

Study of Alteration in Lipid Profile after 4 Weeks of Continuous Fasting in Ramadan

Ilyas Yaqub Bemat¹, Yaser Askari², Quazi Zubair Zafar³, Syed Jawwad⁴, Ishrath Fatima⁵, Mohmmmed Suhail⁶

¹Associate Professor, Dept. of Physiology, Indian Institute of Medical Science and Research, Warudi, Badnapur Dist Jalna

²Assistant Professor, Dept. of Physiology, Indian Institute of Medical Science and Research, Warudi, Badnapur Dist Jalna

³Assistant Professor, Dept. of Pharmacology, Indian Institute of Medical Science and Research, Warudi, Badnapur Dist Jalna

⁴Associate Professor, Dept. of PSM, Indian Institute of Medical Science and Research, Warudi, Badnapur Dist Jalna

⁵Professor, Dept. of OBGY, Indian Institute of Medical Science and Research, Warudi, Badnapur Dist Jalna

⁶Professor Physiology, Indian Institute of Medical Science and Research, Warudi, Badnapur Dist Jalna

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Corresponding Author: Dr. Syed Jawwad

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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. Continuous fasting for a fortnight has been shown various physiological changes and also in blood parameters specially related of basal metabolism of bod this study has been done to find the changes in lipid parameters after 3 weeks of fasting in Ramadan.

Materials and Methods: The present study included healthy adult male Muslim volunteer's staff coming to IIMSR medical college. The number of subjects in the study was 75. Blood samples from all 75 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 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: Lipid profile, Fasting, Ramadan.

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Introduction

Fasting during the holy month of Ramadan has been shown to have a significant impact on lipid profiles, particularly in improving High-density lipoprotein (HDL) levels. Research indicates that fasting during Ramadan can lead to positive changes in lipid ratios, such as LDL/HDL and TG/HDL ratios, which are important markers in predicting cardiovascular disease risk [1]. Interestingly, omitting just one meal during Ramadan may help in controlling HDL levels without the need to reduce overall calorie intake [1]. However, the impact of Ramadan fasting on total cholesterol levels seems to be negligible, with conflicting data existing on this matter in various

studies [2, 1]. It is essential to note that the beneficial effects of fasting on lipid profiles during Ramadan are contingent upon individuals adhering to a balanced diet with normal food intake, emphasizing the importance of dietary habits during fasting periods [2]. Moreover, follow-up studies are recommended to determine the duration of these beneficial effects on lipid profiles, and further research with larger sample sizes and control groups is necessary to fully evaluate the impact of fasting during Ramadan on lipid profiles [1].

How does fasting in Ramadan affect the levels of cholesterol and triglycerides? Fasting during the month of Ramadan has been found to have a significant impact on lipid levels in the bloodstream. Research indicates that abstaining from food and drink during this period leads to a reduction in the levels of both triacylglycerol and cholesterol in the blood [2]. This decrease in lipid levels during Ramadan fasting can have beneficial effects on overall cardiovascular health. By observing fasting rituals during Ramadan, individuals may experience improvements in their lipid profiles, which could contribute to a reduced risk of cardiovascular diseases. Are there any changes in HDL (good cholesterol) and LDL (bad cholesterol) levels during fasting in Ramadan? During Ramadan fasting, there is a significant alteration in the lipid profile that may have potential cardiovascular benefits. Research has shown that the TG/HDL ratio, which is linked to the composition of HDL particles, is inversely related to the presence of atherogenic small dense HDL3 particles and positively associated with large and less dense HDL2 particles that offer protection against atherosclerosis [1]. Interestingly, studies have demonstrated a decrease in the TG/HDL ratio specifically during Ramadan fasting, indicating a favorable shift towards a more cardioprotective lipid profile [1]. Moreover, the levels of triglycerides (TG) remain unaffected during fasting in Ramadan, suggesting that the observed changes in the TG/HDL ratio are not driven by alterations in TG levels [1]. These findings collectively suggest that Ramadan fasting could potentially confer protection against coronary artery disease through its impact on the TG/HDL ratio, highlighting the potential cardiovascular benefits of this religious practice [1]. 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.

Aim

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

Materials and Methods:

For this study, healthy adult male Muslim volunteers were taken from staff members and faculties coming to IIMSR medical college campus. The number of subjects in the study was 75. 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. Fasting blood samples from all subjects were collected twice during our study once in the week prior to the beginning of Ramadan (75 subjects) and then again in the last week of Ramadan (75 subjects). The first set of blood samples from 75 subjects were taken in the week before the start of Ramadan month after overnight fasting while the second set of blood sample from 75 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:

(a) Serum total cholesterol estimation was done by fully enzymatic cholesterol oxidase peroxidase method. [3]

(b) Serum triglycerides estimation was done by fully enzymatic glycerol phosphate oxidase-peroxidase method (GPO-POD).[4]

(c) 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

Results and Discussion

The present study was conducted on healthy male subjects for knowing effect of *Ramadan* fasting on cardiovascular and biochemical parameters. Out of 75 participant's 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 2]. Serum triglycerides recorded in our study group ranged between 69 mg% to 268 mg% before Ramadan [Table 2]. A

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:

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

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

Age group (in years)	Subjects No. (%)
0-35	42 (56.00)
36-50	21(28.00)
51-74	12(16.00)
Total	75 (100.00)

Table 2: Comparison of lipid parameters before and after 3 weeks fasting

Parameter	Before fasting (n=75) Mean±SD	After fasting (n=75) Mean±SD	Statistical Analysis (t-test)	P value
Total cholesterol (mg%)	160.05±32.12	129.32±31.50	8.316	0.005
HDL-C (mg%)	39.70±5.63	44.00±5.74	-7.639	0.002
Triglycerides (mg%)	168.47±50.08	127.97±38.70	6.942	0.002

The average length of fast over the time of our investigation was between 13 to 14 hours per day. There is neither starvation nor insufficient calorie intake during an Islamic fast. The timing of meals is the only distinction between complete fasting and Ramadan fasting. Those who keep the fast during Ramadan skip lunch, rise early, and eat nothing until dusk. Put differently, the fasting observed throughout Ramadan is a controlled, partial fast. Fasting during Ramadan has numerous benefits in terms of spirituality, health, psychology, and society; yet, improper fasting practices can lead to man-made issues. First off, breaking the fast with excessive food at Iftar (evening), also known as Sahur (a light meal typically consumed for thirty minutes), and dinner is not necessary.

Research has indicated that the body adapts to fasting during Ramadan, resulting in enhanced fat oxidation and decreased carbohydrate oxidation. Additionally, a shift in blood cholesterol level has been observed to be inversely correlated with fat energy intake. It seems that blood cholesterol levels throughout Ramadan are determined by the type and amount of fat consumed. [3,8] Studies of a similar nature have demonstrated a significant (*P* < 0.05) drop in cholesterol levels during the Ramadan fast. [10,9] This is consistent with what we found. Furthermore, a study by Mirzei et al. supported the findings of our investigation. [11]

However, no discernible change in total cholesterol was discovered in a study on the impact of Ramadan fasting on lipids and lipoproteins. [12, 24] Low blood cholesterol levels are caused by a substantial drop in HMG-CoA-reductase activity during fasting, which leads to lower cholesterol synthesis. [13] Despite the fact that the participants' serum cholesterol levels were within normal ranges, a notable decrease in the levels can be linked to a changed eating schedule during Ramadan. In participants with a prior history of cardiovascular illness, a prospective observational research on fasters has demonstrated a significant improvement in cardiovascular risk variables. [14] HDL-C plasma concentration is a protective factor against the development of cardiovascular illnesses and atherosclerosis. In our investigation, HDL-C was 39.70 ± 5.63 mg% prior to fasting and rose to 44.00 ± 5.74 mg% following fasting. The statistical analysis yielded a highly significant *P* value of 0.001 in these results. It has been proposed that consuming one substantial meal—also known as gorging—raises serum HDL levels noticeably.[15] Another study found that the subjects who were fasting did not alter their level of physical activity, their smoking habits, or their intake of alcohol, which was prohibited by religious law.

Therefore, except from the alteration in eating habits, no other factor was found to have an impact

on plasma HDL-C levels, indicating that the rise in HDL levels. 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 findings support the findings of previous studies who saw a progressive rise in HDL cholesterol during the month of Ramadan. [19] They stated that while the exact process or mechanisms by which fasting raises HDL cholesterol levels are unknown, weight loss in the population under study may raise HDL cholesterol levels. They also proposed a possible link between the nutritional diet or the body's physiological reaction to famine and the impact of Ramadan fasting on blood cholesterol levels. [14] The level of HDL in plasma protects against the onset of cardiovascular disease and atherosclerosis. Raising HDL-C levels would be advantageous since HDL lowers plasma cholesterol by removing cholesterol from peripheral tissues and transferring it to the liver and gut. The level of HDL in plasma protects against the onset of cardiovascular disease and atherosclerosis. Raising HDL-C levels would be advantageous since HDL lowers plasma cholesterol by removing cholesterol from peripheral tissues and transferring it to the liver and gut. The study found that the mean triglyceride level was 168.47 ± 50.08 mg% prior to Ramadan fasting and 127.97 ± 38.70 mg% after the fast. These findings demonstrated a substantial drop in the levels following fasting. A extremely significant P value of 0.000 was revealed by statistical analysis.

The reduction in triglycerides that occurs after a Ramadan fast is supported by earlier studies, as indicated by our data. [20, 21] Other studies, however, discovered that fasting during Ramadan raised lipid levels in the blood. Our findings support prior research that found triglycerides to be lower following a Ramadan fast. [20, 21] However, in several research, participants on a high-carb diet who fasted during Ramadan experienced a rise in blood triglyceride levels. [22] As a result, the conclusions drawn from the research about the benefits of fasting during Ramadan were erratic and even contradictory. Factors including genetics, environment, length of fast, and kind of food eaten most likely have a significant impact. To make sense of these findings, more study is required. [22,23]

Because there is less glucose oxidation during fasting, there is less availability of the precursor chemicals acetyl-CoA and glycerol, which results in a reduction in the manufacture of triacylglycerol (TAG). [24,25] Moreover, it has been shown that the pentose phosphate pathway's dehydrogenases,

which are known to be essential for the production of cholesterol and fatty acids, become less active during fasting. [13] During fasting, this results in a decrease in the blood levels of triacylglycerol, low-density lipoprotein, and cholesterol. How long the benefits of fasting during Ramadan endure each year and what the long-term repercussions are of fasting year after year need to be further studied.

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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