

## ORIGINAL ARTICLE

**Effects of ramadan fasting on cardiovascular and biochemical parameters**Gupta M<sup>1</sup>, Khajuria V<sup>2</sup>, Akhter P<sup>3</sup><sup>1&3</sup> Associate Professor, Departments of Physiology, <sup>2</sup>Pharmacology, Government Medical College, Jammu, J&K[Abstract](#) | [Introduction](#) | [Methods](#) | [Result](#) | [Conclusion](#) | [References](#) | [Citation](#) | [Tables](#)**Article Cycle****Address for Correspondence:** Mrityunjay Gupta, Associate Professor, Deptt. Physiology, Government Medical College, Jammu, J&K.

E Mail ID: mritnje\_physiolo@yahoo.co.in

**Citation**

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**Source of Funding :** Nil, **Conflict of Interest:** None declared**Abstract**

**Background:** Muslims abstain from food and drink from dawn to sunset every day during Ramadan - the holiest month in Islamic lunar calendar. **Methods:** The effect of Ramadan fast on body mass index (BMI), blood pressure (BP), fasting blood glucose (FBG) and lipid profile were studied on 100 healthy male, adult Muslim volunteers. All parameters were recorded one week before the onset and then in the last week of Ramadan month and compared. **Results:** There was no statistically significant effect on BMI, and systolic or diastolic blood pressures ( $p > 0.05$ ). However, fasting blood glucose (FBG), serum total cholesterol (TC), serum triglycerides (TG) were significantly decreased ( $p = 0.000$ ) and high density lipoprotein cholesterol (HDL-C) level was significantly ( $p = 0.000$ ) increased in last week of Ramadan fasting compared to pre fasting levels. **Conclusion:** Our results show beneficial effects of Ramadan fasting on FBG and serum lipid profile.

**Key Words**

Blood Pressure, Blood Glucose, Lipid Profile, Ramadan Fasting

**Introduction**

Fasting during Ramadan, the ninth month in the Islamic calendar is obligatory for all healthy, adult individuals of the Islamic faith with exemption to sick, travellers and pregnant women. In this month, healthy Muslims observe total abstinence from food, fluids and tobacco daily from pre-dawn until dusk. Although free eating is allowed from sunset to dawn, traditionally two main meals are consumed daily, one before dawn at the commencement of the day's fast (Sahur meal) and the second at the break of fast at around 19:00 hours (Iftar meal).

The duration of restricted food and beverage intake makes Ramadan a unique model of intermittent fasting. (1) The Ramadan model of fasting is abundantly available but not extensively studied.

**Aims**

Aim of the present study was to evaluate the effects of Ramadan fasting on BMI, systolic blood pressure (SBP), diastolic blood pressure (DBP), lipid profile and FBG in healthy adult male Muslim volunteers.

**Methods**

Healthy adult, male, Muslim volunteers from eight mosques located in Jammu city (Jammu and Kashmir State, India) were screened for the present study. All the eligible subjects were interviewed by the investigators regarding their age, personal habits, relevant recent or past medical history, smoking and dietary habits. 100 volunteers fulfilled the inclusion criteria which included non-smokers, non-obese (BMI<30), non-diabetic and normotensive individuals. Those with known history of dyslipidemia, hypertension, diabetes mellitus and impaired hepatorenal functions were excluded. The purpose and methodology of tests was explained to them.

A digital weighing machine (Prestige, New Delhi) was used to record the weight in kilograms with least count of 0.5 kg. A vertical measuring rod fixed to the wall was used to record the height without shoes. The height was recorded to the nearest centimeter.

BMI was calculated as per the standard formula by dividing weight in kilogram by square of height in meters.(2) Blood pressure was recorded by auscultatory method. For the estimation of biochemical parameters, blood samples from all subjects were collected twice during our study. First set of blood samples was taken in the week before start of Ramadan month after overnight fasting (sahur meal), while second set of blood sample from 98 subjects was collected after whole day fasting (Iftar in the evening) in the last week of Ramadan. Estimation of biochemical parameters TC, HDL-C, TG and FBG was done using standard procedures.(3,4)

Statistical Analysis: Data was compiled using computer software MS Excel for Windows. Statistical differences among the variables were evaluated using paired 't'-test by using SPSS 20 software. A 'p' value of < 0.05 was considered as statistically significant.

## Result

100 volunteers were enrolled and all completed study. The data collected was compiled and is presented in the tabulated form. Age of the subjects ranged from 20 years to 74 years. Majority of the subjects belonged to the age group of 20-35 years ([Table 1](#)).

BMI showed a minimal decrease after Ramadan which was statistically non-significant ( $p=0.054$ ). Systolic and diastolic blood pressures also did not show any statistically significant difference in values recorded before and at the end of Ramadan month. On analyzing biochemical parameters, there was a significant decrease in TC, TG and FBG at the end of Ramadan whereas HDL-C levels showed a significant increase ([Table 2](#)).

## Discussion

During the month of Ramadan the dietary pattern changes to one large meal at sunset and one light meal before dawn (5) and so becomes exclusively nocturnal. During our study period, the average length of fast was about ten and a half to eleven hours daily. In Islamic fasting, there is no malnutrition or inadequate calorie intake as they consume high calorie diet in meals.

The variability in daily fasting time is one of several confounding variables that influence the effect of Ramadan fasting on health related biomarkers. Other confounding variables include smoking status, medication, diet and cultural habits.(6,7) To negate the influence of these variables in the current study the smokers and those taking any medication were excluded.

BMI, which is a good anthropometric predictor of visceral fat, did not show any significant change at the end of fasting from pre-fasting values in the present study. The numerical loss in body mass observed was relatively small and

it could be attributed to decrease of glycogen bound water stores, extracellular volume contraction secondary to a lower sodium intake and a moderate degree of hypohydration with little loss of body tissue.(8)

Similar observations have been made in a study where BMI also remained unchanged. Authors observed that the caloric content and distribution of nutrients of food consumed before and during Ramadan did not significantly vary and hence BMI did not alter.(9) Our results are also in agreement with the other research workers who failed to document any change in BMI.(10,11)

In our study, systolic and diastolic blood pressure did not change significantly at the end of study as compared with before fasting values. This can be explained on the basis that body has regulatory mechanisms that get activated during fasting.(6)

In current study there was a highly significant decline in TC after fasting. These results are similar to number of earlier reports.(12,13) However, a few reports failed to report any effect on TC.(14) TC has a critical role in the aetiology and course of atherosclerosis which in turn predisposes to myocardial infarction, cerebral thrombosis and other serious illnesses. A previous study has suggested that during Ramadan fast the body develops adaptive mechanisms and there is an increased oxidation of fat and decreased oxidation of carbohydrate.(6) There is marked decrease in the activity of HMG-CoA-reductase during fasting resulting in reduced synthesis of cholesterol depicted as low blood cholesterol levels.(15) Although the levels of serum cholesterol of the subjects in our study were within normal limits, yet a significant lowering in the levels can be attributed to altered pattern of eating in the month of Ramadan. It would be interesting to study the effects on serum cholesterol levels produced by similar

pattern of eating continued over a longer period of time in subjects who belong to a particular socio-economic status.

Plasma concentration of HDL-C is a protective factor against the development of atherosclerosis and cardiovascular diseases. In the present study HDL-C increased significantly ( $p < 0.000$ ). 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 in turn lowering plasma cholesterol. Our results are in agreement with previous studies elucidating the effects of Ramadan fasting on lipids.(14,16) The increase in HDL-C 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 of Ramadan fasting.(17) It has been suggested that eating one large meal (gorging) leads to significant increase in serum HDL levels if the factors affecting HDL-C are avoided due to post-prandial lipemia.(18) In the present study, mean TG level showed a significant decrease in values after fasting ( $p$  value  $< 0.000$ ). Our results are in conformity with numerous reports suggesting decrease in TG.(19,20) Review of the literature reveals that reports on the effects of Ramadan fasting on TG are inconsistent and in some even contradictory. Probably variables such as hereditary, climate, number of days of fasting and type of food consumed come into play.(12) TG biosynthesis is also decreased due to lesser availability of the precursor molecules acetyl-CoA and glycerol in fasting as a consequence of reduced glucose oxidation.

During Ramadan fasting, the quality and quantity of daily energy intake is not same as during the rest of the year. There is calorie intake during fasting and the continual use of glucose in the body for various vital functions

leads to lowering of blood glucose level.(21) In our study, mean fasting blood sugar reduced significantly in last week of fasting compared to pre-fasting levels. Daily physical activity and sleep pattern are also altered in these subjects. These alterations influence biochemical parameters, especially blood glucose level.

Our results are in agreement with number of research workers reporting decrease in glucose levels during fasting.(22,23) It is possible that the changes in sleep schedule and habits during Ramadan induce changes in the rhythmic pattern of a number of hormonal variables including cortisol which has an unfavourable influence on the glucose tolerance.

## Conclusion

During the month of Ramadan, the pattern of food and water intake is altered. Our study shows reduction in total cholesterol and triglycerides along with rise in levels of HDL-C which points towards beneficial cardiovascular effects of Ramadan fasting. Decrease in fasting blood sugar observed in our study could be beneficial in Diabetics and needs further investigation.

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## Tables

**TABLE 1: AGE DISTRIBUTION OF SUBJECTS (N = 100)**

Age group (in years)	Subject's n (%)
20 – 35	56 (56.00)
36 – 50	28 (28.00)
51 – 74	16 (16.00)
Total	100 (100.00)

**TABLE 2: COMPARISON OF MEAN BODY MASS INDEX (KG/M<sup>2</sup>), BLOOD PRESSURE AND LIPID PROFILE CHANGES BEFORE AND IN LAST WEEK OF RAMADAN FASTING (N = 100)**

Parameter	Before fasting (n = 100) Mean ± SD	After fasting (n = 98) Mean ± SD	Statistical inference
BMI (kg/m <sup>2</sup> )	24.23 ± 4.20	23.25 ± 4.20 <sup>†</sup>	Non- significant
SBP (mmHg)	121.89 ± 10.47	121.16 ± 8.89 <sup>†</sup>	Non- significant
DBP (mmHg)	76.93 ± 7.62	76.65 ± 6.73 <sup>†</sup>	Non- significant
TC (mg %)	160.05 ± 32.12	129.32 ± 31.50 <sup>***</sup>	Highly significant
HDL-C (mg %)	39.70 ± 5.63	44.00 ± 5.74 <sup>***</sup>	Highly significant