

Effects of Ramadan fasting on serum lipid profile

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ABSTRACT

Introduction: Ramadan is the ninth month in the lunar Islamic calendar and lasts for about 29–30 days. It is mandatory for all adult individuals of the Islamic faith to fast during the holy month of Ramadan. During this period, healthy Muslims do not eat or drink (i.e., total abstinence from food and fluids) and refrain from tobacco, daily from pre-dawn until dusk (21). Very few studies in the recent years have been conducted on this subject and for primary care physicians, it is of great help in understanding the physiological changes that occur in various populations with different rituals in Muslims. **Materials and Methods:** The present study included healthy adult male Muslim volunteers from different mosques in and around Jammu city. The number of subjects in the study was 100. Blood samples from all 100 subjects were collected twice during the study—once in the week prior to the beginning of Ramadan and then again in the last week of Ramadan (from 98 subjects as 2 subjects opted out). Following biochemical parameters were taken into consideration: (a) Serum total cholesterol (b) Serum triglycerides (c) Serum HDL cholesterol. **Results:** It was observed that compared to pre-fasting levels, total cholesterol (TC) and triglycerides (TG) were significantly decreased ($P = 0.000$) and high-density lipoprotein cholesterol (HDL-C) level had significantly increased ($P = 0.000$). **Conclusion:** This study showed a reduction in total cholesterol and triglycerides along with a rise in levels of HDL-C, which had beneficial effects on lipid profile post Ramadan fasting period.

Keywords: Fasting, lipids, Ramadan

Introduction

Fasting provides a moment of respite to the person, wherein different organs can recover, a reason that can prop-up this practise in the case of certain illnesses of metabolic nature. Moreover, we acknowledge its benefits in purifying the body from toxins and functions that were disturbed by overeating, malnutrition or a bad intake of nutrients. Furthermore, it is an efficient way of preventing certain diseases and assures a better hormonal balance.^[1]

Although free eating is allowed from sunset to dawn, traditionally two main meals are consumed daily, one before dawn and one

just after sunset. The first meal of the day is usually consumed between 04:30 and 05:30 hours before the commencement of the day's fast (i.e. *Sabur* meal), and the second meal at the break of fast at around 19:00 hours (i.e. *Iftar* meal). Research suggests that there are major health benefits of caloric restriction which include reduced risk of cancer, cardiovascular diseases, diabetes, insulin resistance, immune disorders, and more generally, the slowing of the aging process and the potential to increase maximum life span. According to the US National Academy of Sciences, other health benefits include stress resistance, increased insulin sensitivity, reduced morbidity and increased life span. The physiological effects of fasting include lowering of blood sugar, lowering of cholesterol and lowering of systolic blood pressure. In fact, *Ramadan* fasting would be an ideal recommendation for treatment of mild to moderate, stable non-insulin dependent diabetes, obesity and essential hypertension in Muslims.^[2] Consent was taken from all participants. Approval from ethical committee taken on 24/07/19.

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Aim

To study the effects of *Ramadan* fasting on serum lipid profile in healthy volunteers.

Methods

For this study, healthy adult male Muslim volunteers were taken from different mosques in and around Jammu city. The number of subjects in the study was 100. Consent was taken from all participants.

Obese subjects with BMI more than 30 and smokers were excluded from the study. Subjects with a known history of dyslipidemia, hypertension and diabetes mellitus were also excluded from the study.

All the eligible subjects were interviewed by the investigators regarding their age, marital status, personal habits, relevant recent or past medical history, smoking and dietary habits. The purpose and procedure of tests were explained to them. At the end of the study period, two subjects dropped out because of personal reasons.

Fasting blood samples from all subjects were collected twice during our study once in the week prior to the beginning of *Ramadan* (100 subjects) and then again in the last week of *Ramadan* (98 subjects). The first set of blood samples from 100 subjects were taken in the week before the start of *Ramadan* month after overnight fasting while the second set of blood sample from 98 subjects was collected after whole day fasting (i.e. in the evening) in the last week of *Ramadan*. This was done keeping in view the religious concerns associated with the *Ramadan* fasting. All the biochemical parameters were measured using standard biochemical procedures described as follows:

- Serum total cholesterol** estimation was done by fully enzymatic cholesterol oxidaseperoxidase method (CHODPOD).^[3]
- Serum triglycerides** estimation was done by fully enzymatic glycerol phosphate oxidase-peroxidase method (GPO-POD).^[4]
- Serum high-density lipoprotein (HDL) cholesterol** estimation was done by autozyme precipitation reagent method in conjunction with autozyme cholesterol reagent.^[5]

Lipid profile values were assessed according to the National Cholesterol Education Programme of USA^[6] which classifies total cholesterol as desirable (<200 mg/dL), borderline high risk (200–239 mg/dL) and high risk (\geq 240 mg/dL); triglycerides as desirable (<200 mg/dL), borderline (200–400 mg/dL), high (400 to 1000 mg/dL) and extremely high (>1000 mg/dL) and HDL cholesterol as low (<35 mg/dL), normal (35–59 mg/dL) and high (>60 mg/dL).

Statistical analysis

Data was compiled using computer software MS Excel for Windows. Statistically significant differences among quantitative

variables were evaluated using paired *t*-test by using SPSS software ver. 20. A *P* value of less than 0.05 was considered statistically significant.

Result

The present study was conducted on healthy male subjects from Jammu city to observe the effect of *Ramadan* fasting on cardiovascular and biochemical parameters. About 100 volunteers were taken from different mosques and the following results were observed. Age of the subjects ranged from 20 to 74 years. Majority of the subjects belonged to the age group of 20–35 years [Table 1]. The change in total serum cholesterol is apparent in comparing pre- and post-*Ramadan* values [Table 2]. There is a significant decrease after fasting. Mean value of total cholesterol before fasting was 160.05 ± 32.12 mg%. It decreased to 129.32 ± 31.50 after fasting. Fasting subjects had a high overall mean value of high-density lipoprotein-cholesterol after 1 month of fasting (44.00 ± 5.74 mg%) as compared to the mean value before fasting (39.70 ± 5.63 mg%) [Table 3]. Serum triglycerides recorded in our study group ranged between 69 mg% to 268 mg% before *Ramadan* [Table 4]. At the end of the fasting, a marked decrease in these values was observed. Before fasting, the mean serum triglyceride levels were 168.47 ± 50.08 mg% which declined to 127.97 ± 38.70 mg%. Thus, following results were interpreted:

- Total cholesterol levels decreased considerably after 1 month of *Ramadan* fasting. The findings were statistically highly significant with a *P* value of 0.000.
- HDL cholesterol showed an increase in levels after *Ramadan* fasting. The values obtained were statistically highly significant (*P* = 0.000).
- Triglycerides levels decreased after 1 month of fasting. Statistically, the decrease was highly significant with *P* = 0.000.

Discussion

During our study period, the average length of fast was about 10.5 to 11 hours daily. In Islamic fasting, there is no malnutrition or inadequate calorie intake. The only difference between *Ramadan* fasting and total fasting is the timing of food. During *Ramadan*, those who observe fast miss a lunch, take early breakfast and do not eat until sunset. In other words, *Ramadan* fasting is a controlled, partial type of fast.

Ramadan fasting has spiritual, physical, psychological and social benefits; however, man-made problems may occur if fasting is not properly practised. Firstly, there is no need to consume

Table 1: Age distribution of subjects (n=100)

Age group (in years)	Subjects No. (%)
20-35	56 (56.00)
36-50	28 (28.00)
51-74	16 (16.00)
Total	100 (100.00)

Table 2: Comparison of mean total cholesterol (mg%) of subjects before (n=100) and after (n=98) fasting

Parameter	Before fasting (n=100) Mean±SD	After fasting (n=98) Mean±SD	Statistical Analysis (t-test)		
			t	P	Statistical inference
Total cholesterol (mg%)	160.05±32.12	129.32±31.50	8.316	0.000	Highly significant

Table 3: Comparison of mean high-density lipoprotein-cholesterol (mg%) of subjects before (n=100) and after (n=98) fasting

Parameter	Before fasting (n=100) Mean±SD	After fasting (n=98) Mean±SD	Statistical Analysis (t-test)		
			t	P	Statistical inference
HDL-C (mg%)	39.70±5.63	44.00±5.74	-7.639	0.000	Highly significant

Table 4: Comparison of mean total triglycerides (mg%) of subjects before (n=100) and after (n=98) fasting

Parameter	Before fasting (n=100) Mean±SD	After fasting (n=98) Mean±SD	Statistical Analysis (t-test)		
			t	P	Statistical inference
Triglycerides (mg%)	168.47±50.08	127.97±38.70	6.942	0.000	Highly significant

excess food at *Iftar* (the food eaten immediately after sunset to break the fast) and dinner or *Sabur* (the light meal generally eaten about half an hour to one hour before dawn). A diet that is less than a normal amount of food intake but balanced is adequate to keep a person healthy and active during the month of *Ramadan*. It is often said that the beneficial effects of fasting during *Ramadan* will occur only in people who maintain a diet that is appropriate to them.^[7]

In our study, the mean total cholesterol level before fasting was 160.05 ± 32.12 mg% and after fasting was 129.32 ± 31.50 mg%. This shows a considerable decrease in total cholesterol after fasting. On statistical analysis, a *P* value of 0.000 was obtained which is highly significant.

Studies have shown that during *Ramadan* fasting, the body develops adaptive mechanisms and there is increased oxidation of fat and decreased oxidation of carbohydrate and it has been noted that change in serum cholesterol level is inversely related to fat energy intake. It appears that the quality and quantity of fat intake in *Ramadan* governs the blood cholesterol levels.^[3,8]

Similar studies have shown that cholesterol levels decreased significantly (*P* < 0.05) during *Ramadan* fasting.^[9,10] This is in agreement with our study.

Also, a study conducted by Mirzei *et al.* was in accordance to our study.^[11]

On the other hand, a study was performed about the effect of *Ramadan* fasting on lipids and lipoproteins and no significant change was found in total cholesterol.^[12,24]

There is a marked decrease in the activity of HMG-CoA-reductase during fasting, resulting in reduced synthesis of cholesterol depicted as low-blood cholesterol levels.^[13]

Although the levels of serum cholesterol of the subjects in our study were within the normal limits, yet a significant lowering in the levels can be attributed to an altered pattern of eating during the month of *Ramadan*. A prospective observational study on fasters has shown a significant improvement in cardiovascular risk factors in the subjects with previous history of cardiovascular disease.^[14]

Plasma concentration of HDL-C is a protective factor against the development of atherosclerosis and cardiovascular diseases. In our study, HDL-C before fasting was 39.70 ± 5.63 mg% and after fasting it increased to 44.00 ± 5.74 mg%. These results on statistical analysis gave a *P* value of 0.000 which is highly significant. It has been suggested that eating one large meal (gorging) leads to a significant increase in serum HDL levels.^[15] According to another study, there was no change in the physical activity level or smoking pattern of the fasting subjects nor did they consume alcohol (forbidden by religious command). Thus, none of the factors were known to affect the plasma HDL-C levels other than the change in meal pattern, suggesting that the increase in HDL levels was due to post-prandial lipemia. The magnitude of post-prandial lipemia was considered to be important for the metabolism and plasma levels of HDL.^[16]

The increase in HDL-cholesterol at the end of *Ramadan* in the present study can be explained by decreased saturated fatty acid intake and decrease in circulating insulin and a rise in catecholamine concentration from lipolysis in adipose tissue in response to hypoglycemia during *Ramadan* fasting.^[8,17,18]

Our results are in conformity with the observations made by other researchers, who noted a gradual increase in HDL cholesterol during *Ramadan*.^[19] They reported that although the mechanism(s) by which fasting increases the level of HDL cholesterol is unclear, loss of weight in the studied population may increase HDL-cholesterol. They also suggested that the effect of *Ramadan* fasting on serum lipid levels may be closely

related to the nutritional diet or biochemical response to starvation.^[14] Plasma concentration of HDL is a protective factor against the development of atherosclerosis and cardiovascular diseases.

Increased levels of HDL-C would be beneficial as HDL picks up cholesterol from peripheral tissues and transports it to the liver and intestine, thus lowering plasma cholesterol.

In the present study, the mean triglyceride level before fasting was 168.47 ± 50.08 mg% and after *Ramadan* fasting it was observed to be 127.97 ± 38.70 mg%. These observations showed a significant decrease in the values after fasting. Statistical analysis showed a *P* value of 0.000 which is highly significant.

Our results are in accordance with other studies wherein a decrease in triglycerides was observed after *Ramadan* fasting.^[20,21] However, in certain studies, an increase in blood triglyceride level was observed with *Ramadan* fasting in subjects on a high carbohydrate diet.^[22]

Consequently, the findings reported in the literature on the effects of *Ramadan* fasting were inconsistent and in some cases contradictory. Probably, variables such as hereditary, climate, the number of days of fasting and type of food consumed play an important role. Further research is necessary to clarify these points.^[22,23]

Triacylglycerol (TAG) biosynthesis is also decreased due to lesser availability of the precursor molecules acetyl-CoA and glycerol in fasting because of reduced glucose oxidation.^[25] Furthermore, the activity of dehydrogenases of the pentose phosphate pathway has also been reported to decrease in fasting and is a known mandatory requirement for the synthesis of fatty acids and cholesterol.^[13] This leads to lowering of the blood levels of cholesterol, triacylglycerol and low-density lipoprotein during fasting. It needs to be further investigated, how long the effects of *Ramadan* fasting last each year and what are the chronic effects of fasting year after year.

Conclusion

There are some known medical benefits of fasting. In general, fasting has been used in medicine for reasons including weight management, for providing rest to the digestive tract and for lowering lipids. During the month of *Ramadan*, the pattern of food and water intake is altered. Our study shows a reduction in total cholesterol and triglycerides along with a rise in the levels of HDL-C which points towards beneficial effects of *Ramadan* fasting.

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Conflicts of interest

There are no conflicts of interest.

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