

# The effect of fasting in Ramadan on patients with heart disease

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## Summary:

**Background:** Knowledge about the clinical problems during the fast of Ramadan is important in order to opens the way to further research aimed at discovering the significance of Ramadan fasting in patients with heart disease.

**Patients and Methods:** Eighty-six outpatients with heart disease with intention to fast were studied in the month of Ramadan 2010 (1430 H) at the Ibn Al-bitar Hospital. Detailed clinical and biochemical assessments were performed within 3 days before the start of Ramadan and then on the last day of Ramadan.

**Results:** There were 54 (62.8%) males and 32 (37.2%) females with a mean age of 56.3 years (range, 17-84 ). Forty-six patients (53%) had coronary artery disease, 23 patients (27%) had valvular heart disease, 13 patients (15%) had congestive heart failure and 4 patients (5%) were treated for arrhythmia. Sixty-two patients (72%) were in New York Heart Association (NYHA) Class I, 18 patients (21%) in Class II, and 6 patients (7%) were in Class III. Seventy-four patients (86%) managed to fast during the entire Ramadan, 9 patients (10.4%) missed the fasting for up to 7 days, and 3 patients (3.5%) could not fast. There were no significant changes in the NYHA Class ( $p=0.12$ ). No significant changes occurred in any of the hematological or biochemical parameters during the fasting of Ramadan.

**Conclusion:** The effects of fasting during Ramadan on stable patients with cardiac disease are minimal. The majority of patients with stable cardiac disease can fast during Ramadan without significant detrimental effects.

**Key words:** Ramadan, fasting, cardiac disease, biochemical effects

*Fac Med Baghdad*  
2011; Vol. 53, No. 1  
Received Nov. 2010  
Accepted Dec. 2010

## Introduction:

Fasting in Ramadan, one of the 5 pillars of Islam is observed by approximately 400 million Muslims all over the world<sup>1</sup>. During Ramadan, Muslims abstain from food and drink from dawn until sunset. While a significant number of patients with heart disease insist on fasting despite the physician's medical advice, physicians do not always know how to advise such patients regarding fasting during Ramadan. Several studies had been conducted during the fast of Ramadan<sup>1,2</sup>. Only few have studied the metabolic implications of Ramadan fasting<sup>3,4</sup>. The aim of this study was to assess the impact of fasting during Ramadan on the clinical status of patients with cardiac disease, and to evaluate the effects of fasting on their biochemical profiles. To our knowledge, this is the first study on the effects of fasting on patients with cardiac disease

## Patients and Methods:

To study the effects of fasting Ramadan on cardiac patients, 86 patients seen in the cardiac outpatient clinic with intention to fast were studied. Patients were recruited to the study during the 3 days prior to the onset of Ramadan. Detailed clinical and biochemical assessments were performed within 3 days before the start of Ramadan and then on the 29<sup>th</sup> day of Ramadan. Fasting blood was taken for full blood count (EDTA 4.5 ml tube, Beckman Coulter Gen-S automated analyzer), erythrocyte sedimentation rate (ESR) (EDTA 4.5 ml tube, Westergen method), prothrombin time (PT), partial thromboplastin time (PTT) (citrate blood 4.5 ml

tube, Dade-Behring analyzer), sodium, potassium, urea, creatinine, total cholesterol, triglycerides, low density lipoprotein (LDL), high density lipoprotein (HDL), fasting blood sugar, uric acid, aspartate aminotransferase (AST), lactic acid dehydrogenase (LDH) and alkaline phosphatase (Hitachi 917 Roche Diagnostic analyzer, 5 ml BD Vacutainer (SST) with no additives). The blood was drawn between 12 and 2 o'clock p.m. The patients were advised to take their medications regularly and adjustment to once or twice daily drugs was made.

**Statistical analysis** All values are expressed as mean  $\pm$  standard deviation. Continuous variables are compared with 2 tailed t-test. Categorical variables are compared using the chi-square test. The  $p$  value  $\leq 0.05$  was considered significant

## Results:

The baseline characteristics are shown in **Table 1**. The majority of the patients were men (62.8%). The mean age was 56.3 years (range, 17-84). Forty six patients (53.4%) had CAD, including 18 patients who had coronary artery bypass grafting (CABG) and 11 patients with percutaneous transluminal coronary angioplasty (PTCA). Twenty-three patients (26.7%) had valvular heart disease, 13 patients (15.1%) had congestive heart failure (CHF) and 4 patients (4.6%) were treated for arrhythmia. All of the patients were on one or more cardiac drugs. Twelve patients were on warfarin. The majority of the patients were in NYHA Class I or II. Seventy-four patients (86%) managed to fast during the entire Ramadan, 9 patients (10%) missed the fasting of up to 7 days (only one of them was female), and 3

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patients (4%) could not fast. Patients were fasting for approximately 12 hours during this month of Ramadan. The mean weight decreased by 1.4 kg but was not statistically significant ( $p=0.5$ ). Subjectively, 67 patients (78%) reported no change in their symptoms, 7 patients (8%) experienced that their symptoms had improved and 10 patients (11.6%) reported worsening of their symptoms. However, there were no significant changes in the NYHA class ( $p=0.12$ ) nor there were any significant changes in the Canadian Cardiac Society (CCS) class in patients with coronary artery disease ( $p=0.45$ ). Subjectively, 80 patients were compliant with their drug therapy. None of the patients required hospitalization during the month of Ramadan. No significant changes occurred in any of the hematological or biochemical parameters during the fasting in Ramadan (**Table 2**). Analysis of data of patients with CAD (46 patients) showed no significant changes in hematological or biochemical parameters by the end of Ramadan (**Table 3**). Since females may miss few days of fasting due to their monthly period and this may affect the results, analysis according to gender was performed (**Table 4**). There were no significant changes in the parameters before and at the end of Ramadan in either males or females. There were no significant changes in the blood glucose level in both diabetics and non-diabetic patients (**Table 5**). In the group of patients receiving warfarin, no significant changes occurred in the prothrombin time ( $p=0.4$ ) though statistically significant change observed in partial thromboplastin time ( $p=0.04$ ). No complications related to anticoagulants were observed.

**Table 1 - Baseline characteristics.**

Characteristics	n (%)
Males	54 (62.8)
Females	32 (37.2)
Age (years)	56.3 (range 17-84)
Coronary artery disease	46 (53.4)
Valvular heart disease	23 (26.7)
Congestive heart failure	13 (15.1)
Arrhythmia	4 (4.6)
NYHA Class I	62 (72)
NYHA Class II	18 (20.9)
NYHA Class III	6 (6.9)
Diabetes mellitus	28 (32.5)
Hypertension	27 (31.3)
Hyperlipidemia	37 (43)
Obesity or overweight	47 (54.6)
Smoker	18 (20.9)
NYHA- New York Heart Association	

**Table 2 - Clinical and metabolic characteristics before and at the end of Ramadan.**

Characteristics	Before Ramadan	End of Ramadan	p value
Mean weight (kg)	78.5	77.1	0.50
Mean systolic BP (mm Hg)	132	131	0.62
Mean diastolic BP (mm Hg)	82	81	0.85
Mean NYHA Class	1.4	1.2	0.12
Mean hemoglobin (g/dl)	13.9	13.6	0.37

Mean ESR	24.2	22.7	0.52
Mean serum sodium (mmol/L)	139	139	0.88
Mean serum potassium (mmol/L)	4.3	4.4	0.52
Mean blood urea (mmol/L)	6.4	5.9	0.5
Mean serum creatinine (Umol/L)	85.8	86.5	0.88
Mean total cholesterol (mmol/L)	5.4	5.3	0.47
Mean high density lipoprotein (mmol/L)	1.0	1.0	0.82
Mean low density lipoprotein (mmol/L)	4.2	4.1	0.59
Mean triglycerides (mmol/L)	1.69	2.94	0.23
Mean serum uric acid (Umol/L)	313	322	0.59
Mean aspartate aminotransferase (U/L)	20.6	20.9	0.86
Mean lactic acid dehydrogenase (U/L)	144.3	141.1	0.57
Mean alkaline phosphatase (U/L)	76.8	75.7	0.80
Mean fasting blood glucose (mmol/L)	7.9	9.0	0.24

BP - blood pressure, NYHA - New York Heart Association Classification, ESR - erythrocyte sedimentation rate

**Table 3- Clinical and metabolic characteristics in subgroup with coronary artery disease.**

Characteristics	Before Ramadan	End of Ramadan	p value
Mean systolic BP (mm Hg)	131.8	131.2	0.27
Mean diastolic BP (mm Hg)	83.7	82.3	0.41
Mean NYHA Class	1.2	1.1	0.57
Mean hemoglobin (g/dl)	14.3	13.8	0.2
Mean ESR	25.7	25.3	0.89
Mean sodium (mmol/L)	139.2	139.2	1
Mean potassium (mmol/L)	4.37	4.4	0.82
Mean blood urea (mmol/L)	5.5	5.78	0.57
Mean serum creatinine (Umol/L)	86.8	86.7	0.99
Mean total cholesterol (mmol/L)	5.59	5.44	0.5
Mean high density lipoprotein (mmol/L)	0.95	0.95	1
Mean low density lipoprotein (mmol/L)	4.38	4.16	0.31
Mean triglycerides (mmol/L)	1.96	2.19	0.66

Mean uric acid (Umol/L)	321	329	0.74
Mean aspartate amino-transferase (U/L)	19.4	20.2	0.71
lactic acid dehydrogenase (U/L)	138	131	0.32
Mean alkaline phosphatase (U/L)	78.4	74.5	0.58
fasting blood glucose (mmol/L)	8.5	10.3	0.3
BP - blood pressure, NYHA - New York Heart Association Classification, ESR - erythrocyte sedimentation rate			

### Discussion:

The results of this study show that the effects of fasting during Ramadan on stable cardiac patients are minimal. Stable patients with heart disease can observe fasting during the month of Ramadan safely. Few studies have reported the metabolic effects of fasting during the month of Ramadan but the assessment of cardiac patients fasting during Ramadan has not been reported<sup>2,4</sup>. In an 18 sedentary adults reported by Ramadan et al<sup>5</sup> no significant changes occurred in maximal exercise capacity or treadmill walking efficiency during the month of Ramadan. Heart rate and ventilatory responses to moderately intense bouts of sub-maximal aerobic exercise (70% of maximum volume of oxygen utilization) were reduced but the actual difference was clinically small<sup>5</sup>. The ambulatory blood pressure in treated hypertensive patients did not differ before and during Ramadan<sup>6</sup>. Patients on thrice daily medications should be switched to twice daily or once daily regimens. Similarly our data show that systolic and diastolic blood pressures do not change significantly at the end of Ramadan compared to the beginning of Ramadan. It is not known if mild dehydration and hemoconcentration may harm those with moderate to severe coronary artery disease. Temizhan et al<sup>7</sup> speculated that fasting during Ramadan does not lead to an increase in the number of acute coronary events. In their study, the number of patients admitted with Acute Coronary syndrome was significantly lower in Ramadan than before or after Ramadan. However, this may be due to reluctance of the patients to be admitted to hospital during the month of Ramadan, which will disrupt their fasting. Weight loss of 1.7-3.8 kg after fasting has been reported in normal weight individuals<sup>1,4,8</sup>. In our study, the mean body weight declined by 1.4 kg at the end of Ramadan. However, this was not statistically significant. Studies performed in healthy subjects on blood levels of blood urea nitrogen, serum creatinine, uric acid, protein, albumin, alanine amino-transferase, aspartate amino-transferase, hemoglobin, white blood cell count and the sedimentation rate did not show significant changes during Ramadan<sup>1,9</sup>. Although PT did not change significantly in patients on warfarin, an unexplained increase in PTT was observed in our patients at the end of Ramadan. Prior studies on the effect of

fasting during Ramadan on blood lipids show variable results. Some have reported an increase in the level of cholesterol with fasting<sup>4,10</sup>. Others have found no change or decrease in cholesterol level during Ramadan<sup>2,11</sup>. A marked increase in plasma HDL cholesterol of 23-30% after fasting was reported in smaller studies of healthy subjects<sup>2,12</sup>. The changes in blood lipids are probably related to the quality and quantity of food consumption and the degrees of weight loss. The adoption of low fat, low calories diet by hyperlipidemic healthy individuals may have lead to reduction in total cholesterol, LDL cholesterol and triglyceride levels<sup>13</sup>. In our study, no significant changes were observed in the total cholesterol, LDL or HDL cholesterol levels. Although there was a trend toward an increase in the level of triglycerides at the end of Ramadan, this was not statistically significant. Few studies have reported the effect of fasting during Ramadan on serum glucose. One study reported a decrease in serum glucose level by the end of Ramadan<sup>14</sup>. Other studies have shown a mild increase or variation in serum glucose concentration which may be due to amount or type of foods consumed during Ramadan<sup>1,11</sup>.

This study has important limitations. The sample size is relatively small, the lack of measurements during each week of Ramadan and the heterogeneity of the patient population. We did look at CAD patients alone since they represent the largest number of patients with heart disease. The conclusions from this study can not be extrapolated to patients with worse functional classes or those who are unstable. It is clear that more work should be carried out to evaluate the impact of fasting on cardiac patients with higher NYHA class. Assessment of functional class using specific measures such as the Minnesota Score should be performed in future studies. With an estimated 400 million Muslims in different states of health observing the fast annually, there is a vital need for more studies to document the effects of Ramadan on different states of illnesses. To our knowledge, this is the first study to systematically assess the effects of fasting during Ramadan on patients with cardiac disease. It opens the way to further research aimed at discovering the significance of Ramadan fasting in patients with heart disease.

**Conclusion:** The results of this study show that the effects of fasting during Ramadan on stable cardiac patients are minimal. Stable patients with heart disease can fast during the month of Ramadan safely.

**Table 4 - Clinical and metabolic characteristics in men and women.**

Characteristics	Male			Female		
	Before Ramadan	End of Ramadan	p value	Before Ramadan	End of Ramadan	p value
Mean systolic BP (mm Hg)	130	128	NS	137	135	NS
Mean diastolic BP (mm Hg)	82	82	NS	82	82	NS
Mean NYHA Class	1.3	1.2	NS	1.4	1.3	NS
Hemoglobin (g/dl)	14.5	14.4	NS	12.9	12.5	NS
ESR	20.8	20.2	NS	30.7	27.0	NS
Sodium (mmol/L)	139	139	NS	139	139	NS
Potassium (mmol/L)	4.4	4.4	NS	4.2	4.3	NS
Urea (mmol/L)	7.3	6.2	NS	4.8	5.3	NS
Creatinine (Umol/L)	92.3	94.6	NS	74.8	73.8	NS
Total cholesterol (mmol/L)	5.3	5.3	NS	5.71	5.30	NS
High density lipoprotein mmol/L)	1	1	NS	1	1	NS
Low density lipoprotein (mmol/L)	4.1	4.1	NS	4.3	4.2	NS
Triglycerides (mmol/L)	1.95	3.9	NS	1.24	1.28	NS
Uric acid (Umol/L)	335	337	NS	274	294	NS
Aspartate amino-transferase (U/L)	22.8	22.3	NS	17.0	18.7	NS
Lactic acid dehydrogenase (U/L)	147.8	139.3	NS	139.8	144.0	NS
Alkaline phosphatase (U/L)	75.8	74.8	NS	78.7	77.4	NS
Fasting blood glucose (mmol/L)	8.1	9.8	NS	7.61	7.75	NS

NS - non significant, BP - blood pressure, NYHA - New York Heart Association, ESR - erythrocyte sedimentation rate, HDL - high density lipoprotein, LDL - low density lipoprotein

**Table 5 - Fasting blood sugar in diabetics and non-diabetics (mmol/L).**

Patients	Before Ramadan	End of Ramadan	p value
Non-diabetics	6.6	7.04	0.27
Diabetics	10.82	13.36	0.34

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