SHORT ARTICLE

Is Ramadan Fasting Cardio-protective? A Study in a Village of West Bengal

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Abstract

Background: Islam is the second largest religion of the World (23%) and Muslims are the second largest majority of Indian Republic (14.3%). Ramadan is the ninth and holiest month(Hijra) of the 12-month Islamic calendar during which Muslims fast from dawn to dusk each day maintaining certain rules (consuming food/drink once, avoiding smoking and sexual activity, as well as impure thoughts, words and immoral behavior). It is observed by Muslims as a month of fasting to commemorate the first revelation of the Qur'an to Muhammad. **Aims & Objectives:** To evaluate the effect of Ramadan on cardio-metabolic profile among adult Muslims residing in rural West Bengal. **Methods and Materials**: The present study was a longitudinal community based study done among 43 Muslims residing in a village of West Bengal during 6thJune to 7th July 2016. Cardio-metabolic profile (physical activity, diet, BMI, blood pressure, blood lipids and glucose) were assessed before, during and after Ramadan. **Results:** There was a significant reduction in VLDL and TG level while significant elevation in HDL level along with the reduction in Framingham risk score after fasting. All the anthropometric measurements along with blood pressure reduced significantly after Ramadan with significant reduction in intake of all micro-nutrients during Ramadan. However physical activity also reduced significantly during Ramadan. **Conclusion**: Our study had found no detrimental effects of Ramadan fasting on the contrary has an overall beneficial effect on cardiovascular profile was observed.

Keywords

Ramadan; Fasting; High density lipoprotein; Framingham risk score; Cohen's d effect size

Introduction

Islam is the second largest religion of the World (23%) and Muslims are the second largest majority of Indian Republic (14.3%). (1,2) Ramadan is the ninth and holiest month(Hijra) of the 12-month Islamic calendar, which is based on the moon, it falls short of the solar calendar by 11 days hence this month occurs at different times of the year over a 33-year cycle. (1,3,4) It is one of the five pillars of Islam. (1) The word Ramadan comes from the Arabic word 'ramiḍa' or 'ar-ramaḍ' which means scorching heat or dryness. (5) It is observed by Muslims as a

month of fasting to commemorate the first revelation of the Qur'an to Muhammad. (1) Ramadan is a time to practice self-restraint and self-reflection. (6)

Fasting is seen as a way to cleanse the soul and have empathy for those in the world who are hungry and less fortunate. (7) During Ramadan, Muslims fast from dawn to dusk each day maintaining certain rules (avoiding food/drinks during daytime, avoiding smoking and sexual activity, as well as impure thoughts, words and immoral behavior). (1,4) Since Ramadan falls at different seasons, the average fasting time varies from 12 hours near equator to 22 hrs in summer at polar regions which can be challenging to the followers living at different altitudes and climate. (4) All Muslims who have reached puberty and are in good health should fast. The sick, elderly, travelers, pregnant women and those who are nursing are exempted, although they are supposed to make up for the missed days sometime in future or help feed the poor. (1,3,4)

Various studies have reported the effects of Ramadan fasting on individual health such as performance decrements, heat stress, increased accidents, detrimental effects on fetal growth, poor drug compliance and various other effects. (3,8,9)

In the last decade, the prevalence and incidence of Cardio-metabolic diseases (Cardiovascular diseases [CVDs] and Diabetes mellitus) is on increasing trend. (10) CVDs are also quite prevalent among Indian Muslims. (11) Few studies have implicated effect of fasting on cardiac health during the fasting period of Ramadan. (6)

But there is dearth of in-depth analysis, none in this part of country regarding the effects of Ramadan fasting on their blood biochemistry and other risk factors of cardio-metabolic diseases. It was envisaged that such a study would scientifically reveal the clinical and medical effects of religious fasting.

Aim & Objective

To evaluate the effect of Ramadan on cardio-metabolic profile among adult Muslims residing in rural West Bengal.

Material & Methods

The study was a community based prospective observational study performed during the period of Ramadan i.e. 6thJune to 7thJuly 2016. The sample size was calculated after using the formula

$N= [\{Z(1-\alpha/2)+Z(1-\beta)\}2*s2]/d2$, α= 5%, 1-β= 0.80, standard deviation(s)= 15.3mm of Hg(12), minimum deviation expected(d)= 8 mm of Hg, $Z(1-\alpha/2)$(Z value for alpha error)= 1.96, $Z(1-\beta)$ (Z value for beta error)= 0.84, with the design effect of 1.5 final sample size was 43.

The Rural Health Unit and Training Centre, Singur is the rural field practice area of All India Institute of Hygiene and Public Health(AIIHPH), Kolkata under which there are 61 villages. Out of these 3 villages have pre-dominant Muslim population of which one was selected by lottery method. Line-listing of all the adult Muslims was done. Out of whom 43 were selected randomly and informed written consent was obtained. Permission from the Ethics Committee of AIIHPH was obtained before starting of the study. Data collection was done with the help of a predesigned pretested questionnaire to collect information regarding socio-demographic and behavioural characteristics and 24 hour recall diet by interview method. Physical activity in Met-Min/week was assessed by International Physical Activity Questionnaire(IPAQ) short version. The study was conducted in the following manner:

- Before Ramadan (1/6/16-5/6/16): Interview, clinical examination and blood collection (Weight, Height, Waist Circumference [WC], Hip circumference [HC], Blood pressure(BP), Fasting blood glucose and lipid profile) was done among 43 participants.
- The Ramadan was from 6/6/16-7/7/16.
- During Ramadan, 24 hr recall diet survey and 7 day recall physical activity was done after 7 days of Ramadan fasting. (N=43)
- After Ramadan (8/7/16): Clinical examination and blood collection was done among 34 participants. (9 participants lost to follow-up)

Age, Sex, BP, HDL, Total cholesterol, Diabetes status and smoking status were used to calculate the Framingham risk score (10-year CVD risk) of the participants before and after Ramadan. (13)

All analyses were conducted with the SPSS 16.0. Statistical significance was set at $P<0.05$. Paired-t test and Wilcoxon signed rank were used. Cohen's d (effect size) was used to quantify the effect of Ramadan on various variables. (14)

Results

The mean age of the participants was 32.16±10.48years. Majority of the participants were females 37(86%) and 18(41.9%) belonged to age

group 21-29 years. Most of them 34(79.1%) belonged other backward caste(OBC). 29(67.4%) were married at the time of survey. 22(51.2%) belonged to nuclear family. 26(60.5%) were home makers and 21(48.8%) were literate up to primary while 20(46.5%) were from socio-economic class IV (modified B. G. Prasad scale 2016).

Physical activity status and dietary intake status of all macro-nutrients (protein, carbohydrate, fat) including total calorie intake during Ramadan fasting were significantly less than before Ramadan and these differences were statistically significant. (Table 1)

Food group wise dietary intake during Ramadan fasting for cereals, pulses and flesh foods were significantly less than before Ramadan while it were more for fruits and dairy products. (Table 2)

All the anthropometric measurements (weight, Body Mass Index(BMI), WC, Waist Hip Ratio(WHR)) were statistically reduced after the fasting. Same was observed for Systolic Blood Pressure(SBP) and Diastolic Blood Pressure(DBP). (Table 3)

In our study, we had found a statistically significant elevation of High Density Lipoprotein(HDL) levels and a significant reduction of Triglycerides(TG) and Very Low Density Lipoprotein(VLDL) levels while it was observed that though there was a reduction in Total Cholesterol(TC) levels and Framingham risk score, it was not significant. (Table 4)

Discussion

During prolonged fasting, there is a decrease in the activity of HMG-CoA-reductase enzyme which leads to decrease in TC levels. The reduction of TG, LDL-c may be due to the lipolytic effect of fasting which causes lesser availability of the precursors (acetyl–CoA and glycerol). (15) These biochemical changes can be seen in our findings which were significant elevation in HDL-c levels and significant reduction in TG and VLDL-c levels and non-significant reduction in TC levels with no change in LDL-c levels. Our findings are similar to other studies (16,17,18,19,20,21,22). However, in some studies some parameters did not change significantly. (23) The cause for these heterogeneous findings are the differences between studies in the amount of daily fasting time, the percentage of subjects who smoke, take oral medications, receive intravenous fluids, the subjects' eating habits, the socio-economic conditions and knowledge regarding fasting among the participants in different studies.

Our study found a non-significant increase in fasting blood sugar from 89 to 91 mg/dl which is in concurrence with the study done by Nematy *et al*. (22) However this may be explained by an abrupt change in dietary habits and high intake of simple sugars in the form of “Sherbet” usually at “Shehri”. However, few studies have also found significant decrease in the blood glucose level after Ramadan. (17,18,23) These variations may be due to differences in geographical locations with different food habits, period of daily fasting and seasons of fasting.

Our study findings indicated Ramadan fasting affected body weight, BMI, WC and WHR significantly. These observations were consistent with those of other studies and partly with the study done by Fararjeh M A *et al*. (12,19,20,22,24,16) During Ramadan, food intake is less frequent which may explain this reduction. However, our findings did run contrary to the study by Farooq A *et al* in Qatar as their study participants belonged to higher socio-economic status than ours and dietary intake of all macro-nutrients (fats, carbohydrates and protein) was increased while in our study it was decreased. (21)

It has been documented that hunger inhibits catecholamine release reducing the venous return thereby causing a fall in blood pressure and cardiac output. (25) This is further supported by our findings and findings in other studies. (12,19,22)

This study found significant decrease in dietary intake of total calorie and macro-nutrients which is in concurrence with the findings of Nematy *et al*. and Al-Hourani H M *et al*. (22,24) These findings are contradictory to the belief that Muslims tend to overcompensate in food intake during Ramadan. These results are not similar to that of study done by Farooq A *et al*. and this may be due to unique dietary habit specific to Qatar. (21)

In our study, we have found significant reduction in physical activity which differs from the findings of Al-Hourani HM *et al*. in which they had found no significant change. (24) This difference may be attributed to the difference in age and sex composition of the study.

A significant improvement in Framingham risk score was found in study done by Nematy *et al*. which is partly similar to our finding. (22)

Our study has certain limitations. There was no control group. We performed investigations and measurements only twice that is pre and post

Ramadan, evaluation in the middle of the fasting and sometime after might possibly elicit more detailed trend of changes. Also, some data collected in the study was self-reported (Diet, Physical activity and fasting status during Ramadan). Finally, other known cardio-metabolic risk factors such as sleep pattern, stress were not investigated.

The strength of this study lies in the fact that it was community based and the investigation of almost all the major cardiovascular risk factors (dyslipidemia, impaired glucose tolerance, dietary pattern, physical inactivity, hypertension and obesity) with evaluation of Framingham risk score were done which made the study more conclusive.

To conclude this longitudinal study on the effect of the fasting and dietary habits during Ramadan was found to have a protective effect on cardio-vascular profile of the study subjects. It was observed that there was a significant reduction in VLDL and TG levels while significant elevation in HDL levels which is good for cardio-vascular health. This is further supported by the reduction in Framingham risk score after fasting. All the anthropometric measurements along with blood pressure reduced significantly after Ramadan with significant reduction in intake of all macro-nutrients during Ramadan. However physical activity also reduced significantly during Ramadan which may be due to the feeling of inertia and tiredness during the Ramadan fasting.

Conclusion

Our study had found no detrimental effects of Ramadan. On the other hand, fasting along with change in dietary pattern during Ramadan has an overall beneficial effect on cardiovascular profile in this part of the country. A multi-centric study with larger sample size and broader conceptual framework with a matched control group is warranted

Authors Contribution

All authors have contributed equally in this study.

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Tables

TABLE 1 DIETARY INTAKE AND PHYSICAL ACTIVITY BEFORE AND DURING RAMADAN(N=43)

Parameter	Before Ramadan Mean(SD)	During Ramadan Mean(SD)	Difference in Mean(SD)	Effect Size (Cohen's D) (interpretation)
Total Calorie (Kcal)	1932.42 (169.57)	1388.41 (289.12)	544.01*(267.63)	2.03(large)
Protein(g)	58.53(11.30)	44.87 (13.54)	13.67* (13.29)	1.03(large)
Fat(g)	29.96 (6.36)	22.98 (10.84)	6.98* (10.83)	0.64(medium)
Carbohydrate(g)	351.62 (42.98)	268.53 (47.85)	83.10* (40.52)	2.05(large)
Physical activity (MET-min/week)	3097.53 (1096.89)	1934.19 (1042.5)	1163.35*(759.92)	1.53(large)

** P<0.05; g- grams, Kcal - Kilocalorie , Met-min - Metabolic minutes*

TABLE 2 FOOD GROUP WISE DIETARY INTAKE BEFORE AND DURING RAMADAN(N=43)

Parameter	Before Ramadan Mean(SD)	During Ramadan Mean(SD)	Difference in means Mean(SD)	Effect Size (Cohen's D) (interpretation)
Cereals(gm)	275.6 (53.9)	209.2 (54.9)	66.4* (11.04)	6.01(Large)
Pulses(gm)	81.0(45.5)	54.8 (38.9)	26.2* (34.5)	0.76(Medium)
Flesh food(gm)	114.6 (55.4)	96 (50.8)	18.6* (21.3)	0.87(Larger)
Fruits(gm)	86.2(92.8)	163.8 (146.4)	-77.6* (79.2)	0.98(Larger)
Other Veg(gm)	18.96 (43.7)	18 (37.6)	0.96 (52.15)	-------
Fat and oil(gm)	12.7(4.2)	10.88 (2.2)	1.8 (5.2)	-------
Sugar(gm)	8.9(2.9)	10.3 (2.3)	-1.1 (2.9)	-------
Roots and tuber(gm)	84.6(50.8)	67.8 (52.3)	16.8 (54.9)	-------
Milk and dairy product(gm)	25.64 (50.7)	50 (102.1)	-24.36*(51.4)	0.47(Small)

**p<0.05; gm - grams*

TABLE 3 ANTHROPOMETRY AND BLOOD PRESSURE BEFORE AND AFTER RAMADAN(N=34)

Parameter	Before Ramadan Mean(SD)	After Ramadan Mean(SD)	Difference in means Mean(SD)	Effect Size (Cohen's D) (interpretation)
Weight(kg)	51.60 (12.03)	49.26 (11.55)	2.338* (0.96)	2.43(large)
BMI(kg/m2)	22.68 (4.96)	21.65 (4.75)	1.03* (0.43)	2.40(large)
WC(cms)	83.63 (11.01)	81.32 (10.64)	2.31* (1.24)	1.86(large)
WHR	0.905 (0.054)	0.886 (0.052)	0.2* (0.009)	22.22(large)
SBP (mm of Hg)	114.94 (15.28)	107.82 (15.432)	7.118* (4.54)	1.57(large)
DBP (mm of Hg)	74.15 (9.61)	69.09 (8.86)	5.059* (4.067)	1.24(large)

** p<0.05; cms - centimeters, kg - kilogram, m - meter*

TABLE 4 FASTING BLOOD SUGAR AND LIPID PROFILE BEFORE AND AFTER RAMADAN(N=34)

Parameter	Before Ramadan Mean(SD)	After Ramadan Mean(SD)	Difference in means Mean(SD)	Effect Size (Cohen's D) (interpretation)
TG(mg/dl)	145.35 (29.57)	122.94 (35.50)	22.41* (30.45)	0.74(medium)
TC(mg/dl)	188.82 (34.90)	182.47 (29.92)	6.35(34.31)	-------
LDL(mg/dl)	106.29 (15.94)	106.85 (15.81)	-0.56 (19.26)	-------
HDL (mg/dl)	47.06 (2.40)	48.41 (2.05)	-1.35* (2.01)	0.67(medium)
VLDL(mg/dl)	24.88 (5.55)	22.18 (5.84)	2.70*(5.40)	0.5(medium)
FBS(mg/dl)† (median)	89 mg/dl	91 mg/dl		-------
Framingham risk score	-0.95 (5.40)	-1.60 (5.23)	0.65(1.53)	-------

**Wilcoxon signed rank test, * P<0.05 Mg - milligram, dl - deciliter, TC - total cholesterol, TG - triglyceride , HDL - High density lipoprotein , LDL- Low Density Lipoprotein , VLDL - very low density lipoprotein , FBS - fasting blood sugar*