

THE EFFECTS OF RAMADAN FASTING ON THE CHOLESTEROL AND TRIGLYCERIDE AMONGST HEALTHY SUDANESE IN KHARTOUM

Abdulrhman M. Kamel*

Department of Pre-Clinical Science Almaarefa Colleges for Science and Technology Riyadh – KSA.

*Corresponding Author: Abdulrhman M Kamel

Department of Pre-Clinical Science Almaarefa Colleges for Science and Technology Riyadh – KSA.

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ABSTRACT

Ramadan is known to be the holiest month of the Islamic calendar, during which millions of Muslims around the world fast the entire month and hence complying with one of the five pillars of Islam. During fasting Ramadan many physiological and metabolic changes occur due to change in eating pattern, physical activities and psychological behaviors. The aim of this study was determine the effects of fasting Ramadan on the cholesterol, triglyceride and behaviors amongst healthy Sudanese. in Khartoum. A Cross sectional study performed on 20 subjects aged between 18 to 47 in Khartoum state during the period of July and august 2011 (Ramadan 1432 H). Blood samples were taken to measure total cholesterol (mg/dl) and triglyceride (mg/dl) using analyzer machine selectra XL. Questionnaires were distributed amongst the participants for psychological assessment. Body mass index and physical activity also were performed. In our study the results showed that the change in total serum cholesterol and triglyceride levels were not statistically significant and all values within the normal range. Body mass index significantly decreased ($P=0.000$) at the end of Ramadan. Fasting Ramadan improve the negative psychological phenomenae. Regarding to control days shows that there was significant reduction of sadness, depression, feeling of boredom, decreased (but not significant) of irritability, tension and causing problems with others. Social and religious activities showed significant improvement. From the presented study Fasting Ramadan has no effect on the cholesterol and triglycerides levels, but give Muslims a good chance to reduce their weight. During this holy month the behaviors of people improve either socially or religiously and the negative psychological disorders will decrease.

KEYWORD: Ramadan, cholesterol, triglyceride, Body mass and physical activity.**INTRODUCTION**

Ramadan is known to be the holiest month of the Islamic calendar, during which millions of Muslims around the world fast the entire month and hence complying with one of the five pillars of Islam. (The Holy Quran). The fasting Muslims are obliged to fast from food and drink as well as abstain from sexual relationships from dawn to sunset representing restraint and reflection. Food intake is therefore mainly nocturnal and usually the food frequency and quantity are reduced, as well as sleep duration and daily physical activities. It's also been known that the dietary habits and nature are different from that of any other month other than Ramadan in which there are differing proportions of fat, protein and carbohydrate intake. There is an increased tendency of carbohydrate rich foods and drink in comparison with the remainder of the year. So not only the quantity but the quality of nutrients is different during the month of Ramadan. The period in which the person fasts may vary depending on the geographical location of the country and the season of the year, and can be as long as 11- 14

hours per day during the summer of temperate regions. It has been proved that nutrients ingested at unusual times can result in different metabolic effects. (Nelson *et al*; 1973) The factors affecting the lipid profile are dietary habits, daily fat percentage and saturation and exercise. (Tsai *et al* and Afrasiabi *et al* 2003) Some further factors are continuous snacking and eating overly large meals. The physiological changes of Ramadan have still not been entirely well known. There is a scarcity of studies some incomplete and of varying results on the effects of Ramadan fasting on blood lipids, lipoproteins and Apo lipoproteins. The foundation behind the potential effects of Ramadan fasting on various biochemical parameters have been shown in investigation results which reported differing metabolic effects that have been a result of a decrease in meal frequency or by different types of intermediate fasting. Many conflicting results have been reported on the effect of Ramadan fasting on changes in lipid profile within healthy subjects. (Forst and pirani 1987) It is of important interest to compare pre- and end fasting Ramadan lipid and lipoprotein profiles in fasting

individuals. It is why this study was designed to evaluate the effects of Ramadan fasting on plasma cholesterol and triglyceride lipids and lipoproteins.

The physiological changes that occur during fasting

Hormonal changes

Hormones play major roles in the metabolism of carbohydrates, fats and proteins. Many studies have reported about the changes of hormones levels during fasting Ramadan. Aziz et al. (1986) reported that, no significant alterations in serum concentrations of T4, T3, TSH, and TSH response to intravenous injection of TRH occurs in males during Ramadan. (Azizi and Amir 1986) In other research conducted by Sulimani (1988) showed that, In women, total serum T4 and T3 may decrease in the last days of Ramadan; however, the fall is mainly due to thyroxine-binding globulin (TBG). Alterations, as free thyroid indices remain unchanged. (Sulimani; 1988) While Fedail et al. (1982) found a small but significant increase in serum T4 in the last days of Ramadan. (Fedail et al. (1982) and Suryanarayana et al (1969) found that, the effect of prolonged fasting there were no change on serum testosterone and FSH. (Suryanarayana et al (1969) and Klibanski (1981) investigated the effect of fasting on serum testosterone and FSH found that, decrease in both hormones. On other hand, In a detailed study of Ramadan fasting subjects; the nocturnal peak of melatonin was diminished and delayed; there was a shift in the onset of cortisol and testosterone secretion; the evening peak of Prolactin was enhanced; FSH and GH rhythmic patterns were affected little or not at all by the fasting, and only the serum TSH rhythm was blunted. (Bogdan and Touitou 2001).

The Heart

Although bradycardia and hypotension may occur during prolonged fasting, (Kadiri et al 2001) heart rate and blood pressure remain normal during the first few days of fasting. Changes in the electrocardiogram, including decreased amplitude of QRS complex and T-wave and right axis deviation seen in prolonged fasting, are not seen in short fasts. (Theorell et al 1978) There seems to be no contraindication to observe fasting in patients with valvular problems or subjects with mild coronary artery disease. It is not known if mild dehydration and hemoconcentration may harm those with moderate to severe coronary artery disease. However, one study has conducted that Ramadan fasting does not increase acute coronary artery disease events. (Temizhan et al 1999).

The Lung

It has been shown that Ramadan fast does not exert a significant effect on pulmonary volume functions in healthy individuals. (Duncan et al 1990) Dehydration and dryness of respiratory tract mucosa may worsen bronchoconstriction in asthmatic patients. However, some workers have allowed asthmatic patients whose disease is stable to fast while using inhalers, slow-release drugs. (Rashed 1992)

Gastrointestinal Tract

In experimental fasting, there is a fall in gastric secretion. Gastrointestinal tract movements occur every two hours. (Sana 1985) It starts from the stomach and moves towards the duodenum, jejunum and ileum, evacuating all food debris, desquamated cells and GI secretions. The gallbladder empties less frequently than in the fed state, one to three times every 4 hours. (Ellenbogen et al 1988) Although complications of ulcers in fasting patients have been reported, (Donderici 1994) another study using proton pump inhibitor has found that patients with duodenal ulcer have equal rate of healing and no complications with or without fasting. (Mehdi and Ajmi 1997) Therefore, patients with complicated peptic ulcer may be advised against fasting. However, asymptomatic patients may try fasting, and take cimetidine or ranitidine, or a small dose of proton pump inhibitors at Iftar and Sahur, if hyperacidity remains a problem. Since intestinal contractility decreases during fasting to approximately once every two hours, (Sana 1985) fasting may benefit patients with spastic colitis and some other intestinal motility disorders.

Neuropsychiatric Function

Daytime sleepiness as evaluated by the Epworth Sleepiness Scale was significantly increased. (Taoudi et al 1999) Oral temperature, subjective alertness and mood are decreased during daytime and increased at 23.00 h during Ramadan fasting. (Roky et al 2000) The stress encountered during this fasting period, as depicted in the platelet aggregation responses, is less than that encountered on an ordinary nonfasting day. (Kordy and Abdel 1991) Headaches were reported by 41% of the 91 persons who had fasted, as compared to 8% of those who did not fast. The headache was of the tension type in 78% of the cases. Headache frequency increased with the duration of fasting and affected mainly those prone to headaches, and the most important exogenous – associated factor was caffeine withdrawal. (Awada and Jumah 1999).

The Kidney

During Ramadan, urinary volume, osmolality pH, nitrogen, solute and electrolyte excretion remain normal. (Cheah et al 1990) Changes in serum urea and creatinine are usually small and not statistically significant. (El-Hazmi et al 1987, Sliman and Khatib 1988) In prolonged fasting, serum uric acid increases to abnormal values. (Murphy and Shipman 1963) This is probably due to decreases in glomerular filtration rate (GFR) and uric acid clearance. In Islamic fasting, however, there is only a slight increase in uric acid, (Azizi and Amir 1986, El-Hazmi et al 1987) due to the nature of fasting which is short-lasting and intermittent. Ramadan fasting does not cause significant alterations in serum sodium and potassium. (El-Hazmi et al 1987).

Changes in Body Weight

Weight loss ranging from 1.7-3.8 kg has been reported in normal weight individuals after fasting in the month of

Ramadan. (Azizi and Amir 1986, Sajid et al 1991, Sulimani 1988) In one study that was over-represented by females, no change in body weight was seen. (Shoukry 1986) It has also been reported that overweight subjects lose more weight than normal or underweight subjects. (Takruri 1989).

Cholesterol

It's found in tissues and in plasma as free cholesterol or combined with a long-chain fatty acid. When it present in blood, it is an amphipathic lipid and as such is an essential structural component of membranes and of the outer layer of plasma lipoproteins. Endogenous Cholesterol synthesized in many tissues from acetyl-CoA and is the precursor of all other steroids in the body, including corticosteroids, sex hormones, bile acids, and vitamin D. As a typical product of animal metabolism, exogenous Cholesterol found in foods of animal origin such as egg yolk, meat, liver, and brain. (Russell 1992).

Total cholesterol

Total cholesterol means the total amount of cholesterol in the blood. This includes low density lipoprotein (LDL) should be less than 100 mg/dl, cholesterol which is Less than 200 mg/dl and high density lipoprotein (HDL) cholesterol which Higher than 40 mg/dl for men, higher than 55 mg/dl for women. Total cholesterol/HDL cholesterol ratio this ratio shows how high your HDL "good" cholesterol is relative to your overall cholesterol levels should be Less than 5.0. (<http://www.heartandstroke.ca>).

Triglyceride

Many cell types and organs have the ability to synthesis triglycerides, but in animals the liver and intestines are most active, although most of the body stores of this lipid are in adipose tissue. Normal triglycerides between 150-199 mg/dl. The lipid serves as a store of energy, which can be released (Sulimani 1988) rapidly on demand, and as a reserve of essential fatty acids. However, lipid droplets may also serve as a protective agency to remove any excess of biologically active and potentially harmful lipids such as free fatty acids, diacylglycerols, cholesterol (as cholesterol esters), retinol esters and coenzyme A esters. (William 2011).

OBJECTIVES

1. General objective

To determine the effects of Ramadan fasting on the cholesterol and triglyceride amongst healthy Sudanese in Khartoum.

Specific objectives

1. To determine triglyceride values before, end of fasting Ramadan.
2. To determine cholesterol values before end of fasting Ramadan
3. To compare between the values of cholesterol and triglyceride values before and end of fasting Ramadan.

4. To measure BMI of the participant before, end of fasting Ramadan
5. To determine the psychological behaviors before and end of fasting Ramadan.

MATERIALS AND METHODS

Study area

The study conducted during 25 of July to 29 of August 2011 (Ramadan of 1432 Hijri) in the National Ribat University, which is located in Khartoum state.

Study population

The study was involved 20 healthy individuals.

The criteria for study population include

1. Age group 18-47 years.
2. Healthy with no symptoms of present illness.

The exclusion criteria include: Any chronic disease.

Data Collection

Questionnaire

All selected subjects interviewed to fill a questionnaire form including information about personal data, qualitative nutritional assessment, physical activity and behavior studies. (Before and during Ramadan).

Body Mass Index (BMI)

Weight and height were measured with participants standing without shoes and wearing light clothing by using digital Weight scale and height scales Measurement of weight and height were conducted to calculate the BMI as weight in kilograms over height in meters squared. $\text{Weight (kg)/Height (m)}^2$.

Height scale

It measures the height in centimeters (cm).

Lipid profile

Sample collection

Blood (5 ml) was collected into vacutainer tubes containing lithium heparin (Anticoagulant) and gently mixed by inverting the tube five to six times immediately after drawing.

Blood analysis

The samples were put in centrifuge 10 min to separate the serum which tested after that sera of the samples were put selectra XL.

Selectra XI

The Selectra XL is an open system offering a wide range of testing, including Clinical Chemistry, Special Proteins, Drugs of Abuse, Therapeutic Drugs and Electrolytes. Consist of 2 major system.

Method of data analysis

Results obtained were analyzed using the Statistical Package for the Social Sciences (SPSS). Data were expressed as means with the standard deviation (sd). P

value equal to or lower than 0.05 was considered statistically significant.

RESULTS

Demography of the sample

A total of 20 subjects in the age group 17- 47 years participated in the study. Over all 65% of the study participants were male subjects. The mean height 172.7 ± 7.85 for male and female. 15% of participants were married while 85% single. The distribution of economic status showed 15% high, 80% medium and 5% low economic status.

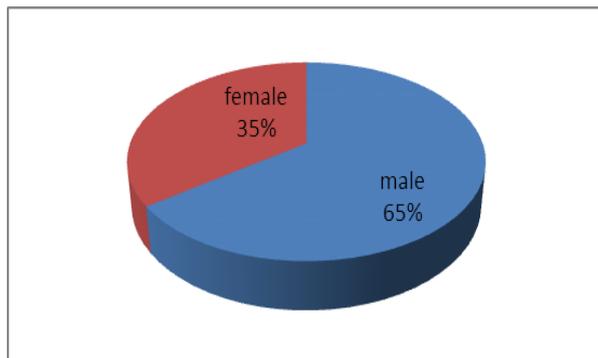


Figure 1: the percentage of participants according to gender.

Table 1: Correlation between cholesterol level (mg/dl), triglyceride (mg/dl), BMI and physical activities (hours/day) before Ramadan and at the end of fasting Ramadan.

	Before Ramada Mean \pm (SD)	At the end of Ramadan Mean \pm (SD)	P
Cholesterol	166.45 \pm (27.98)	177.70 \pm (35.22)	0.159
Triglyceride	117.90 \pm (148.40)	117.30 \pm (70.40)	0.981
BMI	25.56 \pm (6.14)	24.67 \pm (5.88)	0.000*
Physical activities	9.25 \pm (1.90)	4.98 \pm (2.06)	0.655

*Significant at $P < 0.05$, ** $P < 0.001$

Nutritional analysis

Qualitative analysis of common food stuff (daily food intake before and during Ramadan) was done. Before Ramadan 35% of participants daily take meat and 25% of them take egg 70% take foal and 30% take milk. During Ramadan 60% of participants take gorasa, 30% take asieda, 60% take foal, 10% take milk, 45% take egg and 50% take meat. These ordinary food stuff showed no significant correlation with levels of cholesterol and triglyceride at the end of Ramadan, although egg and meat intake increase during Ramadan.

Psychological analysis

Psychological assessment of the participants was done including psychological disorders, social and religious points.

Table 2-1: Psychological disorders score observed in Ramadan fasting among participants, compared to non-fasting period derived from scale (where 0= absent disorder and 4 = extreme disorder).

Parameters	Before Ramadan Mean \pm SD	During Ramadan Mean \pm SD
Decrease daily performance	1.75 \pm 0.85	2.65 \pm 0.88**
Tiredness	1.85 \pm 0.93	2.69 \pm 1.14**
Tension	1.50 \pm 0.95	1.25 \pm 1.38 ^{N.S}
Irritability	1.60 \pm 1.1	1.55 \pm 1.36 ^{N.S}
Boredom	2.0 \pm 1.1	1.60 \pm 1.50*

*Significant at $P < 0.05$, ** $P < 0.001$

Table 2-2: Psychological disorders score observed in Ramadan fasting among participants, compared to non-fasting period derived from scale (where 0= absent disorder and 4 = extreme disorder).

Parameters	Before Ramadan mean \pm SD	During Ramadan mean \pm SD
Decrease in attention	1.30 \pm 1.1	1.80 \pm 1.32*
Interruption in sleeping	1.30 \pm 1.41	0.70 \pm 0.87*
Disturbance in dreams	1.1 \pm 1.12	0.80 \pm 0.84
Sadness and depression	0.90 \pm 1.0	0.55 \pm 0.83*
Causing problems	0.90 \pm 1.26	0.80 \pm 1.20 ^{N.S}

* Significant at $P < 0.05$

Table 3: Social and religious activity scores observed in Ramadan fasting among participants, compared to non-fasting period derived from scale (where 0= absent disorder and 4 = extreme disorder).

Parameters	Before Ramadan Mean \pm SD	During Ramadan Mean \pm SD
Visiting relatives	2.70 \pm 0.98	2.50 \pm 1.1*
Giving money to the needs	2.90 \pm 0.97	3.15 \pm 0.75*
Obligatory prayers (farid) in regular manner	3.55 \pm 0.69	3.85 \pm 0.37*
Non obligatory prayers (nafila) in regular manner	2.55 \pm 0.83	3.0 \pm 0.86**

* Significant at $P < 0.05$, ** Significant at $P < 0.001$

DISCUSSION

Fasting in Ramadan is a religious practice respected by a large majority of Muslims. Consequently, the observed change of biologic profile accompanying the fast of Ramadan is not surprising. However, examination of data revealed that the impact of Ramadan fasting on the health is not same in different populations of Muslims.

During the fasting month of Ramadan, Muslims are obliged to fast during daytime hours and restrict food and drink intake to the period after sunset. Long lasting modifications in the circadian distribution of the eating and sleeping schedule result in various changes in metabolism. This will provide a unique opportunity to study the effect of meal frequency reduction on total cholesterol, triglyceride and body mass index. Effect of Ramadan fasting on serum of cholesterol and triglyceride.

Studies reported in literature on the effect of Ramadan fasting on serum cholesterol have been conflicting and inconstant. Fedail et al. (1982) and Hallak et al. (1988) reported that Ramadan fasting raised the blood cholesterol level, Maislos et al. (1993) have found that Ramadan fasting does not change the blood cholesterol level, on the other hand some studies such as that performed by Adlouni et al. (1997) showed that there was a decrease in the blood cholesterol level by the end of Ramadan fasting. In our study the results showed that the change in total serum cholesterol level were not statistically significant and all values within the normal range (table 1). Explanation of this result is that the body will adapt to change in lipid metabolism that occur during Ramadan and the blood cholesterol level may reach its normal value by the end of Ramadan fasting, so that to confirm the changes in blood lipids, serum cholesterol should be investigated every week during the month of Ramadan. Asgary et al. (2000) (and Mahboob et al. (1999), reported that there was a significant decrease in serum triglyceride by the end of Ramadan. In our study the results showed that there was no change in the serum triglyceride level at the end of Ramadan. (Table 1). The non-significant change in serum triglyceride level by the end of Ramadan could be explained and may depend on the amount and type of food intake and physical activity. This result of lipid profile is logic if we considered the mechanism of how the body adapts with fasting by changing the sources of energy. During a fast, these stores of glucose are used up first to provide energy. Later in the fast, once the stores of glucose run out, fat becomes the next store source of energy for the body. That means there is a mechanism of mobilization of free fatty acids to be used as a second source of energy, so weight and body mass index will decrease as a result of this mobilization. Also to confirm the accurate results and correlations between Ramadan and changing in lipid profile the levels of hormones that play vital roles in metabolism of lipids should be studied. In agreement with previous studies (Ziaee et al 2006 and Saleh et al 2004), fasting in Ramadan causes a change of anthropometric profiles. At the end of Ramadan, our subjects exhibited a significant decrease in BMI. These variations will explain the unchanged values of serum cholesterol and triglyceride, because the weight loss mobilizes more free fatty acids into the blood maintaining a constant plasma level of triglyceride and cholesterol. the decrease in body weight through Ramadan fasting may be related to reduction in fluid

intake (Takruri 1989). In our study the daily activities as hours per day show a non-significant reduction through Ramadan. This reduction was mainly due to an increase in tiredness and irritability at day time fast (Sweileh et al 1992) also the sleeping duration at night was reduced that may contribute to reduction of physical activity during fasting hours. Nutritional assessment can be detected quantitative and qualitative analysis, in our qualitative study showed that no significant relations between ordinary types of food taken by participants and levels of cholesterol and triglyceride to confirm the relationship between nutrition and lipid profile, quantitative studies should be done to give the chance to calculate the caloric changes. Study of behavior is an important aspect to complete the evaluation and understanding of physical changes that occur during fasting Ramadan. Psychological assessment can be obtained by studying of psychological disorders, social and religious activities. Our results demonstrated that Fasting Ramadan improve the negative psychological phenomenae. Regarding to control days shows that there was significant reduction of sadness, depression, feeling of boredom, decreased (but not significant) of irritability, tension and causing problems with others (Table 2-1). This improvement may be explained by the spiritual and the sanctity of Ramadan, in addition to increase of worship activities. (The Holy Quran) Significant improvement of sleeping in fasting Ramadan compared with non-fasting days was shown in this study (table 2-2). Many results have been reported regarding to sleeping during the holy month. Roky et al (2001) reported there was significant reduction in total sleep while Bahmmam (2004) demonstrated no change in total sleep time. This may be related to changing the hole daily patterns and meals. The attention decreased significant during fasting and there was significant increase in tiredness. Attention and tiredness have inverse relationships. When the tiredness increase the attention will decrease and this justify the result of decreased the attention. These inverse relationships can be explained by decreased glucose level during fasting, daily work and hot weather. Social and religious activities showed significant improvement in our results. Both obligatory and non-obligatory prayers during fasting Ramadan has increased in addition of reading the Qur'an regarding to control days. The same results were found by Afifi (1997), Husain *et al* (1987). (Albokhary and Mohammed 1992) confirm the motivation of Muslims in Ramadan to try to get maximum benefit of the reward in this month.

CONCLUSION

Fasting Ramadan has no effect on the cholesterol and triglycerides levels, but give Muslims a good chance to reduce their weight. During this holy month the behaviors of people improve either socially or religiously and the negative psychological disorders will decrease.

RECOMMENDATION

1. The result of this study need to be verified in larger samples with quantitative nutritional analysis and hormonal investigation.
2. The improved psychological and religion impact of Ramadan fasting encourage Muslims to fast non-obligatory days.

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