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Impact of Ramadan fasting on lipid profile and cardiovascular risk factors in patients with stable coronary artery disease

Research Article

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Abstract

Background: Ramadan fasting concerns over one billion Muslims in the world.

The effects of fasting on cardiometabolic risk factors in patients with stable ischemic heart disease are not well known.

Aim :we aimed to evaluate the impact of fasting on lipid profile and cardiovascular risk factors in patients with stable coronary heart disease.

Methods: Patients with stable ischemic heart disease with the intention to fast were recruited. Detailed clinical and biochemical assessments were performed before and after the holy month. Parameters of glycemic control, lipid profile, ultrasensitive C-reactive protein concentration (Us-CRP) and homocysteine were measured pre- and post-fasting.

Results: This study did not find any significant deterioration of anginal status. Levels of cholesterol, triglycerides, low-density lipoprotein-cholesterol (LDL-CT) and apoprotein A were significantly improved after Ramadan fasting in comparison with their pre-Ramadan values. Our results demonstrated a significant decrease in blood fasting glucose, insulin level, homeostasis model assessment of insulin resistance index (HOMA-IR) and in Us-CRP level.

Conclusion In patients with stable ischemic heart disease, Ramadan fasting may be accompanied by an improvement of lipid profile and glycemic parameters without increase in coronary events.

Keywords: Ramadan fasting, lipid, blood sugar, cardiovascular risk factors, ischemic heart disease.

Abbreviations list:

Us-CRP: ultrasensitive C-reactive protein

LDL-CT: low density lipoprotein-cholesterol

HDL-CT: high density lipoprotein-cholesterol

HOMA-IR: Homeostasis model assessment of insulin resistance index

CAD: coronary artery disease

Introduction

Ramadan represents the holiest lunar month in the Islamic calendar.

Ramadan fasting concerns over one billion observant Muslims in the world (1).

From a physiological standpoint, Islamic fasting is a unique fasting model. It is distinct from voluntary or experimental fasting.

During Ramadan, fasting Muslims carefully abstain from all oral intakes of food, water, beverages, and drugs for more than 10 hours (from sunrise to sunset) each day during a whole month.

Ramadan fasting traditionally makes a radical change in lifestyle and dietary habits which may affect cardiovascular risk in patients with coronary artery disease (CAD). Although more than a billion Muslims worldwide fast during Ramadan, there is no overwhelming consensus on its effects on ischemic heart disease (2). Some published studies have shown that the effects of fasting on stable patients with CAD are minimal and the majority of them can experience Ramadan fasting with no clinical deterioration (3-6). However, there are some controversies (7).

In fact, patients with cardiovascular disease are categorized as high risk for Ramadan fasting in the last practical guidelines (8).

Otherwise, most of these studies were performed in the Middle East and Gulf areas, and therefore such conclusions may not be extrapolated to the *Mediterranean* region's *population*, where the period of daily fasting may be longer and the quality of food intake and physical activity may change (9).

In the present study, we aimed to objectively evaluate the potential impact of fasting on lipid profile and other biochemical markers that are traditionally used for accurately predicting cardiovascular events in patients with stable coronary artery disease.

Subjects and methods

Study design

This was a prospective observational study that was carried out in a group of patients with a documented previous history of CAD. Eighty-four out patients with stable ischemic heart disease with the deliberate intention to fast were recruited in the department of Cardiology. Detailed clinical and biochemical assessments were performed before the beginning of Ramadan and within the first week after this month. We investigated the effects of fasting on body weight, blood pressure, lipid profile, glycemic control, and inflammatory markers.

This study was conducted in the month of Ramadan during May/June 2019 in the city of Tunis, Tunisia. Patients were followed with three consecutive visits before and during Ramadan to witness whether they were capable to continue fasting, and immediately after the sacred month.

The average fasting period totals 16.5hours. Height and weight were recorded for

Each subject and averaged for analysis. Body mass index was calculated to the nearest decimal place by using the formula weight in kilograms/ height in square meters. Blood pressure was measured using validated monitors.

Subjects

The study enrolled patients between 18 and 70 years old with a documented previous history of CAD in the past 5 years. We excluded patients with ongoing myocardial ischemia (class III-IV angina of The *Canadian* Cardiovascular Society), pregnant and lactating women, subjects aged below 18 years old and those who fasted for less than 20 days. Patients with any type of acute or chronic inflammation were also excluded. Written informed consent was obtained from all subjects. All participants were instructed not to make any changes to their usual physical activities during Ramadan.

Sample collection and preservation

Fasting blood samples were collected from each patient between 9 am and 11 am a week before Ramadan and in the first 7 days after the end of this month. Approximately 6 ml venous blood sample was collected from the left arm by using a vacuum sampling method and analyzed in the same hospital affiliated laboratory. Blood samples were centrifuged to separate the plasma at 3000 rpm for 5 min at 4 C and were kept at -20 C until analysis.

Determination of biochemical parameters

The levels of triglycerides, total cholesterol, HDL-CT, apoproteins A and B, and total protein were measured by an enzymatic colorimetric method with an automated chemical analyzer (The Abbott Architect c8000).

LDL-CT was estimated following the Friedewald

formula (10). HDL risk was also estimated [Cholesterol (mmol /l) /HDL-CT (mmol/l)]

The level of fasting blood sugar was measured using the glucose oxidase method and noted as mmol/l. Insulin concentration was measured by chemiluminescence.

HOMA-IR was calculated using fasting glucose and fasting insulin as follows:[fasting insulin (mUI/L) fasting glucose (mmol/l)]/ 22.5. HOMA-IR ≥ 2.6 was considered a marker of insulin resistance. Us-CRP and Homocysteine were measured using a radioimmunoassay method.

Statistical analyses

The data were reported as mean ± standard deviation. A paired t-test was used to compare pre- and post-Ramadan levels of biochemical variables. Statistical analysis was performed using SPSS 20.0 software. Differences were considered significant at $p < 0.05$

Results

A total of 114 subjects initially consented to voluntarily participate in the study; however, 22 patients were excluded because of fasting for less than 20 days and 8 subjects declined to participate for personal reasons. Eighty-four patients including 79 males and 5 females with a mean age of 57±7 years completed the study. During the holly month we did not identify any clinical deterioration or significant worsening of CAD. Baseline clinical characteristics, history and ongoing treatment are summarized in Table 1.

Table1: Baseline clinical characteristics, medical history and treatment

Cardiovascular risk factors	84 patients, nb (%)
Hypertension	57(68%)
Diabetes	26(31%)
Dyslipidemia	18(13%)
Smoking	60(71%)
Family coronary artery disease	20(24%)
Sedentary lifestyle	62(74%)
Cardiovascular history	
Stroke	5(6%)
Myocardial infarction	18(21%)
Coronary angioplasty	26(31%)
Coronary artery bypass graft	27(32%)
Treatment	
Statins	47 (56%)
Oral antidiabetics	26(31%)
Angiotensin Converting enzyme inhibitor	52 (62%)
Beta-blocker	57(68%)
Calcium inhibitor	7 (8%)
Diuretics	5(6%)
Aspirin	72 (86%)
Clopidogrel	11(13%)

The values of total cholesterol, triglycerides, and LDL-CT, were significantly decreased after Ramadan fasting; however, the changes in HDL-CT cholesterol were not significant. HDL risk decreased significantly during Ramadan than before fasting (4.85±1.49 vs 4.26±1.37 $p<0.001$). Apoprotein A significantly increased after fasting, but we didn't find any significant changes in apoprotein B before and after fasting (Table 2).

Table 2: Effect of Ramadan fasting on clinical, anthropometric and biochemical parameters.

Variables	Pre-Ramadan	Post-Ramadan	*p value*
BMI (Kg/m²)	26.84±3.18	26.80±3.14	**0.094**
SBP (mmHg)	132.9±16	129.9±17	**0.03**
DBP (mmHg)	83±8	82±7	**0.07**
Cholesterol (mmol/l)	4.34±1.2	3.83±1.18	<0.001
Triglycerides (mmol/l)	2.04±1.34	1.79±1.33	<0.05
LDL-CT (mmol/l)	2.51±0.91	2.26±0.87	<0.001
HDL-CT (mmol/l)	0.91±0.18	0.91±0.16	0.750
HDL- risk	4.85±1.49	4.26±1.37	<0.001
Apoprotein A (g /l)	1.21±0.15	1.26±0.15	<0.01
Apoproteins B (g /l)	0.85±0.27	0.97±0.53	0.055
Fasting Glucose (mmol/l)	7.14±3.21	6.58±2.68	**<0.001**
Insulin(µU/ml)	11.69±6	9.93±5.13	**<0.001**
HOMA-IR(%)	3.84±2.8	3.08±2.5	**<0.001**
Vitamin B12 (pg/ml)	300±191	374±248	**<0.001**
Homocysteine (µmol/l)	11.18±1.79	11.4±1.68	0.159
Folate (ng/ml)	3.82±1.34	5.04±1.55	**<0.001**
us-CRP (mg/l)	2.18±1.22	1.97±1.08	**0.034**

Fasting blood sugar, insulin concentrations and HOMA-IR index showed a significant decrease after Ramadan fasting ($p<0.05$) (Figure 1). Fasting decreased significantly blood sugar by 8% (7.14±3.21 vs 6.58±2.68 mmol/l, $p<0.001$). Post-Ramadan fasting, insulin levels were lower than pre-Ramadan fasting levels (11.69±6 vs 9.93±5.13 µU/ml, $p<0.001$).

Also, the HOMA-IR index significantly decreased after Ramadan (3, 84 vs 3, 08 %, p<0,001).

Ultra-sensitive CRP decreased significantly during Ramadan ($p=0.034$) (Fig. 1) but homocysteine didn't significantly change after fasting (11.18±1.79 vs11.40±1.68; $p = 0.159$).

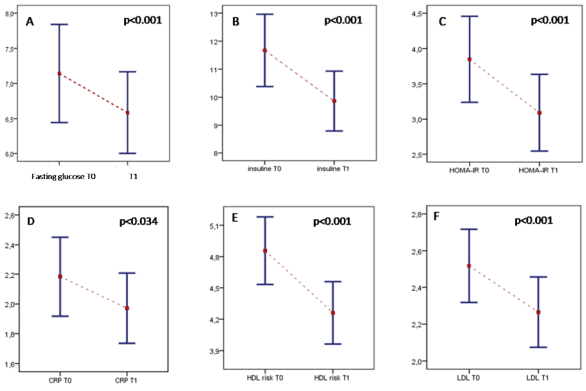

Figure 1: Effects of Ramadan fasting on glycemic control, inflammation and lipids profile markers: T0 (before Ramadan), T1(after Ramadan),fasting blood sugar (mmol/L) (A), insulin (µUI mL) (B), HOMA-IR index (C), Us-CRP (ng/L) (D), HDL-risk (E) and LDL-CT (mmol/L) (F).

Discussion

Our study found that Ramadan fasting may be accompanied by an improvement of lipid profile and glycemic parameters and does not increase acute coronary events in patients with stable ischemic heart disease.

Muslims worldwide represent a diverse and heterogeneous population in terms of health status. Many Muslim patients insist on fasting Ramadan even if it isn't mandatory, especially when fasting could worsen one's illness or delay recovery. Major changes in meal timings during fasting days, as well as changes in the quality and quantity of diet, could affect metabolic profiles.

Our results showed that fasting effects are beneficial and the majority of patients with stable coronary artery disease can endure Ramadan fasting without any clinical deterioration or any significant worsening of their anginal status.

These results are consistent with the investigation of Chamsi-Pasha et al which reported a non-significant effect of fasting on hospitalization rates for heart failure, acute myocardial infarction and the incidence of angina pain in patients with stable cardiovascular diseases (11). Also, Khafaji et al reported no adverse effects on the clinical status of stable cardiac patients while fasting during Ramadan (12). Another study showed that there was no significant difference in the number of hospitalizations for heart failure while fasting in Ramadan when compared to the non-fasting months (6).

Similar to our results ,Mossavi and al , showed that patients with underlying stable coronary heart disease can safely observe fasting in Ramadan without increased incidence of acute coronary syndrome (13).

The present study showed a significant decrease in cholesterol, triglycerides, LDLc, systolic blood pressure and a significant increase in plasma level of apolipoprotein A. Improvement of the lipid profile in patients with cardiovascular risk have been documented in several studies (5,9,14). In contrast to some reports in the literature, our results showed no significant differences in HDL-C levels and apolipoprotein B levels. Contrary to our findings, Nematy et al reported a significant increase in HDL-C levels (5). Other studies have shown that fasting is effective to ameliorate HDL, LDL/HDL, and TG/HDL ratios, and could be protective of coronary artery disease (3,15). This contradiction may result from the differences in dietary habits and calorie intake of the study population. Different geographical locations, climate conditions, as well as different socioeconomic status in *Mediterranean populations*, may explain, in part, some discrepancies observed in these studies.

A Tunisian report showed that dietary changes in Ramadan are associated with an increase in dietary cholesterol intake, which deteriorates plasma lipids, and apolipoproteins levels in patients with atherosclerosis risk (16).

The present study reported a decrease in us-CRP levels however; there was no significant change in homocysteine levels. This result is in contrast to that reported by Chennaoui et al, who found that CRP and homocysteine levels were significantly low during Ramadan (4). Previous investigations have indicated that Ramadan fasting has impressive effects on decreasing inflammation and oxidative stress markers (17,18). Asadi and al , reported that Serum amyloid-A, a sensitive marker of an acute inflammatory state, and protein carbonyl group, an important index of oxidative stress, was decreased significantly in patients with cardiovascular disease as compared with those of the baseline (before fasting) (19). Hunger creates a stressful situation and stimulates self-regulation mechanisms with suppression of sympathetic tone (12). This change has powerful anti-inflammatory effects which play an important role in atherogenesis and development of atherosclerotic plaques in coronary arteries (20).

Improved glycemic control has been reported in this study with a significant decrease in blood sugar fasting, insulin level, and HOMA index .These results were in agreement with other studies that have demonstrated the ameliorating effect of fasting on glycemic control (21,22). In a recent study, the majority of patients with stable ischemic heart disease and type 2 diabetes under optimal care were able to fast Ramadan without any significant change in cardiovascular risk factors or hospitalization for diabetes complications.

Glycemic control improved, however, hypoglycaemia was significantly more frequent and profound compared to non- fasting state (23).

Our study has several limitations. The main one is the small number of patients included and the absence of a non-fasting control group. Insufficient data on chronobiological modifications during fasting is an important factor, which affects the association of fasting with biochemical changes and could be another limitation of the present study.

Conclusion

This study showed an improvement in plasma lipids and cardiometabolic risk factors in patients with stable ischemic heart disease. The majority of these patients can fast without anticipating any major adverse cardiac events.

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