

Original Article

## Effect of Ramadan Intermittent Fasting on Haematological Parameters, Lipid Profile and Renal Markers in Young Muslim Males of Kolkata, India

**Anindita Singha Roy and Amit Bandyopadhyay**

Sports and Exercise Physiology Laboratory,  
Department of Physiology,  
University of Calcutta, University Colleges of Science and Technology  
92, A.P.C. Road, Kolkata – 700 009, India.

### Abstract

Thirty seven young Muslim untrained male subjects (experimental group or EG, age: 22.73±1.56 yrs) participating in Ramadan intermittent fasting (RIF) and forty non-fasting counterparts (control group or CG, age: 22.92±1.36 yrs) from different parts of Kolkata, India were recruited in the study to evaluate the effects of RIF on selective haematological profiles, biochemical parameters and renal markers in the studied population. Insignificant difference was found between pre and post Ramadan values of the studied parameters, except in case of fasting blood sugar (FBS) level that was significantly affected by RIF in the EG. CG showed insignificant change in FBS before and after the month of Ramadan. It can be concluded from the present investigation that RIF adversely affected the FBS in fasting individuals although hematological parameters, lipid profile and renal markers were not influenced by RIF in the studied population.

### Introduction

Ramadan is the major religious period of Islam (1) during which all healthy Muslims abstain from food and water intake from sunrise to sunset known as Ramadan Intermittent Fasting (RIF) (2). Eating is allowed from sunset to dawn without any caloric

restriction (3). Ramadan is a lunar month and it becomes 11 days earlier in each solar year (4). During RIF Muslims also abstain from taking oral medicine, intravenous fluid and nutrients from dawn to sunset (5) with reduced physical activity (6). Studies reported that the frequency (7, 8) and quantity (9) of food intake are usually reduced during Ramadan. So it might be expected that caloric intake is reduced during this month (10), which results in reduced body weight (10-13). However, some investigations have reported insignificant changes in body weight or body composition during Ramadan (14-16).

Several studies reported the effect of RIF on certain haematological parameters (4, 17, 18) but still it is a matter of debate. A small change in urea and

**\*Corresponding author :**

Dr. Amit Bandyopadhyay M.Sc., Ph.D., FICN, Assistant Professor, Sports and Exercise Physiology Laboratory, Department of Physiology, University of Calcutta, University Colleges of Science and Technology, 92, A.P.C. Road, Kolkata – 700 009, India, Telephone : +91 33 23508386 (Extension : 317), Fax : +91 33 23519755, E-mail : abphys@caluniv.ac.in

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creatinine was reported by Sliman and Khatib (19). An increase in total protein was also observed during RIF (20). Literature found contradictory findings regarding changes in lipid profile following RIF (6, 9, 21-25).

RIF is known as a unique model of intermittent fasting (26). There is a tendency to intake foods that are rich in carbohydrate and lipids, particularly those which contain mono- and poly-unsaturated fatty acids (27, 28). This change in the eating schedule along with changes in sleeping habits and physical activities bring a change in lifestyle with reduced duration of sleep at night (29). It has been established that a given nutrient ingested at an unusual time can induce different metabolic effects (30). Many physiological and psychological changes take place during Ramadan, most probably due to the changes in eating patterns, eating frequency and disturbed sleep patterns (31). Although it is a matter of debate, but it is quite justified to speculate that there might be some alterations in the hematological parameters as well as in renal markers during the month of RIF. Literature is available in this context in Indian and overseas populations, but pertinent data is unavailable in Eastern Indian context. Moreover, hematological parameters and renal markers were not studied in the similar population, rather those were reported from different provinces of the country.

The present study was aimed to investigate the impact of RIF on selective haematological parameters and blood renal markers in young Muslim males of Kolkata, India.

## Methods

### Study protocol

The entire study was conducted in the Sports and Exercise Physiology Laboratory, Department of Physiology, University of Calcutta, India during 18<sup>th</sup> June to 17<sup>th</sup> July, 2015. Subjects visited the laboratory for 2 occasions. First study session was conducted just before the Ramadan month starts, i.e. on the preceding day of the Ramadan month. The post-experimental trial was conducted on the very next day after the Ramadan month to record

the post-Ramadan values of the studied parameters.

### Selection of subject

Thirty seven Young Muslim untrained male subjects (mean age:  $22.73 \pm 1.56$  years, mean height:  $165.35 \pm 6.35$  cm) who were undergoing RIF were recruited from different parts of Kolkata, India as the experimental group (EG) in this time series study. Another group of forty untrained Muslim male subjects (mean age:  $22.92 \pm 1.36$  years, mean height:  $166.17 \pm 3.88$  cm) who were not undergoing RIF and other rituals of the month of Ramadan were recruited from the same community as the control group (CG). All the subjects belonged to the age group of 20–25 years with similar socioeconomic background. The sample size was calculated using the method of Das and Das (32) where the input of confidence interval was set as 95%. The study was conducted with thirty seven (37) and forty (40) subjects in experimental and control group, respectively, which was greater than the computed sample size of thirty two (32) in each group. The pre Ramadan and post Ramadan body weight of CG were  $55.93 \pm 6.33$  kg and  $56.39 \pm 7.31$  kg, respectively and that for EG were  $57.5 \pm 7.26$  kg and  $55.53 \pm 7.28$  kg, respectively.

Subjects belonging to religions other than Muslim, doing regular exercise, and under medication or with any history of health complication were excluded from the study. The experimental protocol was explained and demonstrated to all of them in the familiarization trial to allay their apprehension. Each subject signed the written informed consent form. The entire study was approved by the Human Ethical Committee, Department of Physiology, University of Calcutta.

Age of each subject was calculated in nearest year from the date of birth as obtained from their identification card issued by the Government of India. Subjects arrived in the laboratory at 9 am in all the occasions. Body height and body mass were measured with the subject standing barefoot and wearing minimum clothing on a weighing machine fitted with height measuring rod (Avery India Ltd, India) with an accuracy of  $\pm 0.50$  cm and  $\pm 0.1$  kg, respectively.

**Blood collection**

Four (4) ml of venous blood was collected from each volunteer just before the onset of holy month of Ramadan (Day 0) and just after the end of RIF. Blood was collected in plain and EDTA tubes. Fresh EDTA blood was used to determine haematological parameters. After the extraction of serum, various biochemical tests were performed.

**Estimation of Haemoglobin and TC, DC (33):**

Haemoglobin was estimated by Drabkin's method using the Drabkin's reagent solution. Total count and differential count was done according to Mukherjee (33).

**Estimation of biochemical parameter:**

Serum total cholesterol (TC) and high density lipoprotein- cholesterol (HDL-C) were measured by an enzymatic colorimetric method using cholesterol oxidase, peroxidase, and the chromogen 4-aminophenazone/phenol (34). Serum triacylglycerols (TAGs) levels were determined by an enzymatic colorimetric method using lipoprotein lipase glycerokinase, glycerphosphate oxidase, and the chromogen 4-aminophenazone/N-ethyl-N (3-sulphopropyl)-nramisidine (35). Low-density lipoprotein - cholesterol (LDL-C) was calculated by using standard equation (36). Serum total proteins were determined by Biuret method (37).

**Statistical analysis**

Data were expressed as Mean±SD. Two tail students

t-test was performed to find out the significance of difference of mean values between the studied groups.

**Results**

Values of the different haematological parameters were presented in Table I whereas Table II showed the values of lipid profile parameters in the studied groups. Fasting blood sugar, renal markers such as serum creatinine, urea, serum total protein and electrolytes were shown in Table III. No significant difference was found between pre and post Ramadan values of all the studied parameters. Pre-Ramadan fasting blood sugar level did not show any significant inter-group variation but post-Ramadan values of fasting blood sugar level showed significant variation between CG and EG. Pre-Ramadan value of fasting blood sugar level was significantly different than that of post-Ramadan value in EG. This finding indicated that RIF imposed significant effects on fasting blood sugar level in the studied population.

**Discussion**

Muslims are restricted from eating, drinking and smoking from sunrise to sunset during RIF without any restriction in food types (6). Body weight showed a slight increase in case of CG but not statistically significant. The blood sample was collected before and after the month of Ramadan to evaluate the effects of RIF on hematological parameters in fasting young Muslim males of Kolkata, India. It would have been of more scientific interest if the blood samples could have been collected during the fasting month of Ramadan. However, the subjects

TABLE I: Haematological parameters of the experimental and control groups before and after Ramadan Intermittent Fasting.

	Control (n=40)		Experimental (n=37)	
	Pre-Ramadan	Post-Ramadan	Pre-Ramadan	Post-Ramadan
Hb Conc.(gm/dl)	12.97±0.65	12.77±0.68	12.66±0.72	12.47±0.75
RBC (Millions)	4.53±0.23	4.45±0.22	4.47±0.27	4.42±0.22
WBC (CU/mm)	8232.5±475.77	8297.5±379.94	8100±615.54	8027±514.05
Neutrophil	69.41±2.92	68.81±2.88	64.70±5.94	65.76±5.57
Eosinophil	4.92±0.68	5.32±0.91	4.65±0.68	5.08±1.04
Lymphocyte	25.68±2.97	25.81±2.71	29.81±5.85	28.46±5.70

Data were expressed Mean±SD

TABLE II: Lipid profile of the experimental and control group subjects before and after the Ramadan Intermittent Fasting.

	Control (n=40)		Experimental (n=37)	
	Pre-Ramadan	Post-Ramadan	Pre-Ramadan	Post-Ramadan
TG (mg/dl)	109.46±9.95	107.38±8.56	108.41±13.34	111.51±12.35
TC (mg/dl)	159.03±7.14	159.86±6.81	158.97±7.21	158.54±5.91
HDL (mg/dl)	41.05±3.54	40.97±2.28	40.95±2.90	42.05±2.04
LDL (mg/dl)	96.11±5.13	98.35±5.31	98.03±6.67	96.84±5.04
VLDL (mg/dl)	21.86±2.86	20.54±2.91	20.43±3.95	19.65±2.99

Data were expressed as Mean±SD, TG = Triglycerides, TC = Total cholesterol, HDL = High density lipoproteins, LDL = Low density Lipoproteins, VLDL = Very low density Lipoproteins.

TABLE III: Renal markers, Electrolyte, Serum protein and fasting blood glucose level of studied populations before and after Ramadan intermittent fasting.

	Control (n=40)		Experimental (n=37)	
	Pre-Ramadan	Post-Ramadan	Pre-Ramadan	Post-Ramadan
Urea (mg/dl)	24.13±2.31	23.3±2.66	23.51±2.43	23.81±2.25
Creatinine (mg/dl)	0.83±0.05	0.82±0.05	0.81±0.06	0.82±0.07
Serum Protein (mg/dl)	7.40±0.43	7.32±0.33	7.46±0.31	7.52±0.33
Sodium (mEq/L)	135.25±2.49	134.15±2.77	134.30±2.88	135.27±2.31
Potassium (mEq/L)	4.28±0.23	4.19±0.26	4.16±0.33	4.09±0.23
Chloride (mEq/L)	95.85±2.95	96.05±2.35	95.03±3.08	95.27±2.27
FBS (mg/dl)	92.84±6.29	92.09±5.00	93.86±6.11*	86.46±5.91**

Data were expressed as mean±SD, \*P<0.001 (when compared with Control), \*\*P<0.001 (when compared with intra group).

denied to prick the finger during the holy month. The present study depicted a slight but statistically insignificant decrease in body weight following the month of RIF in the experimental group as also reported in earlier studies (18, 38). This finding contradicted other studies that reported a significant decrease in body weight following RIF (6, 39). These decreases in body weight following the month of Ramadan might be partly due to increased utilization of stored body fat (12, 40). Different types of food habits and geographical as well as social and environmental factors might be responsible for such inconsistent findings. CG showed no such change in body weight. Though it is a limitation that the fat-free mass was not measured in this study, but the insignificant change in body weight before and after RIF in both the groups (EG and CG) might be due to the insignificant variation in the fat-free mass as reported by Fenneni et al. (38).

Literature depicted inconsistent and conflicting results on the effects of RIF on haematological parameters. In the present study, pre- and post- RIF haemoglobin concentrations did not show any

significant change in both the groups. This finding is in concurrence with earlier studies (10, 41), but other investigations reported contradictory findings. An increase in hematocrit and a decrease in hemoglobin in elite judokas were noted by Chaouachi et al. (11), whereas Maughan et al. (16) noted a decrease in both the parameters in soccer players. Tayebi et al (13) reported insignificant change in either parameter. Pre- and post-Ramadan values of total and differential count of WBC remained unchanged in both the groups and this finding corroborated with previous findings (17, 42) while contradictory finding also exists (43). Geographical, climatic and nutritional variation might be responsible for the existence of such conflicting findings (44).

Lipid profile is one of the indicator of cardiovascular fitness. In the present study young Muslim males showed insignificant alteration in lipid profile parameters following RIF in both the groups. Literature depicted different controversial findings regarding the lipid profile during RIF. Ramadan fasting played a beneficial role on lipid profile by increasing HDL-C and decreasing LDL-C (18, 45, 46). However,

it was contradictory to the present finding. They hypothesized that changes in fat intake and inherent metabolic changes during RIF might be responsible for increased HDL-C. Mirzaei et al., (47) reported significant reduction in LDL-C and total cholesterol. However, other studies (17) reported insignificant alteration in HDL-C, LDL-C, triglycerides and total cholesterol during and after RIF as also observed in the present study. Similar to other studies (6, 47) Serum TG and VLDL remain unchanged in the present study but other study reported significantly increase in serum TG (48). Present finding of insignificant variation in serum cholesterol following RIF in both the groups corroborated with earlier literature (49, 50).

Present study was also aimed to investigate that whether RIF imposed any effect on renal function due to restricted intake of fluids from sunrise to sunset, i.e. for about 12 hours or more. Present finding revealed insignificant impact of RIF on urea and serum creatinine level. Altered food and restricted fluid intake in day time for one month was anticipated to alter the renal functioning but the finding deviated from the speculation as also reported by Attarzadeh et al. (51). Creatinine is an important energy storage substance in muscle metabolism and a waste product of creatine (52). In sports science, creatinine is used for evaluating the health of athletes, particularly in sporting competitions where hydroelectrolytic balance is vital for success (53). A significant rise in serum creatinine and blood urea levels was reported in previous literature (54) while other stated significant reduction in urea and creatinine values in Ramadan fasting group (55). Present study depicted insignificant change in blood urea level following the month of Ramadan. Significant increase in blood urea level by the end of Ramadan was reported by Nomani et al., (36). Many factors might be responsible for such difference in findings, e.g., diet, daily activity, sleep pattern, the season of fasting, socio-economic factors, geographical and climatic conditions of the concerned places.

Serum sodium concentration is an important marker of the hydration status of athletes (56). Present observation revealed insignificant alteration in serum sodium concentration following RIF in both the groups

and this finding was in agreement with previous studies (12, 16). On the other hand, an increase in serum sodium concentration was reported during RIF by Trabelsi et al., (39). Existence of such contradictory findings in different studies might be due to the differences in climatic conditions. The average temperature in Kolkata during this study was 28-30°C, with an average relative humidity of 80-89%. In comparison, the average temperature during the studies conducted by Maughan et al (16) and Ramadan et al. (12) was 26°C and 20-25°C, respectively, with an average relative humidity of 72% and 25-37°C, respectively. Ramadan fasting did not affect serum potassium concentrations in young Muslim men of Kolkata. Serum potassium concentrations during Ramadan noted an increase in soccer players by Maughan et al., (16). Pre- and post-Ramadan values of serum chloride concentration remain unchanged in the present study. The exact reason for this finding remained unclear.

CG showed insignificant variation in fasting blood sugar level before and after the month of Ramadan. But, EG depicted significant difference in fasting blood sugar level before and after the month of Ramadan. Thus, RIF influenced the fasting blood sugar level in the studied population and this finding corroborated with earlier findings. A slight increase in blood glucose was also reported by Mansi et al., (46) where as other studies opposed this findings (6, 40). Some other studies contradicted with the finding of insignificant variation in the fasting blood sugar level during the month of Ramadan (10, 16, 39). However, it is a major limitation that the data of dietary pattern or food intake was not monitored in the present study.

#### **Conclusion**

The present investigation revealed that RIF depicted no adverse effects on the haematological parameters of young untrained male Muslim individuals of Kolkata, India. A mild but statistically insignificant reduction in body weight was noted in this study after the month of Ramadan. However, insignificant alteration in lipid profile parameters, renal markers - and electrolytes - were noted before and after the month of Ramadan in both the groups. Blood glucose level

of pre and post Ramadan showed significant alteration in EG. On the other hand post Ramadan value of blood glucose level showed significant change

when compared with CG while insignificant difference in pre- and post-Ramadan values of blood glucose level was found in the CG.

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