Original article

One month Ramadan Fast Improves Lipid Profile Status of Bangladeshi Male Volunteers

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Abstract :
To evaluate the effect of Ramadan fast on serum lipid profile status of men, the study was carried out in the National Mushroom Development and Extension Centre, Sobhanbag, Savar Dhaka in association with the Department of Pharmacy and Department of Biochemistry and Molecular Biology, Jahangirnagar University, Savar, Dhaka. The experiment was conducted before and after the Arabic month, Ramadan, when there occurs a change both in the pattern and timing of dietary intake. Findings of the study shows Ramadan fast significantly reduced serum Low Density Lipoprotein (LDL-C) (p = 0.011). A statistically non significant reduction of total Cholesterol (TC) (p = 0.340), small elevation of High Density Lipoprotein (HDL-C) (p = 0.252) and Triglyceride (TG) (p = 0.502) were also observed. Considering the findings of the study it was noticeable that one month Ramadan fast can improve lipid profile status of blood and hence able to improve atherosclerotic diseases which includes hypertension, ischemic heart disease and stroke.

Key wards: Ramadan, Cholesterol, TG, HDL-C, LDL-C.

Introduction:

A group of blood tests that include measuring of the total cholesterol (TC), triglyceride (TG), high density lipoprotein (HDL-C)-good cholesterol and low density lipoprotein (LDL-C)-bad cholesterol are considered as lipid profile of an individual. Many test results also include a VLDL cholesterol ratio as part of the final data.

According to the lipid hypothesis, abnormal cholesterol levels, that means, higher concentrations of LDL-C and lower concentrations of functional HDL-C are strongly associated with cardiovascular disease because these promote atheroma, development in arteries (atherosclerosis). This disease process leads to myocardial infarction, stroke, and peripheral vascular disease. Since higher blood LDL-C, especially higher LDL-C

particle concentrations and smaller LDL-C particle size, contribute to this process more than the cholesterol content of the HDL-C particles[1], LDL-C particles are often termed "bad cholesterol" because they have been linked to atheroma formation. On the other hand, high concentrations of functional HDL-C, which can remove cholesterol from cells and atheroma, offer protection and are sometimes referred to as "good cholesterol". These balances are mostly genetically determined, but can be changed by body build, medications, food choices, and other factors[2].

Elevated cholesterol levels are treated with a strict diet consisting of low saturated fat, trans fat-free, low cholesterol foods[3,4], often followed by one of various hypolipidemic agents, such as statins, fibrates, cholesterol absorption inhibitors, nicotinic acid derivatives or bile acid sequestrants[5].

Ramadan is the holiest month in the Islamic Hijri calendar and Muslims fast during this month[6]. It occurs in the ninth month of the lunar calendar, lasting for 29 or 30 days. Ramadan fasting is a religious obligation of Islam, annually followed by millions of Muslims. Believers are commanded to abstain from food, drink and conjugal relationships from sunrise to sunset as a sign of restraint and introspection. It is believed that Ramadan improves health status. During the Ramadan fast, Muslims eat two meals a day, one before dawn and the other shortly after sunset. In addition, there is a tendency to consume foods that are richer in carbohydrate and lipids, particularly mono- and polyunsaturated fatty acids[7,8]. This change in the meal schedule is accompanied with changes in sleeping habits and physical activities, and hence the lifestyle change during Ramadan, as sleep duration at night and daily physical activities are reduced. They also smoke less and overall, their psychological stress is reduced[7,9,10,11].

The body has regulatory mechanisms that reduce the metabolic rate and ensure efficient utilization of the body's fat reserves in times of hunger. So it is important to know the effect of this kind of fasting on people's life especially on their health. During these days people pay a lot to protect themselves against diseases and to reach this goal they should have an intact immune system. The calorie intake of Muslims during Ramadan is at or slightly below the nutritional requirement guidelines.

Ramadan fasting and starvation are not synonymous. Many physiological and psychological changes take place during Ramadan, most probably due to the changes in eating patterns, eating frequency and sleep patterns[12]. Some studies in the eastern Mediterranean area have indicated improved HDL-C during Ramadan fast[13,14]. A balanced diet at Ramadan that is even less in quantity than normal, will be sufficient to keep a person healthy and active.

It has been established that a given nutrient ingested at an unusual time can induce different metabolic effects[15]. Lipid profile is affected by dietary habit, percentage of fat in the daily diet and its saturation, percentage of simple sugar, and exercise[16,17]. Some studies showed positive effects of fasting on the lipid profile[8,9,18,19,20], while opposite effects were observed in others[21,22].

Conflicting results have been reported on the effect of Ramadan fasting on changes in lipid profile within healthy subjects. It is therefore of interest to compare pre- and post-Ramadan lipid profiles in fasting of Ramadan. This study therefore had designed to evaluate the effects of Ramadan fasting on serum lipid profile of Bangladeshi male volunteers.

Materials And Methods:
During the period of Ramadan the study was conducted in Strengthening Mushroom Development Project, National Mushroom Development and Extension Center (NAMDEC), Sobhanbag, Savar, Dhaka.

Subjects: Total 27 healthy male subjects who resided in savar and who indicated that they were going to fast during Ramadan, and aged 28-72 years were considered in the study. The subjects were clarified about the study and after getting their written consent showing willingness to participate in the study they were included. The details history was taken from the subjects which included age, sex, occupation, educational status, marital status, family history and drug history.

Any acute or chronic disease or medication, malabsorption during the study, and any addiction except cigarette smoking were excluded from the study. None of the female and non fast subjects were included.

Study design: At the beginning of Ramadan, subjects were evaluated for health status. Fasting blood sample was collected for analysis of TC, TG, HDL-C and LDL-C. Just after ending of Ramadan the subjects were evaluated and all the investigation procedures were repeated. If any drug was getting by the subjects, it was continued. All the biochemical parameters for the measurement of lipid profile were estimated by semi-auto analyzer (3000 evaluation) using the available reagent kit

Collection of blood samples: Blood samples were collected from the subjects with all aseptic precautions. 10 ml of venous blood were collected from the median cubital vein by a disposable plastic syringe. The needle was detached from the nozzle and blood was transferred immediately into a dry, clean, graduated, screw-capped plastic test tube with a gentle push to avoid hemolysis. The test tubes were kept in slanting position till formation of clot. Centrifuging the blood at 3000 rpm for 5 minutes, serum was separated and supernatant was taken into two small plastic test tubes (eppendorf), containing 1 ml in each. All the tests were carried out as early as possible.

Analytic process of blood samples: Total cholesterol is defined as the sum of HDL, LDL, and VLDL. Plasma total cholesterol (TC) and high density lipoprotein (HDL-C) were measured by an enzymatic colorimetric method using cholesterol esterase, cholesterol oxidase, peroxidase and the

chromagen 4- aminophenazone/phenol. Plasma triglyceride (TG) levels were determined by an enzymatic colorimetric method using lipoprotein lipase glycerolkinase, glycerophosphate oxidase and the chromagen 4-aminophenazone/N-ethyl-N-(3-sulphopropyl)-nramisidine.

Very low density lipoprotein cholesterol (VLDL) was calculated by dividing total triglycerides by five. Low density lipoprotein (LDL-C) was calculated using the Friedewald *et al.* equation. LDL = [total cholesterol] − [HDL-C] − [estimated VLDL].

Anthropometry: Anthropometric measurements were taken by height in cm and weight in kg with the use of a manual machine. Participants were shoeless and wore light clothing. Body Mass Index (BMI) was calculated by taking subject's weight and height (BMl = weight in kg / Height in m^2). Blood pressure (systolic and diastolic) of subjects was measured by sphygmomanometer.

Statistical analysis: The recorded characteristics of the subjects were analyzed using the Statistical Package for the Social Sciences (SPSS) version 17.0 (Chicago, IL, USA). Results were expressed as mean and standard errors (SE). Student's paired t-test was used for data analysis. A p-value of less than 0.05 was considered to be statistically significant.

Results:

The mean ± SE serum cholesterol (mg/dl) before and after Ramadan was 166.11 ± 8.70 and 159.51 ± 6.52 respectively. A statistically non significant mean reduction of cholesterol (p = 0.340) observed at post Ramadan state. This finding shows, although non significant but one month fasting state of Ramadan reduced serum cholesterol by 3.97% (Fig.1).
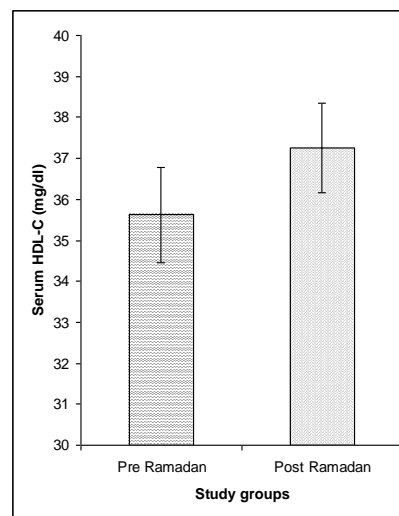
Fig. 1: Mean fasting serum cholesterol of the study groups
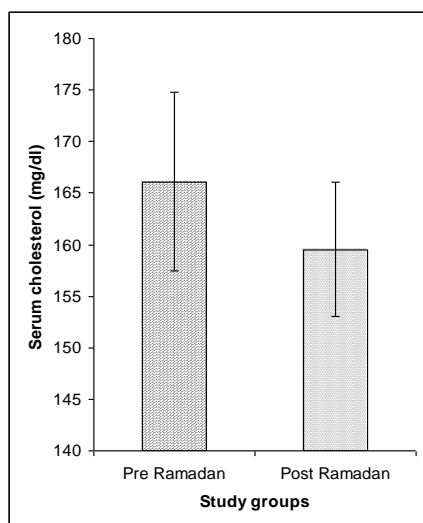
(Results show mean ± SE. Data were analyzed by Paired 't' test. Means were significantly different at p<0.05 at 95% confidence limit)
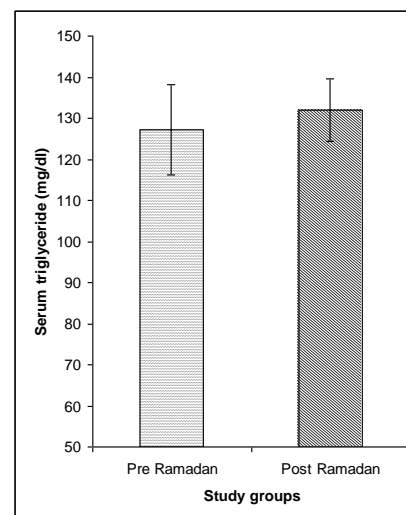
The mean ± SE serum TG (mg/dl) before and after Ramadan was 127.14 ± 10.89 and 131.96 ± 7.61 respectively. A non significant rising of serum TG (p = 0.502) observed at the post Ramadan. This finding indicates one month fasting state of Ramadan not reduces serum TG rather Ramadan increases serum TG by 3.79%. (Fig. 2).

Fig. 2: Mean fasting serum triglyceride of the study groups

(Results show mean ± SE. Data were analyzed by Paired 't' test. Means were significantly different at p<0.05 at 95% confidence limit)


The mean ± SE serum HDL-C (mg/dl) before and after Ramadan was 35.62 ± 1.16 and 37.25 ± 1.10 respectively. A statistically non significant mean difference of HDL-C (p = 0.252) observed before and after Ramadan (Table-2). This finding indicates one month fasting state of Ramadan raised serum HDL-C level by 4.57% (Fig. 3).

Fig. 3: Mean fasting serum HDL-C of the study groups
(Results show mean ± SE. Data were analyzed by Paired 't' test. Means were significantly different at p<0.05 at 95% confidence limit)

The mean ± SE serum LDL-C (mg/dl) before and after Ramadan was 110.49 ± 9.31 and 90.03 ± 6.50 respectively. A significant mean difference of LDL-C (p = 0.011) observed before and after Ramadan (Fig. 4)). This finding shows one month fasting state of Ramadan reduced serum LDL-C by 18.52%.

Fig. 4: Mean fasting serum LDL-C of the study groups (Results show mean ± SE. Data were analyzed by Paired 't' test. Means were significantly different at p<0.05 at 95% confidence limit)
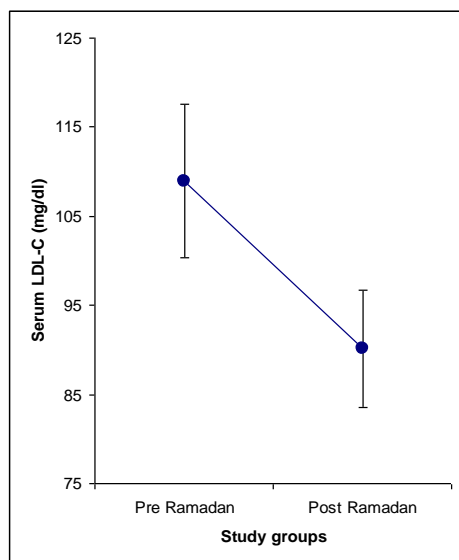
Discussion:

In the study it was observed that there was non significant small reduction of serum total cholesterol. There were small elevation of serum TG and HDL-C, although both of these elevations are also non significant. Interestingly considering LDL-C, there observed significant reduction of it in one month Ramadan fasting. During Ramadan Muslims are obliged to fast at daytime. Long lasting modifications in the eating and sleeping schedule may result in various changes in metabolism.

Obtained findings of this study show, the reduction of serum cholesterol at the end of one month Ramadan fast was 3.97%. The results of this study were consistent with the previous studies of Al Hourani et al. (2009)[23]. Many reports have been published on the effect of Ramadan fasting on blood lipids among healthy individuals, with inconsistent and even conflicting findings. The discrepancy might be attributed to the amount and type of food intake, physical activity, ethnic, and genetic background of studied populations. It is also debatable that a diet, changed to reduce dietary fat and cholesterol, can lower blood cholesterol levels[24], because any reduction to dietary cholesterol intake could be counteracted by the organs compensating for try to keeping blood cholesterol levels constant[25]

In this study a non significant rising of serum TG observed at the end of Ramadan. This finding indicates one month fasting state of Ramadan not reduces serum TG rather Ramadan increases serum TG by 3.79%. Our findings are inconsistent with the findings of Al Hourani et al. (2009)[23]. They observed a significant decrease in serum triacylglycerols after mid of Ramadan and suggested that the reduction in serum triacylglycerols may be either by changes in fat intake or inherent metabolic changes during Ramadan. Although in this study, the serum level of triglycerides had no significant difference in pre and post-Ramadan testing, in some studies, it increased significantly during Ramadan[14]. The raising in serum TG can be explained by changes in high carbohydrate and fat intake during Ramadan in Bangladeshi community, accompanied by less exercise during this month. Also there is a tendency for higher sugar consumption at this month.

A significant mean difference of LDL-C was observed before and after Ramadan in this study and shows one month fasting state of Ramadan reduced serum LDL-C by 18.52%. The significant reduction in LDL-C occurred despite the fact that tendency to consume fried foods was increased during Ramadan. Consumption of increased fried foods suggests a higher intake of fats as compared to non-Ramadan days. It appeared as if the quality and quantity of fat intake in Ramadan govern blood cholesterol level. In another study suggested that feeding behavior that occurs during Ramadan beneficially affects serum apolipoprotein metabolism and may contribute to prevention of coronary heart disease[26]. Elevated levels of the lipoprotein fractions, LDL, IDL and VLDL are regarded as atherogenic. Levels of these fractions, rather than the total cholesterol level, correlate with the extent and progress of atherosclerotic diseases[27].

Considering HDL-C a statistically non significant mean difference was observed before and after Ramadan and indicates one month fasting state of Ramadan raised serum HDL-C level by 4.57%, Although the changes were not statistically significant. However, most previous studies on HDL cholesterol showed a significant increase in plasma HDL-C[18,19,28,29]. Plasma concentration of HDL-C is a protective factor against the development of atherosclerosis and cardiovascular diseases and usually quite stable. Since we have observed a small increase in HDL-C during Ramadan which didn't reach a significant level over the period of one month fasting, our results are in accord with the previous reports that showed an elevation of plasma HDL-C levels. Although, mechanism(s) by which fasting increases the level of HDL-C are not clear.

In our investigation, the level of total cholesterol did not increase during Ramadan. By using body reserve fat and newly-synthesized fat as a source of energy is greater under these circumstances than during normal energy intake conditions that increase circulating fat elements. We also found small elevation of HDL-C and significant reduction of LDL-C. Although we did not measure the level and type of fatty acid in the dietary regimen of the study population, the findings reflect the type of fat consumption. Most of the fats consumed at Ramadan are in the form of oil and they may contain unsaturated fatty acids. Our findings are not in agreement with Ziaee *et al.* (2006)[30] who observed decrease in HDL-C and increase in LDl-C at the end of Ramadan.

Although in our findings it is noticeable that Ramadan did not improve total cholesterol and HDL-C, rather there occurs small rising in TG level, it is mentionable that there was significant reduction of LDL-C, in atherogenic point of view which is very important. In conclusion, considering the findings of the study it is believable that one month Ramadan fast can improve lipid profile status of blood and hence able to improve atherosclerotic disease which include hypertension, ischemic heart disease and stroke.

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