

## EFFECT OF FASTING IN RAMADAN ON BLOOD GLUCOSE AND LIPID PROFILE

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### ABSTRACT

The effect of fasting in Ramadan on some hematological values such as blood glucose and lipid profile in addition to urea and uric acid in human was studied. Thirty one healthy adult employees of college of Women Education/ University of Mosul, IRAQ were identified as subjects to perform the experiment. The subjects (14 males and 17 females) were aged between 30 and 66 years (BMI range 22.5-25.5Kg/m<sup>2</sup>) and were fasting for the whole month. Blood samples were taken one week before Ramadan then after 10 and 25 days of fasting in Ramadan and one week after the fasting. The blood samples were analyzed for fasting blood sugar FBS (glucose), plasma triglycerides (TG), total cholesterol (TC), low and high-density lipoprotein (LDL-C and HDL-C), urea and uric acid. Results show that blood glucose, total cholesterol, LDL-c, urea and uric acid in both men and women were significantly ( $P<0.05$ ) decreased during fasting in Ramadan. However, HDL-c level was significantly ( $P<0.05$ ) increased during fasting in Ramadan. Results also show that plasma TG in men comparing with women was significantly ( $P<0.05$ ) decreased. It is concluded that there were protective effects of fasting in Ramadan on some hematological values such as blood glucose and lipid profile.

### INTRODUCTION

Every day during Ramadan, Muslims abstain from food and drink from dawn until sunset. This is as true fasting which means a complete stop of any food intake and drinks for a period of time. Fasters are followed to abstain not only from eating and drinking, but also from consuming oral medications, intravenous nutritional fluids and even smoking and undesirable behavior. Because the lunar calendar determines the month of Ramadan and is about 11 days shorter than the solar year, Ramadan is not fixed to any season (Mansi, 2007). Therefore, they abstain from food and beverage, even though this month comes during the hottest or coolest season of the year. Fasting extends a period which varies by geographical location, from country to country and season, so the fast can last up to 18 hours or more (Azizi and Siahkollah, 1998 and Mansi, 2007). The change in the number and time of meals and substitution of food intake into only two main meals per day, even though sometime they eat more foods during Ramadan than in other months, might be counterbalanced the metabolism and maintain normal body weight and general health (Adlouni *et al.*, 1997; Nomani, 1999 and Mansi, 2007). More recently, Shariatpanahi *et al.* (2008) found that this may increase insulin sensitivity in subjects with the metabolic syndrome even when the decrease in minimum energy consumption. Further, Ramadan fasting contributed to better blood lipid profiles under the prevailing limited energy intake conditions (Mansi, 2007).

Similarly, Adlouni *et al.* (1997) noticed beneficial affects of fasting in Ramadan on plasma lipids and lipoproteins under the prevailing conditions and feeding behavior of the subjects.

For this reason fasting as a practice in general has been used as an ideal recommendation and effective approach for medical reasons including weight management and control of obesity, case of the digestive tract, sleep pattern, physical performance, fuel and energy homeostasis and for more beneficial lipid profile (Carlson *et al.*, 1994; Adlouni *et al.*, 1997; Nomani, 1999; Khan and Khattek, 2002; Ramadan, 2002; Bahammam, 2004, Karli *et al.*, 2007 and Mansi, 2007). Nowadays, fasting program has been followed by various health and nutritional centers and organizations to reduce weight, counterbalance normal weight and to manage risk of many diseases such as heart disease, kidney failure and diabetes. The aim of this study was performed to evaluate the impact of fasting in Ramadan on blood glucose and some hematological values such as lipid profile, urea and uric acid in human.

### MATERIALS AND METHODS

**Subjects:** Thirty one adult employees of college of Women Education/ University of Mosul, Iraq were identified as subjects to perform the experiment. The subjects (14 male and 17 female) were aged between 30 and 66 years and were fasting for the whole month. The study was conducted during the month of Ramadan in the year 2007 (1428 Hijra).

They were found to be healthy on general medical examination and none was receiving any medication affecting the studied parameters. Histories were taken and some anthropometric variables were identified such as height and weight and their BMIs were calculated ( $22.5\text{-}25.5\text{ Kg/m}^2$ ). The dietary intake was estimated by 24 h recall before, through and after fasting.

**Biochemical Determinations:** Blood samples were taken on one week before Ramadan then after 10 and 25 days of fasting in Ramadan and one week after the fasting. Blood samples were taken after 12 hours of fasting before and after Ramadan and were taken just before breakfast (after sunset) throughout Ramadan. The blood samples were analyzed for fasting blood sugar FBS (glucose), plasma triglycerides (TG), total cholesterol (TC), low and high-density lipoprotein (LDL-C and HDL-C), urea and uric acid by enzymatic method using the commercially available Kits (Friedewald *et al.*(1972); Warnick *et al.*, 1979; Plummer, 1978; Fossati and Prencipe, 1982 and Tietz, 1987). Lipid profile and uric acid were measured using Biolabo reagent kits-France. Blood glucose was measured by Human reagent kits- Germany, whereas, urea was measured by Biomerix reagent kits-France.

**Statistical Analysis:** The complete randomized design (CRD) was used. Statistical differences were determined using Duncan's multiple range test at ( $P<0.05$ ) using Statistical Analysis System (SAS) Version (1989).

### RESULTS AND DISCUSSION

The effect of Ramadan fasting on some hematological parameters such as blood glucose, lipid profile and urea and uric acid was determined in both male

(Table 1) and female (Table 2) subjects. Data show that blood glucose in men was significantly ( $P<0.05$ ) decreased through fasting in Ramadan. Results also show that there was a significant difference between blood glucose value (4.85 mmol/L) for those subjects before fasting and those values (4.23, 4.2 mmol/L) for those subjects after 25 days of fasting and one week after fasting. Similar findings were found with blood glucose values for fasting women. It has been observed that a slight decrease in blood sugar for both male and female subjects at the end of fasting in Ramadan and the values were kept close to these at the end of Ramadan one week after fasting. This may be due to a decline in the blood glucose and in other body tissues through the period of fasting by glucose oxidation and might be due to decrease in The process of gluconeogenesis in the liver. Similar results were observed by Mansi (2007) in which he found a graduate decrease in serum glucose in the first days of Ramadan until the end of the fasting followed by a slight increase two weeks after fasting. Clear reduction in fasting blood glucose in both men and women was

Table (1): Some hematological parameter values (Mean  $\pm$  SD) in men (n=14) before, during and after fasting in Ramadan.

Parameter (mmol/L)	One week before fasting	During fasting		One week after fasting
		After 10 days	After 25 days	
Glucose	4.85 $\pm$ 0.44	4.61 $\pm$ 0.43	4.23 $\pm$ 0.52	4.20 $\pm$ 0.59
Total cholesterol, TC	5.46 $\pm$ 0.66	5.58 $\pm$ 0.72	4.73 $\pm$ 0.51	4.70 $\pm$ 0.61
HDL-c	1.23 $\pm$ 0.23	1.36 $\pm$ 0.25	1.59 $\pm$ 0.27	1.59 $\pm$ 0.28
LDL-c	3.30 $\pm$ 0.67	3.40 $\pm$ 0.84	2.55 $\pm$ 0.55	2.50 $\pm$ 0.66
VLDL	0.73 $\pm$ 0.15	0.78 $\pm$ 0.14	0.63 $\pm$ 0.15	0.63 $\pm$ 0.15
Triglycerides, TG	1.67 $\pm$ 0.32	1.75 $\pm$ 0.29	1.46 $\pm$ 0.34	1.42 $\pm$ 0.33
Urea	4.63 $\pm$ 0.27	4.06 $\pm$ 0.34	3.76 $\pm$ 0.22	3.73 $\pm$ 0.33
Uric acid	298 $\pm$ 27.3	283 $\pm$ 34.2	269 $\pm$ 24.3	273 $\pm$ 24.8
Atherogenic factor (TC/HDL-c)	4.44	4.10	2.97	2.96

Table (2): Some hematological parameter values (Mean  $\pm$  SD) in women (n=17) before, during and after fasting in Ramadan.

Parameter (mmol/L)	One week Before fasting	During fasting		One week After fasting
		After 10 days	After 25 days	
Glucose	4.82 $\pm$ 0.44	4.52 $\pm$ 0.64	4.26 $\pm$ 0.58	4.23 $\pm$ 0.52
Total cholesterol, TC	5.06 $\pm$ 0.38	5.19 $\pm$ 0.31	4.52 $\pm$ 0.38	4.63 $\pm$ 0.44
HDL-c	1.18 $\pm$ 0.36	1.30 $\pm$ 0.20	1.55 $\pm$ 0.27	1.63 $\pm$ 0.14
LDL-c	3.20 $\pm$ 0.23	3.20 $\pm$ 0.47	2.40 $\pm$ 0.38	2.30 $\pm$ 0.39
VLDL	0.63 $\pm$ 0.16	0.54 $\pm$ 0.15	0.54 $\pm$ 0.15	0.55 $\pm$ 0.17
Triglycerides, TG	1.52 $\pm$ 0.32	1.50 $\pm$ 0.31	1.23 $\pm$ 0.30	1.20 $\pm$ 0.35
Urea	4.56 $\pm$ 0.34	3.43 $\pm$ 0.45	3.13 $\pm$ 0.34	3.30 $\pm$ 0.49
Uric acid	311 $\pm$ 22.5	286 $\pm$ 24.7	283 $\pm$ 23.5	281 $\pm$ 22.7
Atherogenic factor (TC/HDL-c)	4.29	3.99	2.92	2.84

observed by Furuncuoglu *et al.* (2007) during Ramadan than that before Ramadan. However, insignificant ( $P < 0.72$ ) rise in blood sugar value was noticed at the end of fasting (Dowod, 2004) and was justified to reduction in serum glucose ceasing due to increased gluconeogenesis in the liver. A variation in blood glucose may occur in subjects depending on food habits and individual differences in metabolism and energy regulation (Mansi, 2007). In diabetic patients, serum glucose may fall or rise and this variation may be due to the amount or type of food consumption, regularity of taking medications, engorging after the fast is broken or decreased activities (Azizi and Siahkollah, 1998).

Lipid profile for both men and women was shown in both Tables (1 and 2 respectively). Results show that there was a slight increase in TC values in both men and women at the beginning of fasting in Ramadan (during first 10 days of fasting) followed by a significant ( $P < 0.05$ ) decrease after 25 days of fasting and kept below the starting values during one week after fasting. This reduction may be attributed to the lipolytic effect of prolonged fasting period (Dowod, 2004 and Mansi, 2007). This result was in agreement with the results found by Furuncuoglu *et al.* (2007). Similar results were recorded by Mansi (2007) in which he found a graduate reduction in TC until forth week of fasting of Ramadan followed by a clear increase two weeks after fasting. Dowod (2004) found that no significant changes were occurred on the TC level at the end of fasting. However, Azizi and Siahkollah (1998) reviewed that the increase in TG levels during Ramadan seldom occurred even for the diabetes.

Tables (1 and 2) show the HDL-c; LDL-c and VLDL-c values in men and women, respectively, after fasting in Ramadan. These results show that serum HDL-c in both men and women had markedly ( $P < 0.05$ ) increased and remained elevated one week after Ramadan, in contrast LDL-c level in both men and women showed a significant ( $P < 0.05$ ) reduction and also maintained low one week after Ramadan. However, a slight variable change in VLDL value in male subjects and a slight increase in female subjects were noticed during 10 days of fasting and remained unchanged lower values during last days of Ramadan and one week after fasting. Concerning HDL-c and LDL-c values, similar results were observed by several researches (Maislos *et al.*, 1993; Adlouni *et al.*, 1997; Dowod, 2004 and Mansi, 2007), whereas, Furuncuoglu *et al.* (2007) found that HDL-c levels did not change but remained similar through fasting in Ramadan. Other results found by Ziaee *et al.* (2006) have reported that HDL was decreased and LDL was increased but no significant change in VLDL during fasting in Ramadan. Concerning to above results, a significant decrease in TC and LDL-c levels corresponding with a significant increase in HDL-c in both men and women during Ramadan resulted in a lower respective atherogenic values (atherosclerosis risk factors) namely 2.97, 2.96 and 2.92, 2.84 at 25 days and one week after Ramadan comparing with 4.44 and 4.29 before fasting in Ramadan. In other words, there was an improvement or lowering effect in the ratio of TC to HDL-c during fasting in Ramadan. These findings contributed to beneficial lipid profile and may be predicted into a reduction in coronary risk. It has been known that changes in the ratios of TC or LDL-c to HDL-c may be better predictors of risk for cardiovascular disease than are changes in LDL-c alone (Kinosian *et al.*, 1994 and 1995) Because HDL-c was known to be a

factor that protects against the development of atherosclerosis and cardiovascular disease and LDL-c was known to correlate causatively with increasing risk of atherosclerosis (Kinosian *et al.*, 1995; Al-Zuhayri, 2000 and Weggemans *et al.*, 2001). Further, although fasting in Ramadan might cause no determinant effect on health of normal subjects, however, it may cause some improvements or favorable effects especially on carbohydrates metabolism and lipid profile. Furthermore, due to its nutritional safety fasting in Ramadan could be used as an effective strategy for prevention and control of obesity (Khan and Khattak, 2002).

Results in Table (1 and 2) show that TG levels were slightly increased from 1.67 to 1.75 mmol/L in men at the beginning of Ramadan before a significant dropping to 1.46 mmol/L at 25 days of fasting. Some what similar results show with women, in which at the beginning of Ramadan the TG level was remained high (1.50 to 1.52 mmol/L) before decreased to 1.23 at 25 days of fasting in Ramadan. In both men and women, the low levels of TG at the end of Ramadan nearly remained constant one week after Ramadan. Similar results were reported by Adlouni *et al.* (1997); Khan and Khattak (2002); Furuncuoglu *et al.* (2007) and Mansi (2007). Previously, Gumaa *et al.* (1978) and Hallak and Nomani (1988) reported that the increase levels of TG after fasting correlated positively with high sugar or carbohydrate diet intake. Other studies (Maislos *et al.* 1993 and Dowod, 2004) indicated a non significant increase or change in TG levels at the end of fasting in Ramadan and this may be attributed to the lipolytic effect of prolonged fasting.

Tables (1 and 2) show the effect of fasting on urea and uric acid levels in the blood of men and female subjects respectively. Urea levels in men and women were significantly ( $P < 0.05$ ) changed from 4.63 and 4.56 mmol/L in men and women, respectively, before fasting to 3.76 and 3.13 mmol/L respectively after 25 days of fasting in Ramadan and remained almost similar in men and slightly increased in women after on week of Ramadan. Similarly, Uric acid levels in men and women were significantly ( $P < 0.05$ ) changed from 298 and 311 mmol/L in men and women, respectively, before fasting to 269 and 283 mmol/L, respectively, after 25 days of fasting in Ramadan, however the levels slightly increased in men and remained almost similar in women after on week of Ramadan. It has been known that urea and uric acid are by products of protein and other nitrogenous substances and purines metabolism and this might concluded that the lower values of urea and uric acid after fasting were correlated with lower consumption of protein such as meat and meat products which may included purines. Furthermore, it might be there was a dehydration and weight loss throughout fasting resulted in reduction of these by products, even though the fasting was conducted during winter of year of 2007 where the temperature was low enough to prevent dehydration. Azizi and Siahkollah (1998) reviewed that serum urea and uric acid with other biological parameters such as creatinine, protein, albumin and some amino acid transferases values did not show significant changes during fasting in Ramadan. They stated that slight non significant increases in some biological parameters may be due to dehydration and metabolic adaptation and have no clinical presentation. In conclusion, it is suggested that fasting in Ramadan has a significant beneficial effect on blood glucose and lipid profile which might be correlate positively with reduction in cardiovascular diseases.

### تأثير صوم رمضان في كلوكوز الدم وبعض القيم الدهنية

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#### الخلاصة

تم دراسة تأثير الصوم في شهر رمضان على بعض القيم الدموية ومنها كلوكوز الدم والثوابت الدهنية بالإضافة إلى اليوريا وحامض اليوريك. تم اختيار واحد وثلاثون متطوعاً من الأصحاء البالغين ومن العاملين في كلية التربية للبنات في جامعة الموصل قد خضعوا للصوم شهر رمضان. كان من هؤلاء المتطوعين كان منهم ١٤ من الرجال و ١٢ من النساء تراوحت أعمارهم بين ٣٠ إلى ٦٦ سنة (تراوح مؤشر الكتلة الجسمية لديهم بين ٢٢.٥ إلى ٢٥.٥ كغم/م<sup>٢</sup>). تم سحب عينات من الدم قبل أسبوع من الصوم في شهر رمضان ٢٥ يوماً من الصوم ثم بعد أسبوع من شهر رمضان. تم تحليل العينات لمعرفة مستوى الكولي والكلسريدات الثلاثية والبروتينات الدهنية ذات الكثافة الواطئة والعالية واليوريا وحامض اليوريك. بينت النتائج انخفاض كل من كلوكوز الدم والكوليسترول الكلي والبروتينات الدهنية ذات الكثافة الواطئة واليوريا وحامض اليوريك وبشكل معنوي ( $P < 0.05$ ) في كل من الرجال والنساء خلال صوم شهر رمضان. في حين إن البروتينات الدهنية ذات الكثافة العالية ازدادت معنوياً ( $P < 0.05$ ). كذلك بينت النتائج أيضاً انخفاض الكلسريدات الثلاثية بشكل معنوي ( $P < 0.05$ ) لد إن للصيام في شهر رمضان تأثيرات إيجابية فيما يتعلق ببعض القيم الدموية منها الثوابت الدهنية لدى الإنسان.

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