

# **METABOLIC CHANGES DURING RAMADAN FASTING IN NORMAL PEOPLE AND DIABETIC PATIENTS.**

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## **ABSTRACT**

Fasting is obligatory on all Muslims every year during the 9<sup>th</sup> Islamic lunar month of Ramadan with exemption to sick, travelers and pregnant women. In spite of the fact that Islam provides exemption from fasting to people suffering from illnesses like diabetes, many patients still want to fast for personal convictions. Physicians often face a dilemma as to how to advise them. Several studies have been published on the effects of fasting; some of the results are controversial. The present study was undertaken to establish the effects of Ramadan fasting on various physiological parameters in normal people and in diabetic patients. This could be used as basis for advice to such patients. The study group consisted of 53 diabetic patients (31 male and 22 female) and 56 (21 male 35 female) healthy volunteers as controls. Inclusion criteria of diabetic patients were: to be non-insulin dependent, and be stable and under reasonable control on oral hypoglycemic drugs and or diet control alone. The subjects were evaluated 1-2 weeks before commencement of fasting (visit 1), at the 4<sup>th</sup> week of Ramadan fasting (visit2) and one month after the end of the Ramadan fast (visit3). Blood samples were collected on each occasion at least 8 hours after the last meal. Our results showed statistically significant weight reduction ( $P<.001$ ) at the end of Ramadan fast in both groups, however it was not maintained in both groups when values were compared before Ramadan and one month after Ramadan. Fasting blood sugar and HBA1C showed significant reduction ( $P<.001$ ) among diabetics but not in control group. The other parameters e.g. cholesterol, blood urea and creatinine did not show any significant changes before and during Ramadan. There was statistically significant increase in serum cholesterol and triglyceride and uric acid ( $P<.001$ ) among healthy volunteers (control group) one month after Ramadan compared to before Ramadan; however no such changes were seen among diabetic group. There was no reported case of serious complication due to fasting in both groups. *Conclusion:* Ramadan fasting lead to significant body weight reduction and improvement of glycaemic control in diabetic patients with out other significant metabolic changes.

**Keywords:** Ramadan fasting, Diabetes mellitus

## **INTRODUCTION:**

Fasting is prescribed by many religions of the world. Islam specifically outlines one full month of fasting during the month of Ramadan. It is a physiological, psychological as well as a spiritual experience. It is generally accepted that a reward for the self – discipline of fasting is better health.<sup>[1]</sup> The act involves refraining from food and drink from dawn until sunset, a period which varies by geographical location and season of the year. The act of fasting also forbids the person from consuming oral medications. As the month of Ramadan is based on sighting the new moon (lunar calendar), the fasting month goes on changing every year. Fasting is obligatory for all healthy adult Muslims during Ramadan.<sup>[2] [3]</sup> Eating and drinking is permitted only after sunset. Muslims typically take two meals after sunset and just before dawn. Individuals are exempted

from fasting if they are suffering from an illness that could be adversely affected by fasting. Those who suffer from diseases like diabetes fall into this category.<sup>[4]</sup> Our experience however shows that many diabetics fast during the month of Ramadan. Certain studies have attempted to correlate religious fasting and possible health benefits.<sup>[5], [6], [7]</sup> Clinical and biochemical effects of fasting among diabetics have been studied before but the results are not conclusive. Studies have reported substantial weight loss, signs of dehydration, raised serum concentrations of uric acid and cholesterol during Ramadan.<sup>[8]</sup> Other studies show Ramadan fasting induces a marked increase in high-density lipoprotein cholesterol and decrease in low-density lipoprotein cholesterol.<sup>[9], [10]</sup> Our aim is to study the effects of fasting on body weight, fasting blood sugar (FBS), glycosylated hemoglobin (HbA1c), serum lipids and renal functions before, during and after the act of fasting in both groups. Any reported case of acute complication related to fasting (hypoglycaemia or any other side effects) was also noted.

## **MATERIAL AND METHODS:**

This was a prospective study conducted in the Medical Faculty at the International Islamic University Malaysia (IIUM), Kuantan. The subjects were diabetic patients who agreed to participate in this study and consented to blood taking. They were chosen from the diabetic clinic Hospital Tengku Ampuan Afzan (HTAA) Kuantan. The decision to fast was entirely the patients own decision for religious convictions. Inclusion criteria were stable non - Insulin dependant diabetics on oral hypoglycemic drugs/diet control alone. All the participants had to fast a minimum of 25 days. Controls were students and staff both male and female from Medical Faculty, international Islamic university Malaysia (IIUM), Kuantan who volunteered to participate in this study. The study has been approved by the ethical committee.

The study was conducted in three visits:

- Visit 1-Before Ramadan (A period extending up to one week before Ramadan fasting).
- Visit 2-During the Ramadan fasting (The fourth week of fasting)
- Visit 3-Post Ramadan (one month after fasting)

During each visit the body weight was recorded and blood samples collected for fasting blood sugar, serum lipids, serum creatinine, uric acid, blood urea nitrogen. Blood sample for HbA1c analysis was taken during visit 1 and visit 3. Hypoglycemic events and other complications of fasting if any were recorded in visit 2.

The data for each patient were entered in a case report form at the initial visit and in the subsequent follow up visits. Base line data included demographic variables, diabetic history, any concomitant illness and drug therapy.

The aim of pre-Ramadan visit (Visit1) was to assess the physical well being of patients, assess their diabetic control and educate them in adjusting their diet and timing of medication during the month of Ramadan. They were also educated about the warning symptoms of hypoglycemia, dehydration, and any other possible complications. They were advised to break fast as soon as any such complication was noted. However they were instructed to carry on with their usual

living habits and physical activity. Blood samples were also collected for baseline blood levels. They were told to revert back to prior schedule after end of Ramadan.

The aim of post-Ramadan consultation (visit3) was to tell the participants the over all impact of fasting on their health and how they could maintain better diabetic control in future. Blood samples were collected for final analysis.

## **RESULTS:**

There were 53 diabetic patients (31 males and 22 females) mean age  $49.24 \pm 12.14$  (Range 14-67) years and 56 control (21 males and 35 females) with the mean age of  $29.26 \pm 11.16$  (range 22- 66) years. The details of ethnic group, sex and age are summarised in table 1.

The other medical problems already diagnosed among our diabetic patients were hypertension, ischemic heart disease, and hypercholesterolemia for which they were on medication. One patient had previous stroke and two had been treated for pulmonary tuberculosis (PTB) in the past. The patients were told to continue their medication as usual, only the timing was changed during fasting month.

There was a significant weight reduction ( $P < .001$ ) at the end of Ramadan fast in both groups. Among diabetic group fasting blood sugar showed significant reduction ( $P < .001$ ) but not in control group. The other laboratory values e.g. lipid profile and renal function did not show any significant changes.

In our study body weight did not show any significant change in either group as compared to before Ramadan. HBAIC showed significant improvement among diabetic group ( $P < .001$ ). There was statistically significant increase in serum cholesterol and triglyceride, and uric acid ( $P < .001$ ) among healthy volunteers (control group) one month after Ramadan as compared to before Ramadan which was not observed in diabetic group. There were no significant differences in renal function before and after Ramadan between these 2 groups.

## **DISCUSSION:**

In our study, both diabetic patients and control group showed significant reduction in body weight during Ramadan as compared to before Ramadan ( $P < .001$ ). This is probably due to dehydration as suggested by rise in blood urea and creatinine in both groups during Ramadan as compared to values before Ramadan, even though the parameters did not show statistically significant difference. In previous studies weight reduction has been shown among controls but not in diabetics.<sup>[11], [12], [13]</sup> However one month after Ramadan weight reduction was not maintained, and although low, it was not statistically significant in both groups. A review of literature shows controversy about weight changes in diabetics during Ramadan.<sup>[14], [15]</sup> Some studies show weight gain instead of loss<sup>[16]</sup>, while others show no change.<sup>[17], [18]</sup> It has been attributed to reduced daily activities by diabetics in fear of hypoglycemia. It has also been reported that overweight persons lose more weight than normal or underweight subjects<sup>[19]</sup>. Slight non-significant increases in some biological parameters have been attributed to dehydration and metabolic adaptation and have no clinical presentation.

Among diabetic group fasting blood sugar showed significant reduction ( $P < .001$ ) but not in control group. This was reconfirmed by HBA1C which showed significant improvement ( $P$  value  $< .001$ ) among diabetic group. This can be explained by decreased carbohydrate intake and decreased number of meals during Ramadan and among diabetics increased gluconeogenesis to keep blood sugar in normal range. The other laboratory values e.g. lipid profile and renal function did not show any significant changes. Many earlier studies have shown either no change or slight improvement in HBA1C values. There was statistically significant increase in serum cholesterol and triglyceride, and uric acid ( $P < .001$ ) among healthy volunteers (control group) one month after Ramadan fasting while no significant change was noted in renal parameters. Among diabetic group no such changes were observed. This can probably be explained due to over consumption of animal proteins in the controlled group, on the other hand diabetic patients were more cautious in their food intake. This is in contradiction to earlier study in which they have shown improvement in lipid profile among healthy volunteers during Ramadan.<sup>[20]</sup>

Three of our diabetic patients reported hypoglycemic symptoms in the first week of Ramadan, but none of them break the fast as it was mild in the form of dizziness and lethargy. Only a few cases of biochemical hypoglycemia without clinical hazards have been reported in the earlier studies<sup>[21], [22]</sup>. In addition, there was no reported case of acute complication from diabetic emergencies all through the period of our study.

## CONCLUSION:

Based on these findings, it was concluded that fasting during the month of Ramadan is relatively safe and devoid of any serious complications among stable diabetic patients provided they are properly educated about drug regimen adjustment, diet control, daily activities and possible complications and how to deal with them. It is beneficial as it leads to body weight reduction and improvement of glycaemic control. Benefits of fasting can be explained to them so that they maintain dietary control in future. We recommend that there should be an educational programme to give the positive benefits of Ramadan fasting and correction of negative customs of over eating and over indulgence in meat preparations and to have a more balanced eating habit through out year.

**TABLE1: Clinical Characteristics of the diabetic patients and the controls in the study**

	<b>Diabetic group</b> n=53 (%)	<b>Controls</b> N=56 (%)
SEX		
Male:	31 (58.4)	21(37.5)
Female:	22(41.5)	35(62.5)
Malay	50(94.3)	44(78.5)

Indian	2(3.7)	5(8.9)
Myanmar	0	3(5.3)
Arab	0	2(3.5)
Others	1(1.88)	2(3.5)
<b>Age(years)*</b>	49.24±12.14	29.26±11.16

deviation

\*Age is expressed as mean and standard

**Table 2: Co-existing medical conditions in the diabetic patients:**

	<b>No (%)</b>
Hypertension	25(47.1)
Ischemic heart disease	11(20.7)
Hypercholesterolemia	5(9.4)
Previous stroke	1(1.8)
Past h/o PTB*	2(3.7)

\*PTB: Pulmonary tuberculosis

**Table 3: Laboratory values\* tested among diabetic patients and controls before fasting (Visit 1) and during Ramadan (Visit 2)**

	<b>Diabetic patients (n=53)</b>			<b>Controls (n=50)</b>		
	<b>Visit 1</b>	<b>Visit 2</b>	<b>P value</b>	<b>Visit 1</b>	<b>Visit 2</b>	<b>P value</b>
	<b>Mean ±SD</b>	<b>Mean ±SD</b>		<b>Mean ±SD</b>	<b>Mean ±SD</b>	
Weight(kg)	70.7±12.6	69.8±12.6	.012	60.6±13.7	58.6±12.4	.001
Fasting blood sugar (mmol/L)	10.6±4.1	8.5± 3.4	.001	5.6± 0.70	5.4±0 .71	NS
Cholesterol (mmol/L)	5.7±1.08	5.9 ±0.9	NS	5.4 ± 0.9	5.6 ± 0.9	NS
Triglyceride(mmol/L)	1.8± .93	1.7 ±0.9	NS	0.8±0 .51	0.8 ± 0.6	NS
Urea(mmol/L)	4.2± 1.5	4.5±2.3	NS	3.6± 1.07	3.8± 2.3	NS

Creatinine(mmol/L)	82.±26	86±28	NS	76.2 ±2.4	76.04± 19	NS
Uric acid (micromol/L)	385±134	376±97	NS	281.3± 85	290± 77	NS

\*all values are expressed as mean and standard deviation

NS: not statistically significant

**Table 4: Laboratory values\* tested among diabetic patients/ controls before fasting**

**(Visit1) and one month after fasting (visit3):**

	diabetic patients n=50			controls n=48		
	Visit 1	Visit 3	P value	Visit 1	Visit 3	P value
	Mean ±SD	Mean ±SD		Mean ±SD	Mean ±SD	
Weight (Kg)	70.8±12.6	70.7± 12.5	NS	60.5±13.8	59.1±13	NS
Fasting blood sugar (mmol/L)	10.8±4.1	9.06±3.8	.002	5.5±0.6	4.9±0.7	NS
HBA1C	7.35±2.03	6.7±1.6	.001	4.84±0.6	4.86±0.5	NS
Cholesterol(mmol/L)	5.7±1. 09	5.7± 1.16	NS	5.5± 1	5.8 ±1.16	.001
Triglyceride(mmol/L)	1.7±0.4	1.8±1.3	NS	0.78±0 .5	1. ±0.6	.001
Urea(mmol/L)	4.1±1.4	5±2.5	NS	3.5±1	4.3±1.3	NS
Creatinine(mmol/L)	79.4±23	81±26.3	NS	75.5±17	90±22	NS
Uric acid (micro mol/L)	381±136	365±109	Ns	278±84	320±95	0.01

\*all values are expressed as mean and standard deviation

NS: not statistically significant.

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