasting) in the sampling day. First, in order to have a basic data, the first phase of the anthropometric measures and blood samples were taken to measure TC, C-LDL, C-HDL and TG. The next times of measurement and blood sampling were the first and the end days of Ramadan and 30 days after that. During the study, for nutritional assessment in terms of observing the assigned meal diet, in unsuccessive days in 12 times, 24 hours nutrition recalls were collected. Auto analyzer apparatus COBAS (Switzerland) using Pars Azemon enzyme kits measured lipid profiles. Cholesterol HDL level was measured after the sediment of another lipoprotein. The body weight and height of persons were measured with China made apparatus Smic with tolerance of 0.1 kg for the body weight and 0.1 cm for the height and for calculation of body mass index the weight and height formula (wt/ht^2) was used. Twenty-four hours nutrition recalls were analyzed through the use of the computer package nutrition III. Some Iranian meal stuff, not being included in the above program, was included with regard to Iranian table of meal stuff composition. Analysis of data was performed by the use of Statistical Package for Social Sciences version 11. The statistic method of repeated measures factorial analysis of variance was used to compare the different phases in each group and the differences between the means in fasting and non fasting groups and independent and repeated t-test to compare the mean of variables before and the beginning Ramadan.

Results. This study was carried out on 38 healthy men in the age group 27-62 (42 ± 10) years from different walks of life. The mean age in the fasting group was 40 ± 8 and in the non fasting group 48 ± 13 . The time of fasting was 12 hours period approximately from 5.30 am-6 pm. The findings in both groups were collected in 2 categories: 1. Received energy and nutrient material 2. Serum lipid levels and anthropometric measures in 3 phases before, during and one month after Ramadan. In both groups, comparing the means of most values before Ramadan showed there was no significant differences in serum TC, C-LDL, C-HDL and the mean of receiving energy and nutrient materials relative to body mass between 2 groups. (**Table 1**) The members of both groups used 3 times low fat and low calorie diet before and after the holy month and in Ramadan the fasting group reduced one term of their meal taking calorie, while the non-fasting group used a diet 3 times a day. As it is shown in **Table 2**, in the non-fasting group no changes were significantly observed in terms of the received energy and nutrient materials during the study while, in the fasting group the reduction in received energy during the holy month and an increase after this month was significant ($p < 0.01$). In fasting group, the reduction in the received nutrient material during the holy month in comparison with before Ramadan period showed a coordinated reduction in macronutrients amounts (fat, carbohydrate and proteins). Moreover, in terms of the proportion of received materials, comparison between the fasting and non-fasting group members showed statistically no significant changes before, during and after the holy month. **Table 3** indicates the serum lipid levels and anthropometric measures in fasting and non-fasting groups. As it is shown, during the period before the month of Ramadan, while the members of both groups were encouraged to use low fat and low-calorie diet, only serum TG level in fasting group decreased ($p < 0.05$) and other parameters showed no significant changes. At the end of the holy month, in fasting group serum TG, TC, C-LDL levels, proportions of LDL/HDL and TC/HDL significantly decreased in comparison to the beginning of month ($p < 0.01$), but in non-fasting group no changes were detected. One month after Ramadan, the serum lipid levels in the fasting group maintained the same levels as observed at the end of holy month. In non-fasting group, the measured levels in all phases of sampling showed no significant differences. Regarding anthropometric parameters in fasting group, there is significant reduction in body weight and body mass index at the end of the Ramadan.

During the different phases of this study (before Ramadan, at the beginning of Ramadan, the end of Ramadan and after Ramadan) there was significant changes in the mean of TC, C-LDL, TG between the 2 groups and phases ($p < 0.01$). In fact, comparison of the means in 4 phases of study showed interaction effects of fasting during Ramadan (Interaction effects of stage and groups). There is a significant difference between the

Table 1 - The mean and SE levels of serum lipids and anthropometric measures before Ramadan in fasting (1) and non fasting (2) groups.

Group	Pre Ramadan stage			t-test for equality of means			
	n	Mean	Standard error	T	df	P	
Body weight	1	28	81.8	1.95	2.07	36	0.046
	2	10	74.2	2.10			
BMI	1	28	28.33	0.64	2.305	36	0.027
	2	10	25.56	0.78			
TG	1	28	246.68	23.69	1.71	36	0.096
	2	10	171.6	22.33			
Total cholesterol	1	28	211.9	4.23	1.39	36	0.172
	2	10	201.5	3.58			
Cholesterol HDL	1	28	37.53	1.71	-1.187	36	0.243
	2	10	41.1	1.90			
Cholesterol LDL	1	28	136.9	2.53	1.91	36	0.064
	2	10	127.5	4.10			
Calorie	1	28	2367	109.74	1.59	36	0.119
	2	10	2034	162.67			
Protein (g)	1	28	73.9	3.38	0.29	36	0.773
	2	10	71.9	5.82			
Carbohydrate (g)	1	28	384.6	22.35	0.68	36	0.401
	2	10	356.4	29.14			
Fat (g)	1	28	59	4.31	1.69	36	0.099
	2	10	45.4	5.92			
Protein (%)	1	28	12.9	0.53	-1.18	36	0.243
	2	10	14.2	1.12			
Carbohydrate (%)	1	28	64.5	1.40	-0.849	36	0.499
	2	10	66.6	1.44			
Fat (%)	1	28	22.7	1.29	1.50	36	0.141
	2	10	19.2	1.37			
Diet Cholesterol (mg)	1	28	177.9	34.03	0.14	36	0.885
	2	10	168.6	46.08			
Diet Fiber (g)	1	28	20.2	1.30	0.48	36	0.632
	2	10	18.9	2.45			
P/S	1	28	1.55	0.17	1.20	36	0.238
	2	10	1.17	0.24			
P/M	1	28	1.18	0.14	-0.57	36	0.568
	2	10	1.35	0.29			

BMI - body mass index, TG - triglyceride, HDL - high density lipoprotein, LDL - low density lipoprotein, T - t-student test, df - degrees of freedom, P - level of significant analysis, P/S - ratio of polyunsaturated fatty acid to saturated fatty acid, P/M - ratio of polyunsaturated fatty acid to monounsaturated fatty acid

Table 2 - The mean and SE of received energy, nutrient materials during the holy month of Ramadan in comparison to before and after Ramadan.

Variables	Fasting group (case)			Non-fasting group (control)			Within subject effects		
	Before	During	After	Before	During	After	F	df	P
Calorie	2367 ± 109.74*	1745 ± 62.85*	2146 ± 80.2*	2034 ± 162.7	1966 ± 135.6	1861 ± 132.1	4.79	2	0.011
Carbohydrate (g)	384.6 ± 22.35	284.75 ± 10.41	352.30 ± 12.02*	356.4 ± 30.57	311.90 ± 22.71	314.32 ± 21.14	1.805	2	0.172
Fat (g)	59 ± 4.31*	43.82 ± 3.36*	54.34 ± 4.25*	45.37 ± 5.92	50.4 ± 5.18	50.65 ± 4.62	3.748	2	0.028
Protein (g)	73.86 ± 3.42*	61.71 ± 2.9b	71.16 ± 3.15*	71.94 ± 5.82	71.44 ± 4.32	73.67 ± 5.39	1.024	2	0.364
Carbohydrate %	64.46 ± 1.40	64.29 ± 1.24	64.90 ± 1.21	66.60 ± 1.41	64.50 ± 2.64	62.40 ± 2.44	1.418	2	0.249
Fat (%)	22.68 ± 1.29	22.07 ± 1.22	20.96 ± 1.29	19.20 ± 1.37	22.90 ± 1.31	22.80 ± 1.96	2.272	2	0.11
Protein (%)	12.90 ± 0.53	13.71 ± 0.38	12.75 ± 0.56	14.20 ± 1.12	14.40 ± 0.6	14.80 ± 1.02	0.553	2	0.578
Diet cholesterol (mg)	177.91 ± 34.02	128.85 ± 12.28	160.03 ± 16.85	168.64 ± 46.08	174.55 ± 21.67	155.92 ± 17.53	0.677	2	0.511
Fiber (g)	20.2 ± 1.29	28.46 ± 7.92	19.53 ± 1.01	18.94 ± 2.45	18.26 ± 1.55	21.23 ± 2.55	0.636	2	0.532
P/S	1.55 ± 0.16	1.36 ± 0.10	1.34 ± 0.10	1.17 ± 0.23	1.45 ± 0.16	1.42 ± 0.26	1.593	2	0.211
P/M	1.18 ± 0.13	1.07 ± 0.11	1.19 ± 0.11	1.35 ± 0.29	1.35 ± 0.24	1.42 ± 0.26	0.029	2	0.972

*significant in each line, F - analysis of variance, df - degrees of freedom, P - level of significant analysis, P/S - ratio of polyunsaturated fatty acid to saturate fatty acid P/M - ratio of polyunsaturated fatty acid to monounsaturated fatty acid

Table 3 - The mean and SE of serum lipids and anthropometric measures during the study.

Variables	Fasting group (case)				Non-fasting group (control)				Within subject effects		
	20 days before	First Ramadan	End Ramadan	One month after	20 days before	First Ramadan	End Ramadan	One month after	F	df	P
TG mg/dl	246.7 ± 23.7*	211.2 ± 20.7*	157.5 ± 17.01*	159.1 ± 17.4*	171.6 ± 22.3	158.7 ± 26.3	143 ± 19.5	161.7 ± 37.8	2.74	3	0.047
TC	211.9 ± 4.2a	207.5 ± 2.2*	191.4 ± 3.1*	193.2 ± 3.4*	201.5 ± 3.6	201.3 ± 4.1	203 ± 6.2	197.6 ± 6.9	3.53	3	0.017
Cholesterol HDL	37.5 ± 1.70*	38.5 ± 1.1*	40.6 ± 1.82*	41.1 ± 1.1*	41.2 ± 1.9	41 ± 1.6	43.7 ± 2.2	41.1 ± 2.4	0.92	3	0.436
Cholesterol LDL	136.9 ± 2.5*	138.7 ± 2.1*	123.9 ± 3.2*	124.4 ± 2.5*	127.5 ± 4.1	132 ± 5.3	129.8 ± 5.9	127 ± 5.4	2.94	3	0.036
TC/HDL	7.1 ± 1.4*	5.51 ± 0.2*	4.85 ± 0.2*	4.85 ± 0.2*	5.2 ± 0.3	5.03 ± 0.3	4.83 ± 0.4	5.04 ± 0.5	0.97	2	0.33
LDL/HDL	4.6 ± 0.2*	3.7 ± 0.1*	3.14 ± 0.2*	3.12 ± 0.2*	3.2 ± 0.2	3.32 ± 0.3	3.11 ± 0.3	3.3 ± 0.3	1.03	3	0.31
Body weight (kg)	81.8 ± 1.95	81.4 ± 1.98*	79.9 ± 1.98*	80.6 ± 2.01*	74.2 ± 3.0	74.3 ± 3.0	74.1 ± 3.0	74.5 ± 3.0	6.34	3	0.001
BMI (kg/m ²)	28.3 ± 0.6	28.2 ± 0.7*	27.6 ± 0.6*	27.9 ± 0.6*	25.6 ± 0.9	25.6 ± 0.8	25.5 ± 0.84	25.7 ± 0.8	5.7	3	0.02

*significant in each line, BMI - body mass index,
 TG - triglyceride, TC - total cholesterol, HDL - high density lipoprotein, LDL - low density lipoprotein, F - analysis of variance, df - degrees of freedom
 P - level of significant analysis

fasting and the non fasting group concerning body mass loss in the fasting group ($p < 0.05$). Also, there is direct correlation between blood lipid changes and weight loss in fasting group but this finding is not seen in the non fasting group. Actually, this study showed body mass loss could leads to favorable decrease in blood lipids in the fasting group.

Discussion. In some of the religions, fasting is performed in different forms. In Islam, the fasting period is one lunar month. During this month, muslims fast and do not eat or drink anything from dawn to sunset. As a result of shorter lunar month than calendar month, lunar year is 10 days shorter than calendar year. For this reason, Ramadan month moves in all seasons. If it was corresponding to summer season, the fasting people should abstain food and drinking in long days, in contrast, to winter season in which, the fasting time is short. This study has been conducted in Ramadan month corresponding to winter season of year 1997. Serum TG level decreased in both groups at the beginning of Ramadan in comparison to 20 days before month but in hyperlipidemic fasting group was significant ($p < 0.01$). During those days, the members of the both groups were encouraged to use low fat and low calorie diets. It seems that observing assigned regimen and probably the decrease in the received calorie, and performing aerobic exercise has lead to a reduction in serum TG level. It is compatible with different studies concerning to the effect of limited energy consumption on decreasing plasma TG level.^{7,13,14} By the end of the holy month, serum TG, TC, C-LDL levels and the proportion of LDL/HDL in the hyperlipidemic fasting group decreased and the reduction was maintained one month after Ramadan. During Ramadan, the previous 3 times low fat diet in the fasting group reduced to 2 times and also the consumed energy decreased on an average 600 Kcal during a 24 hours period. In the non-fasting group who followed the 3 times low fat meal with no decrease in calorie, no

changes were recorded in the referred parameters. This finding suggests that Islamic fasting with low fat diet and the reduction of one term calorie of the meal habit can play a major role in reducing the blood lipids level in hyperlipidemic men. There are conflicting results regarding the effect of holy month fasting on serum lipid levels. Hallak and Nomani⁷ reported in fasting men by hypocaloric diets, either high carbohydrate or high fat, by the end of the Ramadan, body weight, blood TG and C-HDL significantly decreased, C-LDL increased and TC had not changed compared with the beginning of month. Aldouni et al⁸ also reported despite the increase in the level of consumed calorie in Ramadan, the body weight, TC, TG and C-LDL decreased at the end of the holy month. The reduction of both serum TG and TC was maintained one month after Ramadan. Aldouni et al⁸ proposed the decrease in the level of plasma lipids is due to the changes in the feeding behavior during holy month. Nomani¹¹ confirmed an increase in blood cholesterol levels with either increasing or decreasing level of energy intake was in relation to the requirement.

The present data indicates that the diet pattern used by our subjects continued after Ramadan. The fat diet was high in polyunsaturated fatty acid in contrast to saturated fatty acid and was declined to approximately 22% of energy intake. After Ramadan total energy intake increased but as compared with the pre fasting period, total energy level is restricted. The reduction of mean body weight one month after Ramadan in comparing with the first day of holy month could be contributed to a reduction in energy intake and increase in physical activity after Ramadan. Concerning to the short term of the fasting days (some 12-13 hours) and the occurrence of fasting in the winter season during this study, the fasting persons likely had not changed their daily feeding habits after Ramadan. These finding suggest that continuing feeding behavior and aerobic exercise could lead to maintain lipid profile levels and to increase C-HDL level one month after Ramadan. Most of the mentioned studies were performed in the normal lipid

persons with different diet regimen, but our study focused on hyperlipidemic persons with low fat and low calorie regimen.

These findings suggest that Islamic fasting with low fat (20-25%) and low calorie diet (at least reduction of one term of meal calorie) leads to decrease plasma lipid and lipoproteins levels and this reduction is maintained one month after Ramadan. Since there are different opinions concerning the effects of fasting on blood lipid levels, we cannot consider which of the following parameters, for example low fat, low calorie or Ramadan fasting had more effect on reducing serum lipid levels. It seems necessary to perform other study in hyperlipidemic persons in holy month with or without limitation in fat and energy consumption for finding which of the mentioned parameters has more effect on reducing plasma lipid levels and such study is on the way.

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