

# The Effect of Ramadan Fasting on Lipid Profile in Pregnant Women

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ARTICLE INFO	ABSTRACT
<p><b>Article type:</b> Original article</p> <p><b>Article History:</b> Received: 28 Jul 2015 Revised: 7 Aug 2015 Accepted: 8 Aug 2015 Published: 12 Aug 2015</p> <p><b>Keywords:</b> Fasting Cholesterol, HDL Cholesterol, LDL Triglycerides Pregnancy</p>	<p><b>Introduction:</b> Abnormal lipid profile causes maternal mortality and impairs fetal development. This study investigated the effect of Ramadan fasting on plasma lipid profile in pregnant women.</p> <p><b>Material and Methods:</b> This self-control, cohort study was performed in healthy volunteer fasted pregnant women. Serum cholesterol, triglyceride (TG), low density lipoprotein (LDL), high density lipoprotein (HDL), and body mass index (BMI) were measured on 0, 7th, 14th, and 28th days of Ramadan, and two weeks after Ramadan. Statistical analysis was performed by SPSS.</p> <p><b>Results:</b> The mean age and BMI of participants was 26.9±6.4 year and 25±4.2 kg/m respectively. Weight and BMI of women did not change during the study. Cholesterol and LDL significantly increased during Ramadan and decreased after Ramadan (<math>p&lt;0.05</math>). No significant change was seen in TG and HDL during the study (<math>p&lt;0.05</math>).</p> <p><b>Conclusion:</b> Cholesterol and LDL During Ramadan increases and then decreases. There was no change in the levels of TG and HDL in pregnant women. The present study findings may not be sufficient to definitely conclude that Ramadan fasting is safe during pregnancy.</p>

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## Introduction

Pregnant women may be exempted from Ramadan fasting. Based on the Islamic rules they are allowed to make up the fasting missed during pregnancy after delivery but most of Muslim pregnant women prefer to fast with their families rather than doing this later (1). In addition, some Muslims interpret Islamic law as requiring pregnant women to fast (2). In a study conducted in a hospital in Iran, 71% of pregnant Muslim women reported fasting for at least one day of Ramadan, which showed the great desire of Muslim women to fast during Ramadan despite being pregnant (3).

Out of 32 Muslim women in Michigan, the USA 28 fasted for at least one pregnancy and reported that 60-90% of women from their communities fast during pregnancy. During Ramadan Muslims abstain from food and drink from dawn until sunset and the length of the fast varies from 12 to 19 "h" per day (1).

In pregnancy there are significant variations in maternal lipid metabolism (1). In early

pregnancy there is an increased body fat accumulation associated with hyperphagia and increased lipogenesis. In late pregnancy there is a breakdown of fat depots, which plays an important role in fetal development (4).

In a study, assessment of lipid profile in Sudanese pregnant women showed no significant difference in total cholesterol (TC) and triglycerides (TG) concentration between pregnant and non-pregnant control, but a significant decrease in high density lipoprotein cholesterol (HDL-C) was found accompanied with increased low density lipoprotein (LDL) concentration (5).

Lipid is the principal form of stored energy in most organisms (6). Lipoprotein consists of both lipids and proteins and its main function is to transport lipids to different parts of the body via circulation (7).

LDL cholesterol (LDL-C) carries cholesterol from the liver to the cells of body and HDL-C

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collects cholesterol from the body tissues and returns it to the liver (1).

Findings about the impact of Ramadan fasting on lipid profile are controversial. Most studies show no change or a slight decrease in concentrations of TC and TG (8, 9). In a study, only TC level increased during Ramadan (10). Few studies have reported increase in HDL-C in diabetics during Ramadan (11, 12).

A study showed increased LDL-C and decreased HDL-C (13). Abnormal lipid profile not only causes maternal mortality but also impairs fetal development during pregnancy (14). There are conflicting data on the effects of fasting on lipid profile in pregnant women. We attempt to evaluate the effect of Ramadan fasting on plasma lipid profile in healthy pregnant women in this study.

## Materials and methods

In this self-control, cohort study conducted in Ramadan 2012 (from 21st July to 18th August) in Shahrekord University of Medical Sciences, Iran, 39 healthy pregnant fasted women participated voluntarily.

A written informed consent was provided for all participants and women with diabetic mellitus, hypertension, or metabolic disorder or if they were smoker or on any medication were excluded from the study. This research was approved by the Scientific Advisory and Ethics Committee of Shahrekord University of Medical Sciences.

We registered demographic data including name, age and address, duration of pregnancy, height, weight and body mass index (BMI). BMI was measured to the nearest one kg and height to the nearest one cm.

Blood samples were taken at the 7th, 14th, and 28th days of Ramadan, as well as within the

2nd week after Ramadan between 13:00 and 14:00 o'clock to measure serum level of lipids. The blood samples were centrifuged at room temperature for 5 min at 4000 rpm and serum was collected and stored at  $-20^{\circ}\text{C}$  for analysis of lipid profile. TC, TG, and HDL-C were determined enzymatically by Hitachi 917 (Roche, Mannheim, Germany). LDL-C Was estimated by the Siemens Dimension RxL Max by using the Siemens enzymatic methods (Siemens Medical Solution Diagnostics, Tarrytown, NY) (15).

The mean $\pm$ standard deviation was used for descriptive statistics. The parametric repeated measures analysis of variance was applied to determine whether any differences exist among variables of interest during the study period. The F-tests of Greenhouse-Geisser were used within the subject analysis because of violation in sphericity assumptions. To evaluate relationships among variables, Pearson coefficient of correlation was used. Statistical significance was defined as  $< 0.05$  and data analysis was performed by SPSS version 17 (SPSS Inc, Chicago, IL, USA).

## Results

In this self-control cohort study, 39 healthy pregnant fasted women participated voluntarily. Their age range was from 17 to 42 years, with mean of  $26.9 \pm 6.4$  years. Their gestational age was from 7 to 39 weeks with mean of  $22.4 \pm 7.9$  weeks. The BMI of woman at the beginning of the study was from 18.3 to 35.9 kg/m with mean of  $25 \pm 4.2$  kg/m.

The variations in the studied variables during the study are shown in Table 1 and the trends are shown in Figure 1. Weight and BMI of women did not change during the study. Cholesterol and LDL significantly increased

Table 1: Lipid factors during three measurements during Ramadan and two weeks after Ramadan

	First Week	Second Week	Fourth Week	Two Weeks after Ramadan	P
Weight (kg)	62.31 $\pm$ 10.91	62.02 $\pm$ 10.69	62.17 $\pm$ 10.71	62.53 $\pm$ 10.67	0.721
BMI <sup>1</sup>	25.05 $\pm$ 4.24	25.04 $\pm$ 4.25	25.11 $\pm$ 4.26	25.25 $\pm$ 4.26	0.713
Triglycerides (mmol/L)	171.6 $\pm$ 75	164.7 $\pm$ 67.5	169.2 $\pm$ 74.4	162.6 $\pm$ 80.1	0.368
Cholesterol (mmol/L)	193.7 $\pm$ 42.1	197.9 $\pm$ 44.1	212.2 $\pm$ 54.3	192.1 $\pm$ 48.3	< 0.001
HDL <sup>2</sup> (mmol/L)	53 $\pm$ 11.2	52.3 $\pm$ 10	51.1 $\pm$ 8.9	51.4 $\pm$ 11.8	0.612
LDL <sup>3</sup> (mmol/L)	107.8 $\pm$ 32.9	112.9 $\pm$ 33.4	127.1 $\pm$ 43.7	108.3 $\pm$ 35.1	< 0.001

<sup>1</sup>Body mass index; <sup>2</sup>High density lipoprotein; <sup>3</sup>Low density lipoprotein.

during Ramadan and decreased after Ramadan. Tests of within subject contrasts showed a significant increase in the cholesterol and LDL in the fourth week of Ramadan compared to the first week ( $P < 0.001$ ). No significant change in TG and HDL was found during the study.

## Discussion

In this study we determined the changes in lipid profile throughout the Ramadan in fasted pregnant women for the first time. The results of our study showed that the weight and BMI of pregnant women did not change during fasting. This finding is in agreement with some studies which showed no change in body weight during Ramadan fasting (16, 17). It is likely due to decrease in BMI of mother herself, but the trend of fetal growth is continued.

Weight loss of 1.7 kg (18) and 3.8 kg (19) has been reported in normal weight individuals after they have fasted. Pregnancy is a physiological condition with special nutritional requirements essential for the optimal maternal and neonatal outcomes.

During Ramadan, fasting people normally intake 2 meals, one before dawn (Sahari) and one just after sunset (Iftar). In a study weight and BMI of women did not change during the study. This finding is in agreement with some studies which showed no change in body weight was seen during Ramadan (20).

One of the causes of poor weight gain in our study is decrease in maternal daily caloric intake. Some studies of non obstetrics literature showed reduced energy intake (21, 22), and few studies reported increase in daily energy intake during Ramadan that led to an overall weight gain (23, 24). But, poor weight gain and lack of change in BMI in our study showed that food deprivation caused decrease in energy intake. This probably resulted of decrease in energy resource cause to decrease in lipid reserve that it is expected in that BMI was changed.

As a result of caloric insufficiency, low gestational weight gain may induce maternal hormonal and metabolic response that may have abnormal prognosis for neurological development of the fetus (24).

There are a very limited number of studies investigating the effect of caloric restriction on the risk of preterm labor and preterm delivery (25). Meal pattern variations were shown to

influence the frequency of preterm delivery in pregnant women (26).

Siega Riz et al reported that women who ate fewer than three meals and two snacks per day had a 30% higher risk for preterm delivery compared with no increased risk for preterm labor among women with less than optimal meal frequencies (26). Therefore, improving the nutritional status of pregnant women has been suggested as a route to reducing the risk of preterm delivery (27).

Herrmann et al found that 13-“h” fasting in 237 pregnant women significantly increased maternal corticotrophin-releasing hormone (CRH) concentrations compared with fasting of shorter duration. An inverse linear relationship between maternal CRH concentration and gestational age at delivery was also established (28).

Also we found a significant increase in cholesterol and LDL in fourth week of Ramadan compared to the first week ( $P < 0.01$ ).

Some studies about the effect of lipid profile in Ramadan fasting in healthy individual have been done, as well. In a study, serum cholesterol and TG significantly decreased in Ramadan fasting (19). According to Adlouni et al study (8), the TC and LDL-C significantly decreased during Ramadan. These two studies are not consistent with our study.

In a study Ramadan fasting led to significant increase in LDL (29). Another important finding in our study was that TC and LDL significantly increased during Ramadan and decreased after the Ramadan. The rise in TC and LDL may be due to an increase in hepatic lipase activity and a decrease in lipoprotein lipase activity (30). This may be resulted from body dehydration. Dehydration trigger blood dilution and increase in lipid profile volume in Ramadan fasting.

Also, maternal hypercholesterolemia has been linked to increased cholesterol deposition in the fetal aorta that may influence risk of long term morbidity (31).

An abnormal lipid profile is known to be strongly associated with atherosclerotic cardiovascular diseases and has a direct effect on endothelial dysfunction. Several studies have shown that endothelial dysfunction is related to hyperlipidemia (32).

Normally, in early pregnancy altered levels of serum lipid profile increase risk of pregnancy-induced hypertension (32).

Pregnancy-induced hypertension may cause several critical problems in pregnancy, such as premature delivery, intrauterine growth restriction, fetal death, and maternal mortality and morbidity (33). In some studies, the birth weight was unaffected by Ramadan fast in babies born at full term (34, 35).

Endothelial dysfunction is the most important event in the pathogenesis of hypertension during pregnancy and abnormal levels of lipid profile play a critical role in induction of endothelial dysfunction (36, 37). Also, an increase in LDL is associated with the development of atherosclerosis (38).

## Conclusion

Cholesterol and LDL during Ramadan increases and then decreases. There was no change in the levels of TG and HDL in pregnant women. Our findings, especially if taken together, indicate that fasted pregnant women could have a risky pregnancy and may put pregnant fasted women at risk. Also, it is important to remember that the effect of abnormal lipid profile in pregnant fasted women may not always be immediate. Therefore, the present study findings may not be sufficient to conclude that Ramadan fasting is safe during pregnancy.

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## References

1. Robinson T, Raisler J. "Each one is a doctor for herself": Ramadan fasting among pregnant Muslim women in the United States. *Ethn Dis*. 2005;15(1 Suppl 1):S1-99-103.
2. Joosop J, Abu J, Yu SL. A survey of fasting during pregnancy. *Singapore Med J*. 2004;45(12):583-6.
3. Arab M, Nasrollahi S. Interrelation of Ramadan fasting and birth weight. *Med J Islamic Academy Sci*. 2001;14(3):91-5.
4. Janesick A, Blumberg B. Endocrine disrupting chemicals and the developmental programming of adipogenesis and obesity. *Birth Defects Res C Embryo Today*. 2011;93(1):34-50.
5. Jamil AAT, Elsoni B, Zaki H, Elbadawi NEE, Ahmed EG, Ibrahim EK, et al. Assessment of lipid profile in sudanese pregnant women. *Key Res J Biotechnol*. 2013;1(1):4-15.
6. Akturk I, Biyik I, Kocas C, Yalcin A, Erturk M, Uzun F. PP-106 Effects of Ramadan fasting on lipid profile, brain natriuretic peptide, renal functions and electrolyte levels in patients with hypertension. *Int J Cardiol*. 2012;155:S134.
7. Khafaji HA, Bener A, Osman M, Al Merri A, Al Suwaidi J. The impact of diurnal fasting during Ramadan on the lipid profile, hs-CRP, and serum leptin in stable cardiac patients. *Vasc Health Risk Manag*. 2012;8:7-14.
8. Adlouni A, Ghalim N, Benslimane A, Lecerf 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.
9. Waterhouse J, Alkib L, Reilly T. Effects of Ramadan upon fluid and food intake, fatigue, and physical, mental, and social activities: a comparison between the UK and Libya. *Chronobiol Int*. 2008;25(5):697-724.
10. Akaberi A, Golshan A, Moojdekanloo M, Hashemian M. Does fasting in Ramadan ameliorate Lipid profile? A prospective observational study. *Pak J Med Sci*. 2014;30(4):708-11.
11. Ziaee V, Razaee M, Ahmadinejad Z, Shaikh H, Yousefi R, Yarmohammadi L, et al. The changes of metabolic profile and weight during Ramadan fasting. *Singapore Med J*. 2006;47(5):409-14.
12. 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.
13. Frost G, Pirani S. Meal frequency and nutritional intake during Ramadan: a pilot study. *Hum Nutr Appl Nutr*. 1987;41(1):47-50.
14. Framarino-dei-Malatesta M, Derme M, Napoli A, Iaria G, Manzia TM, Orlando G, et al. Placental, lipid, and glucidic effects of mammalian target of rapamycin inhibitors: impact on fetal growth and metabolic disorders during pregnancy after solid organ transplantation. *Transplant Proc*. 2014;46(7):2254-8.
15. Srisawasdi P, Chaloeysup S, Teerajetgul Y, Pocathikorn A, Sukasem C, Vanavan S, et al. Estimation of plasma small dense LDL cholesterol from classic lipid measures. *Am J Clin Pathol*. 2011;136(1):20-9.
16. Maislos M, Khamaysi N, Assali A, Abou-Rabiah Y, Zvili I, Shany S. Marked increase in plasma high-density-lipoprotein cholesterol after prolonged

- fasting during Ramadan. *Am J Clin Nutr.* 1993;57(5):640-2.
17. Lamine F, Bouguerra R, Jabrane J, Marrakchi Z, Ben Rayana MC, Ben Slama C, et al. Food intake and high density lipoprotein cholesterol levels changes during ramadan fasting in healthy young subjects. *Tunis Med.* 2006;84(10):647-50.
  18. Bener A, Yousafzai MT. Effect of Ramadan fasting on diabetes mellitus: a population-based study in Qatar. *J Egypt Public Health Assoc.* 2014;89(2):47-52.
  19. Norouzy A, Salehi M, Philippou E, Arabi H, Shiva F, Mehrnoosh S, et al. Effect of fasting in Ramadan on body composition and nutritional intake: a prospective study. *J Hum Nutr Diet.* 2013;26 Suppl 1:97-104.
  20. Ozturk E, Balat O, Ugur MG, Yazicioglu C, Pence S, Erel O, et al. Effect of Ramadan fasting on maternal oxidative stress during the second trimester: a preliminary study. *J Obstet Gynaecol Res.* 2011;37(7):729-33.
  21. Leiper J, Molla A. Effects on health of fluid restriction during fasting in Ramadan. *Eur J Clin Nutr.* 2003;57:S30-S8.
  22. Rolfes SR, Pinna K, Whitney E. *Understanding normal and clinical nutrition.* 7th ed. Thomson wadsworth: Cengage Learning; 2006.
  23. Gharbi M, Akrouf M, Zouari B. [Food intake during and outside Ramadan]. *East Mediterr Health J.* 2003;9(1-2):131-40.
  24. Bakhotmah BA. The puzzle of self-reported weight gain in a month of fasting (Ramadan) among a cohort of Saudi families in Jeddah, Western Saudi Arabia. *Nutr J.* 2011;10:84.
  25. Hobel C, Culhane J. Role of psychosocial and nutritional stress on poor pregnancy outcome. *J Nutr.* 2003;133(5 Suppl 2):1709S-17S.
  26. Siega-Riz AM, Herrmann TS, Savitz DA, Thorp JM. Frequency of eating during pregnancy and its effect on preterm delivery. *Am J Epidemiol.* 2001;153(7):647-52.
  27. Hobel C, Siega-Riz A. The West Los Angeles preterm birth prevention project: a reassessment of interventions. *J Matern Fetal Neonatal Med.* 1998;3(1):161-4.
  28. Herrmann TS, Siega-Riz AM, Hobel CJ, Aurora C, Dunkel-Schetter C. Prolonged periods without food intake during pregnancy increase risk for elevated maternal corticotropin-releasing hormone concentrations. *Am J Obstet Gynecol.* 2001;185(2):403-12.
  29. Akaberi A, Golshan A, Moojdekanloo M, Hashemian M. Does fasting in Ramadan ameliorate Lipid profile? A prospective observational study. *Pakistan J Med Sci.* 2014;30(4):708.
  30. Brizzi P, Tonolo G, Esposito F, Puddu L, Dessole S, Maioli M, et al. Lipoprotein metabolism during normal pregnancy. *Am J Obstet Gynecol.* 1999;181(2):430-4.
  31. Napoli C, Witztum JL, Calara F, de Nigris F, Palinski W. Maternal hypercholesterolemia enhances atherogenesis in normocholesterolemic rabbits, which is inhibited by antioxidant or lipid-lowering intervention during pregnancy: an experimental model of atherogenic mechanisms in human fetuses. *Circ Res.* 2000;87(10):946-52.
  32. Dutta D. Hypertensive disorders in pregnancy. *Textbook of Obstetrics, Ed Konar, HL, 5th edition, New Central Book Agency, Kolkata.* 2001:234-55.
  33. Obed S, Patience A. Birth weight and ponderal index in pre-eclampsia: a comparative study. *Ghana Med J.* 2006;40(1):8-13.
  34. Cross JH, Eminson J, Wharton BA. Ramadan and birth weight at full term in Asian Moslem pregnant women in Birmingham. *Arch Dis Child.* 1990;65(10 Spec No):1053-6.
  35. Dikensoy E, Balat O, Cebesoy B, Ozkur A, Cicek H, Can G. The effect of Ramadan fasting on maternal serum lipids, cortisol levels and fetal development. *Arch Gynecol Obstet.* 2009;279(2):119-23.
  36. Dimitrova-Sumkovska J, Dosic-Markovska B, Zafirova-Roganovic D, Anastasovska V. Effects of different dietary fatty acid supplements upon lipoprotein metabolism and lipid peroxides production in hyperlipidemic rats. *Prilozi.* 2006;27(1):67-86.
  37. Demirci O, Tugrul AS, Dolgun N, Sozen H, Eren S. Serum lipids level assessed in early pregnancy and risk of pre-eclampsia. *J Obstet Gynaecol Res.* 2011;37(10):1427-32.
  38. Ross R. Atherosclerosis is an inflammatory disease. *Am Heart J.* 1999;138(5):S419-S20.