

## The Effect of Ramadan Fasting on Hemoglobin, Hematocrit and Blood Biochemical Parameters

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### Abstract

**Background:** Physicians in Islamic countries believe that fasting in Ramadan is equal to ingestion of thirty pills regularly ingested every year for clearing the blood and fortifying the tissues. The effects of Islamic fasting on physiologic functions in normal conditions have been considered in different studies and different topics. This study was to determine the quantitative changes of hemoglobin, hematocrit and certain serum biochemical parameters during Ramadan fasting in apparently healthy Muslim college students.

**Methods:** Sixty-two students were followed in five stages: one week before, 3<sup>rd</sup>, 15<sup>th</sup> and 28<sup>th</sup> day of Ramadan and ten days after Ramadan, by proper blood sampling in suitable time of day.

**Results:** The findings showed a significant decrease in hemoglobin, glucose and uric acid on days 3 and 15 of Ramadan ( $P < 0.05$ ), a significant decrease in low-density lipoprotein cholesterol and glucose on day 28 of Ramadan and a significant increase in blood urea nitrogen and high-density lipoprotein cholesterol on day 28 of Ramadan ( $P < 0.05$ ).

**Conclusion:** Changes in biochemical and hematological parameters of blood during Ramadan fasting are very important and the Islamic countries physicians should be informed about these beneficial effects of fasting. It seems that more researches are required for evaluating these effects in various physiologic and pathologic conditions and there are yet many unanswered questions in this relation. We believe that one of the physician responsibilities about patients is guiding and helping them for doing the religious duties in disease conditions because this has a great effect on recovery of patient. This consideration makes strong the physician-patient relationship.

**Keywords:** *Hemoglobin, Hematocrit, Biochemical Parameters, Islamic fasting, Ramadan*

### Introduction

Islamic fasting in Ramadan is a religious obligation for Muslims that repeats every year for one lunar month and during this time the fasted person is not allowed to eat or drink for about 12 to 16 h according to different seasons. Is this program useful for gaining and maintaining a better health condition? Benefit of fasting for body is similar to a medical treatment plan.

Physicians in Islamic countries believe that fasting in Ramadan is equal to ingestion of thirty pills regularly ingested every year for clearing the blood and fortifying the tissues (1). The effects of Islamic fasting on physiologic functions in normal conditions have been considered in different studies and different topics, i.e. effect of fasting on metabolism of carbohydrate and fat, kidney function, electrolytes, hematopoiesis, etc. In Ramadan, Muslims do not drink and eat or sunrise to sunset and this is a suitable time for evalu-

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ating the effects of these limitations on physiologic functions at health and illness (2).

Nomani et al. have studied the effect of fasting in Ramadan on serum uric acid and weight in healthy men in the USA. The findings showed a significant increase in uric acid and a marked reduction of weight (3).

Abdel Fattah and colleagues in Jordan have done a research about the effect of fasting on biochemical parameters in normal subjects and in type II diabetics. The results showed that in healthy subjects only serum triglycerides and uric acid increased but in diabetics triglycerides decreased (4).

In Latifi study a decrease in glucose, potassium, phosphorus, total cholesterol, high-density lipoprotein cholesterol (HDL) and an increase in blood urea nitrogen (BUN) observed with no significant change in levels of triglycerides, uric acid or sodium (5).

The study was done by Sattarivand showed a decrease in total triglycerides, low-density lipoprotein cholesterol (LDL) and glucose in Ramadan and an increase in HDL (6). The goal of this study was to determine the quantitative changes of hemoglobin, hematocrit and certain serum biochemical parameters during Ramadan fasting in apparently healthy Muslim college students.

## Materials and Methods

This pre-experimental study was done in Bandar Abbas, a city with a warm and humid weather located in the South of Iran. Eighty students of Hormozgan University of Medical Sciences, 40 males and 40 females, were selected voluntarily. The criteria for enrolling in the study were as follows: eating and drinking only before sunrise and after sunset; fasting at least for 21 d; living in student's dormitory; no history of infectious or other inflammatory diseases at time of the study. For examining the parameters required for study, 5 ml blood obtained at five stages: one week before fasting; on days 3, 15 and 28 of Ramadan and 10 d after Rama-

dan. A 5 ml venal blood sample was taken in controlled condition (The same and correct technique of blood sampling; bringing to laboratory in icepack) and sent to the laboratory. The time blood sample was taken and weight of samples in all sampling periods was the same also arrangement of blood sampling from volunteers in all periods was the same. The time of blood sampling before and after the Ramadan was 5-6 am at which volunteers were fast and within the Ramadan time of blood sampling was 14-15 pm. Whole blood samples in laboratory was analyzed by a biochemist and a fixed cooperator and specific instrument. Assessment of glucose triglycerides, cholesterol, uric acid, LDL, HDL, BUN and creatinine was done with Pars-Azmoun kits and Autoanalyzer instrument model Hitachi 902 made in Japan. Hb and Hct were analyzed by sysmex kx21. Results analyzed by SPSS software and compared using one-way and paired *t*-test.

## Results

Initially eighty students participated in this study but sixty-two subjects terminated the study on the base of criteria. Of these, 35 cases (56.5%) were male and 27 cases (43.5%) were female. Thirty four cases (55.7%) had an age range of 21 to 25 yr and the mean age was  $21.47 \pm 2.14$  yr. Twenty one cases (42%) continued fasting for 29 d, 12 cases (24%) for 25-28 d and 17 cases (34%) for 21-24 d. In point of view of exercise, 3 cases had a regular and 24 cases had an irregular exercise program.

Laboratory findings (as mean of values): changes of Hct during study was not significant ( $P > .05$ ) but Hb decreased during first 15 d of Ramadan markedly ( $P < .05$ ), and again increased at second half of month. Glucose levels showed a decrease of 12.16 mg/dl at the end of Ramadan ( $P < .05$ ) but triglycerides showed an increase of 21.27 mg/dl during Ramadan ( $P < .05$ ). Serum cholesterol increased at first half of month ( $P > .05$ ) but

decreased at the end of month ( $P > .05$ ). Serum uric acid decreased at the end of month ( $P > .05$ ) and serum HDL increment was not significant at the end of month ( $P > .05$ ). Serum LDL decreased in first half of month ( $P > .05$ ) and then increased markedly ( $P < .05$ ). BUN and creatinine decrement were significant at the end of Ramadan ( $P < .05$ ). Comparison of results of Hb, cholesterol, BUN, uric acid and HDL before Ramadan and on 3<sup>rd</sup> day of the month showed significant difference ( $P < .05$ ) but other parameters changes were not significant (Table 1). Difference between results of Hb, glucose, uric acid and HDL before and on the day 15 of

Ramadan was significant ( $P < .05$ ) but not other parameters (Table 2).

Findings showed a significant difference between levels of glucose, HDL, LDL, BUN, and creatinine before and on day 28 of Ramadan ( $P < .05$ ) (Table 3).

Results of glucose, triglycerides, cholesterol and LDL levels 10 d after Ramadan compared with levels before Ramadan showed a significant difference ( $P < .05$ ) (Table 4). Difference between laboratory results in relation to sex and age was not significant. Decrements in mean weight of cases at the end of Ramadan were statistically significant ( $P < .05$ ) (Table 1-4).

**Table 1:** Comparison of the studied parameters before and on day 3 of Ramadan

Variables	3 <sup>rd</sup> Day of Ramadan		Before Ramadan		P. Value
	Mean	SD	Mean	SD	
Hematocrit (%)	44.214	4.381	43.142	5.259	.25
Hemoglobin(g/dl)	14.458	1.658	15.031	1.643	.03
Glucose (mg/dl)	67.965	6.573	74.396	16.969	.009
Triglycerides(mg/dl)	78.035	0.602	65.373	36.76	.151
Cholesterol(mg/dl)	121.678	25.264	105.813	30.634	.000
B.U.N (mg/dl)	10.932	2.326	12.05	2.706	.014
Uric Acid (mg/dl)	3.365	0.929	3.962	1.155	.000
H.D.L (mg/dl)	47.966	25.196	39.593	15.668	.033
L.D.L (mg/dl)	65.656	26.817	57.68	25.195	.059
Creatinine(mg/dl)	0.747	0.152	0.818	0.231	.06
Weight	57.697	8.373	58.773	8.485	0.061

**Table 2:** Comparison of the studied parameters before and on day 15 of Ramadan

Variables	15 <sup>th</sup> Day of Ramadan		Before Ramadan		P. Value
	Mean	SD	Mean	SD	
Hematocrit (%)	44.21	4.004	43.142	5.259	.38
Hemoglobin(g/dl)	14.091	1.916	15.031	1.643	.000
Glucose (mg/dl)	62.018	7.653	74.396	16.969	.000
Triglycerides(mg/dl)	70.86	30.376	65.373	36.76	.403
Cholesterol (mg/dl)	110.571	23.823	105.813	30.634	.39
B.U.N (mg/dl)	10.981	2.785	12.05	2.706	.053
Uric Acid (mg/dl)	2.984	1.165	3.962	1.155	.001
H.D.L (mg/dl)	43.527	13.963	39.593	15.668	.044
L.D.L (mg/dl)	55.826	22.481	57.68	25.195	.694
Creatinine (mg/dl)	0.753	0.191	0.818	0.231	.156
Weight (kg)	56.570	8.283	58.773	8.485	0.000

**Table 3:** Comparison of the studied parameters before and on day 28 of Ramadan

Variables	28 <sup>th</sup> Day of Ramadan		Before Ramadan		P. Value
	Mean	SD	Mean	SD	
Hematocrit (%)	43.244	4.129	43.142	5.259	.88
Hemoglobin (g/dl)	14.590	1.904	15.031	1.643	.099
Glucose (mg/dl)	62.09	6.918	74.396	16.969	.000
Triglycerides (mg/dl)	68.34	19.855	65.373	36.76	.44
Cholesterol (mg/dl)	110.881	26.713	105.813	30.634	.493
B.U.N (mg/dl)	16.148	2.545	12.05	2.706	.000
Uric Acid (mg/dl)	3.748	1.195	3.962	1.155	.971
H.D.L (mg/dl)	43.284	12.208	39.593	15.668	.022
L.D.L (mg/dl)	48.357	19.622	57.68	25.195	.041
Creatinine (mg/dl)	1.073	0.176	0.818	0.231	.000
Weight (kg)	57.937	7.760	58.773	8.485	0.000

**Table 4:** Comparison of the studied parameters before and on day 10 after Ramadan

Variables	10 <sup>th</sup> Day after Ramadan		Before Ramadan		P. Value
	Mean	SD	Mean	SD	
Hematocrit (%)	44.181	5.28	43.142	5.259	.05
Hemoglobin (g/dl)	14.976	1.621	15.031	1.643	.137
Glucose (mg/dl)	65.478	12.231	74.396	16.969	.001
Triglycerides (mg/dl)	86.644	26.933	65.373	36.76	.000
Cholesterol (mg/dl)	127.374	29.793	105.813	30.634	.000
B.U.N (mg/dl)	11.408	3.022	12.05	2.706	.548
Uric Acid (mg/dl)	3.788	1.09	3.962	1.155	.958
H.D.L (mg/dl)	43.304	8.083	39.593	15.668	.148
L.D.L (mg/dl)	68.954	24.464	57.68	25.195	.001
Creatinine (mg/dl)	0.759	0.207	0.818	0.231	.517
Weight (kg)	56.026	8.033	58.773	8.485	0.000

## Discussion

The published articles about Ramadan fasting and its effects revealed different findings probably due to geographical positions, type of diets as a tradition, time of study, etc.

In this study, Hct increased slightly on 15<sup>th</sup> and 28<sup>th</sup> of Ramadan that might originate

from dehydration during fasting. In the other hand, changes in Hb were not matched with those of Hct. In Janghorbani study observed slight increase in Hb and Hct developed on 14<sup>th</sup> and 28<sup>th</sup> of Ramadan. Although these changes were statistically significant, did not exceed the normal limits (7).

In Sattarivand study, changes of hematological parameters were in normal ranges and a decrease in Hb observed (6). Another study in Saudi Arabia revealed a significant decrease in Hb, MCHC and WBC number (1). In Azizi and Rasouli's study, blood cell count and Hct remained normal during Ramadan (8).

In our study, mean plasma glucose showed a decrement significantly after Ramadan in comparison to initial levels. Other studies also have reported marked decline in glucose level during Ramadan (5, 7, 8). This strongly indicates the beneficial effects of Islamic fasting in diminishing plasma glucose. In prolonged hunger, plasma glucose concentration decreases to lowest possible level and after one week of hunger it starts to increase. If hunger continues for more than three weeks, glucose exceeds the initial levels. In ordinary conditions glycogenolysis maintains plasma glucose level around normal values for 12-16 hours and in prolonged hunger this phenomenon is able to preserve plasma glucose levels in normal ranges for 2-10 d and then after, breaking-down of fats is the most important factor interfering with decrease in glucose. In this situation, roles of important factor interfering with decrease in glucose. In this situation, roles of Insulin and Glucagon are prominent and essential (9).

In our study, there was an increment in triglycerides levels during Ramadan. This result was statistically significant on 28<sup>th</sup> of Ramadan in comparison to before Ramadan. It might be attributed to consumption of more carbohydrate during Ramadan. Studies of Amiri and Dehghani show no significant changes for triglycerides and cholesterol level during fasting (9, 10). In Janghorbani's study, serum triglycerides decreased slightly at the end of Ramadan and in triglycerides increased in subjects using high carbohydrate diet during fasting (7). Some studies have also reported increased level of serum cholesterol. Results of cholesterol measure-

ment in our study showed an increase after Ramadan. Although the Majority of studies have shown increase in cholesterol during fasting, a few ones have also reported a decline or no-changes (1, 12-14).

These discrepancies may be explained by different food habits in particular populations, however, it is possible that the varying results may be due to different seasons during which Ramadan takes place. Two other factors also play a part. First, previous studies have shown that serum cholesterol was significantly higher when the daily food intake was served as one large meal. The second factor is the type of food consumed during Ramadan, as there is a tendency towards increased intake of carbohydrate; mainly sucrose, especially to break the fast and during the night and fat like lamb, beef and milk, which are rich in cholesterol (11).

Since diets during fasting are different with other months and a special desire is present for eating carbohydrate, this is probably the cause of increased triglycerides and cholesterol values.

It seems that changes in triglycerides and cholesterol levels are mainly due to volume of ingested food and its fat content during fasting rather than impaired metabolism. In Janghorbani study, uric acid increased on 14<sup>th</sup> and 28<sup>th</sup> of Ramadan but no marked change in level of urea and creatinine was observed (7).

Increase in uric acid level may be due to tissues nucleic acid breakdown and resulting also from a decrease in glomerular filtration rate and uric acid clearance. Some authors have reported a decrement in uric acid accompanied by weight reduction in obese subjects. In our study, uric acid level decreased significantly in mid 15 of Ramadan. Decrement of BUN was significant in recent study but creatinine changed slightly.

Our study showed a significant increase in HDL at the end of Ramadan which was very important according to total cholesterol in-

crement. In other studies, a decrease in triglycerides, total cholesterol, LDL and an increase in HDL were observed in hyperlipidemic fasted subjects. Decline in lipid-related risk factors has been seen more among people who are using low-calorie diet during fasting (6, 15).

Changes in biochemical and hematological parameters of blood during Ramadan fasting are very important and the Islamic countries physicians should be informed about these beneficial effects of fasting. Because Ramadan fasting is a great opportunity for scientific research due to its peculiar nature. Despite the fact that it concerns the Muslim community of more than 1 billion people, the effect of fasting on humans have not been adequately investigated (16).

In conclusion, it seems that more researches are required for evaluating these effects in various physiologic and pathologic conditions and there are yet many unanswered questions in this relation. We believe that one of the physician responsibilities about patients is guiding and helping them for doing the religious duties in disease conditions because this has a great effect on recovery of patient. This consideration makes the physician-patient relationship stronger.

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