Journal of Fasting and Health
http://jfh.mums.ac.ir
JFH

Fasting Consequences during Ramadan on Lipid Profile and Dietary Patterns

Sondos Pirsaheb [1], Yahya Pasdar [2*], Seied Jafar Navabi [3], Mansour Rezaei [4], Mitra Darbandi [5], Parisa Niazi [6]

[1] General Practitioner, Kermanshah University of Medical Sciences, Kermanshah, Iran.
[2] Assistant Professor in Nutrition, Nutritional Sciences Department , Kermanshah University of Medical Sciences, Kermanshah, Iran.
[3] Assistant Professor in Internal Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran.
[4] Assistant Professor in Biostatistics, Kermanshah University of Medical Sciences, Kermanshah, Iran.
[5] BSc in Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran.
[6] BSc in Nutrition, Kermanshah University of Medical Sciences, Kermanshah, Iran.

ARTICLE INFO

Article type:
Original article

Article history:
Received: 21-Oct-2012
Revise: 21- Feb-2013
Accepted: 10-Jan-2013
Publish: 01 July 2013

Keywords:
Fasting
HDL –C
LDL-C
Ramadan

ABSTRACT

***Introduction*:** The aim was to assess the effects on lifestyle and lipid profile while fasting during holy month of Ramadan.

Materials and Methods: An interventional cohort study designed with 160 subjects who were fasting during Ramadan recruited from different mosques in Kermanshah. Data were collected in three stages at the beginning and at the end of Ramadan as well as one month following Ramadan using demographic and FFQ questionnaires. Blood pressure was measured and a 5 ml blood sample was collected in order to measure BUN, Creatinine, and lipid profile analysis.

Results: Significant increases was observed in total cholesterol (P=0.02), LDL-C (P=0.001), HDL-C (P=0.001), and BUN (P=0.002) following Ramadan compared with earlier measurements. Triglyceride (TG) level decreased following Ramadan (P=0.04) but returned to the same level one month later. Systolic blood pressure increased and diastolic blood pressure decreased during fasting period. There was a significant decrease in cereals, dairy products, and meat consumption while consumption of fruits and vegetables have been increased during Ramadan (P=0.003).

Conclusion: Our results revealed increased levels of T-Chol and LDL-C in fasting as well as HDL-C. Increased HDL-C may prevent the side effects of T-Chol and LDL-C in healthy subjects. Given the metabolic changes that occurred during Ramadan, healthy eating and intake of low fat and low sugar diet during Ramadan are highly recommended.

Please cite this paper as:
Pirsaheb S, Pasdar Y, Navabi SJ, Rezaei M, Darbandi M, Niazi P. Fasting Consequences during Ramadan on Lipid Profile and Dietary Patterns. Asia Oceania J Nucl Med Biol. 2013; 1(2):6-12.

Introduction

Fasting is one of the five pillars of Islam and each year, millions of healthy Muslims around the world avoid eating, drinking, and smoking from sunrise to sunset in the holy month of Ramadan in obeisance to God. Ramadan is the ninth month of Hijri-qamari and the duration of fasting, depending on the season, varies between 11 and 18 hours. (1) Ramadan triggers a radical change in dietary pattern and is of interest to researchers because of its worldwide extent since almost 25% of the world's population is Muslim. (2)

Researchers reported different results from their studies which may be due to factors such as

* *Corresponding author:* Yahya Pasdar, Nutritional Sciences Department, Faculty of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran. Tel: +98 (831) 8281991; Fax: +98 (831) 8263048; Email: yahya.pasdar@kums.ac.ir

different fasting duration (season-dependent) and different diets and physical activities during the holy month of Ramadan. (3, 4)

Studies show that limiting calori intake can have some health benefits for instance decreasing the risk of cancers, heart diseases, diabetes, insulin-resistance, immune system disorders, slowing of the aging process, and possibly increasing life-expectancy. (5) However, there are some negative aspects such as disruption of the body heat balance, excessive thirst, and lack of necessary nutrients for the body. (6, 7) Some studies have shown that despite the limitation in food and drink consumption from sunrise to sunset, if enough nutrients are taken during sunrise and sunset meals, the nutritional balance of the body would be preserved. (8) Other researches show that the level of serum cholesterol, thyroxin, and uric acid are significantly increased during fasting. (4, 9) Ziai *et al* reported that fasting causes decreased level of HDL and glucose and increased level of LDL. (10) Saleh Mensi showed that during the Ramadan, there are significant decreases in LDL and significant increases in HDL levels. (11) Janghorbani reported that TG, total cholesterol, LDL, and HDL are significantly decreased in the middle of Ramadan. (12)

There are differing reports on the effects of fasting on the serum urea and creatinine. In some reports, there is an increase in the level of serum urea and creatinine (10 and 13-14) however in some others; no difference has been observed. (15) During Ramadan, because of the alteration in frequency and meals' schedule, some changes in the dietary pattern of Muslims had been observed. In a study by Amena Sadiya, the consumption of fruits, vegetables, and meat diminished nonetheless the consumption of fat and sugar had been increased subsequently. (16) Since numerous Muslims fast during the month of Ramadan, a restored understanding of the effects of fasting on the body may result in a potential modification of the diet during fasting and have it be a confirmation of the benefits of fasting for healthy individuals and its probable disadvantages for unhealthy subjects. (1) On the other hand, there are only a few studies on the changes in the dietary patterns during the month of Ramadan in Iran and the focus of this research was to study the effects of a month fasting during the warmest month of the year on lipid profile, renal function, and dietary patterns.

Materials and Methods

In an interventional cohort study, samples were collected during the month of Ramadan, 2011, from individuals who were fasting in Kermanshah City, located in western part of Iran. Inclusion criteria were male gender, middle-aged, and negative past medical history.

One hundred and sixty subjects recruited from four different mosques in Kermanshah, Iran. Subjects were volunteers and had been matched according age and socioeconomic status. Ethical approval was obtained from Kermanshah University of Medical Sciences (KUMS) research ethics committee. The study was conducted in three different phases. In the first phase, data had been collected 1-7 days prior to Ramadan; the second phase was conducted 1-4 days prior to the end of Ramadan and the last phase was done one month following the end of this month (Eid al-Fitr).

Data were collected using demographic questionnaires and FFQ (for studying the food intake during last year) which were completed by participants in interviews. Subsequently, systolic and diastolic blood pressures (BP) were measured using digital arm sphygmomanometer in all three phases. Hypertension was defined according to the WHO guideline as systolic BP≥140 mmHg, diastolic BP≥90 mmHg, or taking antihypertensive medications (17) and excluded from the study.

Usual dietary intake assessment was done using food frequency questionnaires (FFQs) in all three phases. FFQs were completed quickly which the participants replicated for each food item. Validity and reliability of the questionnaires were already examined in earlier studies. (18-22) Questionnaire comprised of 50 food items and standard portions for each. Despite the fact that yearly intake of the foods was considered, according to the type of food, their intake frequency during a day, a week, and a month had been asked. The intake frequency for each food was transformed into standard portion size and further statistically analyzed. For identifying dietary patterns, foods were divided into five major collections. These groups were categorized bread and cereals, dairy products, meats and grains, fruits and vegetables, and miscellaneous. Conventional food intake was asked from the participants when filling the FFQ questionnaires.

Subsequently, 5 ml of fasting blood was collected for studying lipids from the participants at each stage of the study. The only difference was in the time of blood collection, i.e., in Ramadan, samples were taken before the sunset instead of the early morning for non-Ramadan times. Samples were kept in special plastic tubes and were stored in boxes before dispatch to the lab. Following the sampling, participants were asked to be in contact with the project coordinator regarding the timing of the next phase of the study. Completing these procedures

took 3-4 hours every day. In the lab, clots were removed and samples were centrifuged. Their serum was separated and divided into two different samples. Then, they were coded according to the participant and kept in the freezer in -40 °C. Other data and questionnaires were also coded accordingly.

In the lab, blood samples were analysed for measuring lipid profiles using Technicon RA-XT, Ireland and standard kits from Pars Company, Iran by photometric method.

At the end of each stage, all data were controlled, coded and then entered into SPSS version 16. Finally, according to the purpose of the study, participants' anthropometry data, lipid profile, etc., were expressed as mean±SD and comparisons were made using the Friedman test for qualitative variables in the three stages and t-test for two stages. In our study $P<0.05$ was considered as statistically significant.

Results

All participants were males with mean age of 39.35±10.7 (minimum age of 21 and maximum of 63 years old). There were initially 160 participants included into the study however data for 152 of them who underwent all stages of the study were analyzed. In this research, all participants were studied in three stages (one week prior to Ramadan, the last four days of

Table 1. Blood Pressure (mmHg) Changes during the Study.

Variables	Phases	Mean±SD	Minimum	Maximum	*P*
Systolic BP	I	126.96±14.6	100	188	0.01
	II	123.93±15.2	88	200	
	III	127.54±13.9	98	181	
Diastolic BP	I	81.18±10.1	60	114	0.02
	II	81.33±10.8	54	124	
	III	83.01±10.7	60	133	
Pulse Rate	I	75.20±10.9	54	118	0.001
	II	75.76±11.6	49	114	
	III	72.01±10.1	49	102	

Table 2. Blood Lipid Profile Changes of the Subjects during the Study (mg/dl).

Variables	Phases	Mean±SD	Minimum	Maximum	*P*
LDL	I	95.8±20.6	45	151	0.019
	II	99.40±21.3	40	161	
	III	96.95±22.8	43	173	
HDL	I	44.70±7.9	21	69	0.114
	II	45.59±9	22	73	
	III	46.25±9.3	25	69	
TG	I	151.44±85.2	32	518	0.001
	II	140.44±75.2	46	486	
	III	161.25±87.6	43	473	
T-Chol	I	185.46±46.8	67	297	0.216
	II	193.62±40.3	79	284	
	III	190.72±41.3	60	302	

Table 3. Urea and Creatinine Changes of the Subjects during the Study (mg/dl).

Variables	Phases	Mean±SD	Minimum	Maximum	*P*
Serum Creatinine	I	1.332±0.3	0.6	2.8	0.001
	II	1.286±0.2	0.7	2.0	
	III	1.183±0.2	0.6	2.2	
Serum Urea	I	33.05±7.7	16	60	0.002
	II	31.79±9.1	16	80	
	III	30.95±7.4	11	56	

Table 4. Changes in the Consumption of Food Groups before and Following the Month of Ramadan (Unit/day).

Food Groups	Phase	Mean±SD	*P*
Breads and Cereals	I	5.77±1.4	< 0.001
	II	4.23±1.3	
Dairy Products	I	3.01±1.6	< 0.001
	II	1.75±1.1	
Fat and Oils	I	2.12±0.9	< 0.001
	II	1.91±0.9	
Meats	I	3.25±1.6	< 0.001
	II	2.28±1.2	
Stews	I	1.43±1.0	< 0.001
	II	1.55±1.1	
Fruits and vegetables	I	5.74±3.6	< 0.001
	II	8.62±3.8	
Miscellaneous	I	2.68±1.4	< 0.001
	II	2.57±1.7	

Ramadan) for body composition and variables for lipid profiles, urea, and creatinine. Systolic BP (*P*=0.01) and diastolic BP (*P*=0.02) showed significant differences. (Table 1)

Findings revealed that blood lipid profile increased significantly during fasting, LDL-C and total cholesterol decreased following one month of Ramadan, however did not reach the initial level. (Table 2) The difference between the levels of HDL-C was considerably different between the three stages of the study but it was not really significant. During Ramadan, TG showed a significant decrease nevertheless one month following Ramadan, increased considerably which was even higher than the initial level. (*P*=0.001)

Serum urea and creatinine showed a significant decrease during Ramadan although increased one month following the end of the month but did not reach the initial level. (Table 3)

Bread and cereal intake decreased during

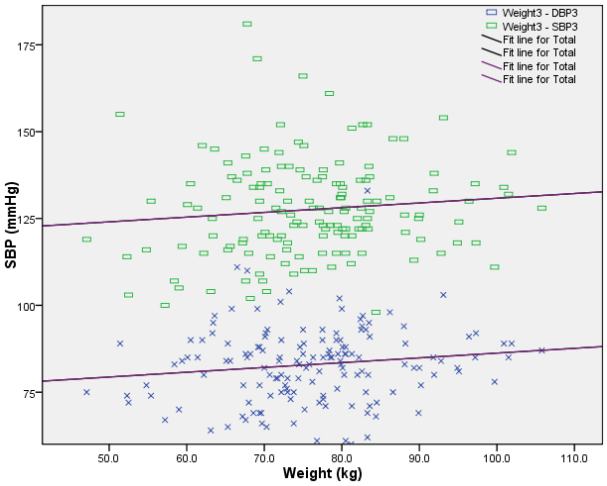

Figure 1. The Correlation between Systolic and Diastolic Blood Pressure and Weight in the Third Phase of the Study.

Ramadan then again increased one month following the Ramadan (*P*<0.001). The same flow ensued for dairy products. Consumption of all food groups were decreased during Ramadan and one month following the end of this month, increased significantly. (Table 4)

As revealed in Table 4, consumption of all food groups decreased significantly during Ramadan compared with the period prior to this month.This decrease was more prominent in dairy products. However, consumption of fruit and vegetable, in contrast to other groups, increased significantly. Zulbia Bamieh (a traditional Iranian high sugar and fat sweet which consumed during the Ramadan) increased significantly during Ramadan. Haleem (a thick beefy stew tradition food) and different sorts of Ashs (similar to soup but denser) increased significantly during Ramadan.

Table 5. Blood lipid profile changes during and after the Ramadan in Previous Study.

Author	Study Phases	Saleh Mansi KM(11)	Janghorbani M(12)	Yar Ahmadi S (31)	Zareh M (32)	Navaei L (14)
LDL (mg/dl)	I	112±32	76±20	135±32	106±42	-
	II	98±25	68±40	145±35	-	-
	III	104±23	106±30	173±42	92±36	-
HDL (mg/dl)	I	36±6	41±6	39±16	47±11	-
	II	49±12	41±9	48±8	-	-
	III	44±10	40±7	45±10	46±11	-
TG (mg/dl)	I	148±54	136±94	214±122	104±51	340±23
	II	139±52	131±63	170±90	-	243±13
	III	154±56	122±55	180±87	114±68	313±91
T-Chol (mg/dl)	I	164±28	147±32	216±40	175±49	258±56
	II	159±19	136±42	225±40	-	222±43
	III	176±26	171±36	238±42	160±41	229±44

Discussion

This study was performed in three stages to investigate the effects of fasting on blood lipid profile, body composition, and dietary pattern. The results showed that in Ramadan, fasting levels of LDL, HDL, and total cholesterol were increased compared with the months prior to Ramadan. A significant increase was noticed for LDL which decreased following this holy month but HDL level increased following Ramadan.TG changes was considerable during the stages of the study. During Ramadan, TG decreased meaningfully and one month following it increased significantly. This increase of the final level was much higher than its initial value. In a study by Asgary in Isfahan, Iran the level for cholesterol and TG decreased significantly in fasting people following Ramadan. (23) Adlouni showed that during Ramadan, there is a significant decrease in the levels of total cholesterol and TG. The value of HDL cholesterol increased and stayed high following one month after Ramadan. LDL and total cholesterol, on the other hand, showed a decrease. In a study by Hallak, TG and HDL significantly decreased, LDL level increased and total cholesterol showed no changes. (24,25) In Bojnord City which is located in the Eastern Iran, Babai showed that the levels of cholesterol, TG, LDL cholesterol, and HDL cholesterol in day 28 of Ramadan decreased compared with the first day of this month. (26) Differences in blood lipid profiles in Ramadan can be attributed to the different diets of Muslems during this holy month. In a study by Navai, blood cholesterol and TG increased significantly during Ramadan compared with the period before, however, both of them decreased following this holy month. (14) There have been reports about the changes in the levels of TG and cholesterol in healthy subjects during Ramadan. (23 and 27-30) Other researchers have been reported either increased or decresead level of TG and cholesterol after one month of fasting (Table 5) (11,12, 14, 16, 31, 32) In the current study, the levels of urea and serum creatinine decreased significantly at the end of Ramadan and subsequently, this decrease continued. In a study by Ziai (10) in Iran and Sadiya in US (16), researchers showed an increase in the levels of urea and creatinine in fasting men. Schemahl reported significant increases in the levels of urea and creatinine in workers with hard physical labor during the month of Ramadan. The study concluded that severe dehydration due to lack of water contributed to these changes. (13) Navai et al found no significant difference between the level of blood urea before and during Ramadan but reported a significant decrease following this holy month compared with the level of urea during this holy month. (14)

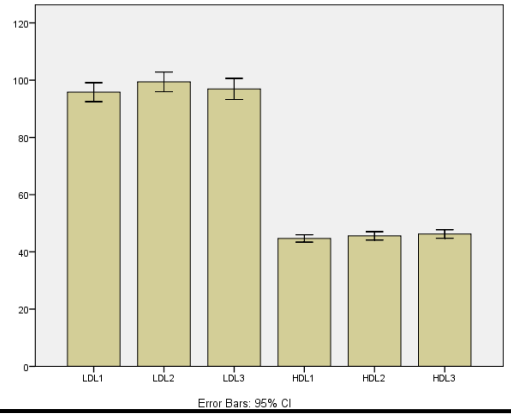

Figure 2. LDL and HDL Changes during the Study. **P*<0.05

There are different reports on the effects of fasting on systolic and diastolic BP. Some of the studies reported that both of them decreased (12, 33, and 34) and some of them reported no changes. (35, 36) In the current study, authors observed that in the third phase of the study, diastolic blood pressure was less than that of the second phase and in this phase it was less than that of the first phase. Overall, the level of systolic BP showed no significant difference before and succeeding to Ramadan. However, diastolic BP increased in the second phase and decreased significantly in the third phase of the study. In 2010, Trepanowski in US showed that diastolic and systolic BP decreased significantly in fasting people during Ramadan. (37) Kassab found no difference in the level of BP during Ramadan in Tunisia. (38) In a study conducted by Navai, a decrease in systolic BP at the end of Ramadan and an increase following two months following this holy month was reported. Diastolic BP decreased which remained consistent in the third phase of their study. (14) The decrease in the BP may be due to weight loss. There are numerous reports about the strong correlation between BMI and diastolic and systolic BP (33, 39, and 40), Reisin *et al* also showed the correlation between weight reduction and decrease in the level of BP. (41) During Ramadan, because of changes in the number and timing of meals, body metabolism can be adversely affected. In the current study, fruit and vegetable consumption increased during Ramadan which is inconsistent with the research conducted by

Sadiya in US. This difference can be explained by different dietary patterns in these two cultures. In the current study, fat intake decreased during Ramadan which was different from what was reported in former studies in Kuwait and US (16, 42, and 43).

Conclusion

In the current study, an increase in the levels of total and LDL cholesterol was reported however with simultaneous increase in the level of HDL-C as a deterrent factor, no serious adverse effects can be expected from fasting in healthy people. Because of metabolic changes during fasting, abstinence from fatty, sweet foods and following a sound diet seems necessary for maintain the subjects healthy during this holy month.

Due to the significant decrease in the consumption of cereals, dairy products, and meats during Ramadan and the increase in the intake of sweets, intensifying knowledge and awareness of fasting and its effects should be made to the general population, perhaps through mass media.

Acknowledgement

The current study was sponsored by the Vice Chancellery of Research & Technology Affairs at Kermanshah University of Medical Sciences, Kermanshah – Iran (Grant no. 90193). The authors are deeply grateful to all participants for their time and blood sample donation.

References

1. Nomani MZA, Hallak MH, Nomani S, Siddiqui IP. Changes in blood urea and glucose and their association with energy. Contaning nutrients in men on hypocaloric diet during Ramadan. Am J Clin NUTT 1989;49:1141-5.
2. An analysis of the world muslim population by country / region(article online). 2005. Ref Type: Internet Communication.
3. Cheah SH, Ch'ng SL, Husain R, Duncan MT. Effects of fasting during Ramadan on urinary excretion in Malaysian Muslims. Br J Nutr 1990;63:329-37.
4. Leiper JB, Molla AM, Molla AM. Effects on health of fluid restriction during fasting in Ramadan. Eur J Clin Nutr 2003;57(2):30-8.
5. http://www. worldhealth.net/news/every-. other_day_fasting_may_reduce_cance 2012.
6. khadija-devi. Adverse Effects of Islamic Fasting CHOWK. /74462/51533. Retrieved. http://www chowk com/ilogs 2009;74462(51533).
7. Ramadan. Health effects of fasting. http://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2809%2961506-3/fulltext 2009;374(9690):588.
8. Ramadan J, Telahoun G, Al-Zaid NS, Barac-Nieto M. Responses to,exercise, fluid and energy balances during Ramadan in sedentary and active males. Nutrition 1999;15(735):39.
9. Fedail SS, Murphy D, Salih SY, Bolton CH, Harvey RF Changes in certain blood constituents during Ramadan. Am J Clin Nutr. 1982 Aug;36(2):350-3.
10. Ziai V, Yousefi R, Ahmadinejad Z, Sheikh H, Rezaei M, Behjati MJ. The effect of ramadan fasting on serum osmolarity, some electrolytes and hematological parameters. Shahid beheshti university of medical sciences & health services endocrine & metabolism research center 2007;9(1):47-53.
11. Saleh Mansi KM. Study the Effects of Ramadan Fasting on the Serum Glucose andLipid Profile among Healthy Jordanian Students. American Journal of Applied Sciences, 2007;4(8):565-9.
12. Janghorbani M. Effect of Islamic fasting on body weight, blood pressure, electrolytes, blood cell count and certain serum biochemical variables in males. J Kerman university of medical sci 1995;2(4):183-92.
13. Schemahl FW, Metzler B. The health risk of occupational stress in Islamic industrial workers during the Ramadan fasting period. Pol J Occup Med Environ Health 1991;4:219-28.
14. Navaei L, Mehrabi Y, Azizi F. Changes in body weight, blood pressure, consumption pattern and biochemical parameters in diabetic patients during fasting in Ramadan. Iranian Journal of Endocrinology and Metabolism 2001;3(2):125-32.
15. Sajid KM, Aktar M, Malia GO. Ramadan fasting and thyroid hormone profile. JPMA 1991;41(213):216.
16. Sadiya A, Ahmed S, Siddieg HH, Babas IJ, Carlsson M. Effect of Ramadan fasting on metabolic markers, body composition, and dietary intake in Emiratis of Ajman (UAE) with metabolic syndrome. Diabetes Metab Syndr Obes 2011;4:409-16.
17. Arthur L, Francisco J, Smith K. The pathogenesis of obesity. Clin Endo and Met 1999;13(1):13-30.
18. Wolf A, Colditz G. Current estimates of the economic cost of obesity in the United States. Obes Res 1998;6:97-106.
19. Al-Nuaim A. prevalence of diabetes mellitus, obesity and hypercholesterolemia in Saudi Arabia. In: Musaiger AO, ilady SS, editors. Diet-

related non-communicable diseases in the Arab countries of the gulf. Cairo 1996;73-81.

20. Musaiger AO. Trends in diet- related chronic diseases in United Arab Emirates. In: Musaiger AO, ilady SS, editors. Diet-related non-communicable diseases in the Arab countries of the gulf. FAO. 1996; Report No.: 73-81.
21. Al-Isa AN. Prevalence of obesity among adult Kuwaitis: a cross-sectional study. Obes relat metab disord 1995;19:431-3.
22. al-Mannai A, Dickerson JW, Morgan JB, Khalfan H. Obesity in Bahraini adults. J R Soc Health. R Soc Health 1996;30(2):37-40.
23. Asgari S, Aghaei A, Naderi Gh, Azali Sh. The inhibitory effect of fasting on lipid peroxidation; A protective role on cardiovascular system. The Journal of Qazvin Univ of Med Sci 2005;9(34):13-7.
24. Adlouni A, Ghalim N, Benslimane A, Lecert JM, Saile R. Fasting during Ramadan induces a marked increase in high-density lipoprotein cholesterol and decrease in low-density lipoprotein cholesterol. Ann Nutr Metab 1997;41(4):242-9.
25. Hallak MH, Nomani MZ. Body weight loss and changes in blood lipid levels in normal men on hypocaloric diets during Ramadan fasting. Am J Clin Nutr 1998;48(5):1197-210.
26. Babaee A.K, Ghasemi M, Tavakili H, Yoosefi A. Study of some biochemical parameters in male university students affected by Ramadan fasting. J university Khorasan shomali medical sci 2008;1(1):21-6.
27. Azizi F, Amir Rasouli HA. Serum glocose,bilirubin,calcium,phosphorus,protein and albumin concentrations during Ramadan. Med J IRI 1987;1:38-41.
28. Owen PE. Starvation In: DeGroot LJ (ed). Endocrinology 2nd ed. Philadelphia Saunders 1989;3:2282-93.
29. Scott TG. The effect of muslim fast of Ramadan on routine laboratory investigation. King Abdolaziz Med J 1981;1:23-35.
30. Soulaiman AN, Elkhatib FA. Effect of fasting during Ramadan on weight and some blood constitiuents in healthy muslims. In the first international congress on healths and Ramadan Casablanca. Morocco 1994.
31. Yarahmadi S, Larijani B, Bastanhagh MH, Pajouhi M, Baradar JR, Zahedi F, et al. Metabolic and clinical effects of Ramadan fasting in patients with type II diabetes. J Coll Physicians Surg Pak 2003;13(6):329-32.
32. Zareh M, Mohammadi GhR. Study of some biochemical parameters in male university students affected by Ramadan fasting. J Sabzevar university of medical sci 2002;9(3):30-5.
33. Dewanti L, Watanabe C, Sulistiawati, Ohtsuka R. Unexpected changes in blood pressure and hematological parameters among fasting and nonfasting workers during Ramadan in Indonesia. Eur J Clin Nutr 2006;60(7):877-81.
34. Sarraf-Zadegan N, Atashi M, Naderi GA, Baghai AM, Asgary S, Fatehifar MR, et al. The effect of fasting in Ramadan on the values and interrelations between biochemical, coagulation and hematological factors. Ann Saudi Med 2000;20:377-81.
35. Fakhrzadeh H, Larijani B, Sanjari M, Baradar-Jalili R, Amini MR. Effect of Ramadan fasting on clinical and biochemical parameters in healthy adults. Ann Saudi Med 2003;23:223-6.
36. Ramadan J. Does fasting during Ramadan alter body composition, blood constituents and physical performance? Med Princ Pract 2002;11(2):41-6.
37. Trepanowski JF, Bloomer RJ. The impact of religious fasting on human health. Nutr J 2010;9:57.
38. Kassab S, bdul-Ghaffar T, Nagalla DS, Sachdeva U, Nayar U. Interactions between leptin, neuropeptide-Y and insulin with chronic diurnal fasting during Ramadan. Ann Saudi Med 2004;24(5):345-9.
39. Adair LS. Dramatic rise in overweight and obesity in adult Filipino women and risk of hypertension. Obes Res 2004;12:1335-41.
40. Capuano V, Bambacaro A, D'Arminio T, Vecchio G, Cappuccio L. Correlation between body mass index and others risk factors for cardiovascular disease in women compared with men. Monaldi Arch Chest Dis 2003;60(295):300.
41. Reisin E, Abel R, Modan M, Silverberg DS, Eliahon HE, Modan B. Effects of weight loss without salt restriction on the reduction of blood pressure in overweight hypertensive patients. N Engl J Med 1978;298:1-6.
42. Saleh SA, El-Kemery TA, Farrag KA, Badawy MR, Sarkis NN, Soliman FS, et al. Ramadan fasting: relation to atherogenic risk among obese Muslims. J Egypt Public Health Assoc 2004;79(5-6):461-83.
43. Wissam HI, Hosam MH, Amjad HJ, Samer AAB. Effect of Ramadan fasting on markers of oxidative stress and serum biochemical markers of cellular damage in healthy subjects. Ann Nutr Metab 2008;53(175):181.