

# Effects of Fasting in the Holy Month of Ramadan on the Uric Acid, Urea, and Creatinine Levels: A Narrative Review

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## ABSTRACT

Fasting during the month of Ramadan is one of the Five Pillars of Islam. During this holy month, healthy Muslims abstain from eating, drinking, and smoking from dawn to dusk. Although fasting is obligatory for every adult Muslim, if it has hazardous effects on the body, it is prohibited. Due to some Islamic principles, patients are exempted from fasting; however, due to the willingness of some individuals to fast, there are concerns about its effects on urea, uric acid, and creatinine levels. Atypical levels of these compounds can cause serious disorders or indicate abnormal renal function. The present narrative review is aimed to investigate the effect of abnormally high levels of urea, uric acid, and creatinine on one's health and effects of fasting during Ramadan on these indicators. Articles were searched from PubMed, Elsevier and Google Scholar and then they were evaluated. It can be concluded that fasting does not have any adverse effects on the urea, uric acid, and creatinine levels according to the above-mentioned studies.

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## Introduction

People attend to have healthy nutritional methods because these methods protect one's health. Attention to Islamic advices is very important and usefulness in order to obtain these methods. (1-3). The ninth lunar month of the Islamic calendar is the revered month of Ramadan. This annual ritual is regarded as one of the Five Pillars of Islam according to Hadith of fifth Shia Imam (may peace be upon him). Fasting is a divine practice that has many therapeutic effects (4). During Ramadan, healthy Muslims abstain from eating, drinking, and smoking from dawn till dusk (5, 6). Although fasting is obligatory for every adult Muslim, if it has hazardous effects on the body, it is prohibited. According to the holy Quran,

(BAQARA Surah; 185th verse), if fasting may cause health risks, it is not permitted. It should be noted that fasting duration ranges from less than 12 h to 19 h based on the seasonal and locational attributes. On the other hand, urea, uric acid, and creatinine levels play a significant role in one's health. Atypical levels of these compounds can cause serious disorders or indicate abnormal renal function. The present narrative review aimed to investigate the effect of abnormally high levels of urea, uric acid, and creatinine on one's health and effects of fasting during Ramadan on these indicators.

## Definition of urea, uric acid, and

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## **creatinine and the effects of their abnormally high levels on the human body**

### ***Uric acid***

Uric acid is the final breakdown of purine metabolism. Long-term high-levels of uric acid (hyperuricemia) is associated with gout or gouty, a condition characterized by tender, red, hot, and swollen joints caused by recurrent attacks of acute inflammatory arthritis. Gout is caused by elevated uric acid level. This condition creates crystal deposits in tendons, joints, and other connective tissues; it can also cause uric acid renal stones (7, 8).

As mentioned above, hyperuricemia is a primary cause of nephrolithiasis and gout; thus, attention to uric acid level is necessary. Males are at greater risk of developing gout than females given the higher baseline of uric acid. It should be noted that hyperuricemia is associated with metabolic syndrome. A previous study suggested that fructose-induced hyperuricemia can lead to metabolic syndrome (9) and may also be associated with the development of the risk factors for cardiovascular diseases (10).

### ***Urea***

Urea ( $\text{H}_2\text{NCONH}_2$ ) is a water soluble compound that was originally thought to simply pass slowly among cell membranes by passive diffusion. This colorless crystalline compound is the main nitrogen catabolic product of amino acid and protein (11). Urea is a clinical indices for evaluation of glomerular filtration rate so it is helpful in diagnosis of acute kidney failure (12). Uremia is an abnormally elevated level of urea in the blood; moreover, uremia can cause complications such as osteomalacia, infertility, xeroderma, cardiovascular diseases, polyneuritis, encephalopathy, and comatose (13-16); thus, attention to the urea level is of paramount importance.

### ***Creatinine***

Creatinine is a product of creatine phosphate in muscles and is usually produced as much as necessary for the body. Serum creatinine is an important indicator of renal health; therefore, measurement of serum level of creatinine is the most commonly used indicator of renal function (glomerular filtration rate). The elevated level of creatinine can result leukemia, hyperthyroidism

and anemia. (17-19).

## **The effects of Ramadan fasting on Urea, Uric acid, and Creatinine levels**

### ***Urea and uric acid serum concentrations***

Babaei et al. based on the assessment of biochemical markers of health during Ramadan concluded that Ramadan fasting lowers the concentration of uric acid serum (20). In a similar study, Akanji et al. noted favorable changes in serum Apo A-1 and its ratio to Apo B, as well as high-density lipoprotein in stable hyperlipidemic individuals after Ramadan fasting. They illustrated that the concentration of uric acid decreases after Ramadan fasting (21). In addition, Boobes et al. reported that renal transplant beneficiaries did not reveal any adverse effects due to fasting for renal graft function. They also stated that Islamic fasting does not significantly elevate urea level (22). Another study conducted by Bernieh et al. indicated that fasting during Ramadan does not have notable effects on the fluctuation of serum uric acid in renal transplant recipients; furthermore, these patients showed no significant increase of urea level (23). Also other study was confirmed that there is not notable difference of urea level between fasting kidney transplant recipients and non-fasting kidney transplant recipients (24).

On the other hand, Salahuddin and Javed performed a study to investigate the effects of fasting during Ramadan, which showed some biochemical and physiological parameters in hypertensive and healthy individuals in Aurangabad District of Maharashtra, India. They explained that serum urea returns to the baseline once fasting ends (25). Similarly, in another study evaluating the effect of Islamic fasting on renal function and oxidative stress in diabetics, explained that fasting can return urea level to the baseline once the patients ceased to fast (26), which mentioned result is in line with findings of Chamsi-Pasha's study (27). Shirpoor and Eskandari stated that urea level remarkably reduced on the 15th and 29th days of Ramadan compared to the first day (28).

### ***Creatinine serum concentration***

The study by Azizi et al. revealed the effects of Ramadan fasting on creatinine level, and suggested that fasting during Ramadan does

not have a notable association with the increase of serum creatinine. Moreover, Bernie et al. indicated that Islamic fasting in the month of Ramadan did not have statistically significant effects on creatinine level in kidney transplant patients. Similarly, another study confirmed this result (12, 23, 29). The absence of changes in mean creatinine level was also found in the study by Cheah et al. it can be concluded that fasting did not have any adverse effects on renal function and that the body can adapt to fasting. The results obtained by Said are in agreement with these findings (30, 24).

Statistical analysis in other studies showed there were not any significant changes in all parameters such as creatinine level prior, during, and following Ramadan (31). The results of Einollahi did reflect any significant changes in the concentration of serum creatinine among fasting kidney transplant patients (mean serum creatinine concentrations before and after Ramadan were  $1.07 \pm 0.24$  mg/dl and  $1.08 \pm 0.2$  mg/dl, respectively). Also, in a controlled group, the levels were  $1.00 \pm 0.24$  mg/dl and  $1.03 \pm 0.28$  mg/dl, respectively.

It was concluded that there were not any significant differences among the fasting and the control groups regarding renal function before and after Ramadan (32). Additionally, Shirpoor and Eskandari evaluated the effects of fasting on the serum level of albumin, creatinine and urea. Twenty-four male and female cases aged 19-22 years were selected. Results showed the creatine level in the male group did not show any significant changes by the 15th day of Ramadan. However, this level

non-significantly increased by the 29th day. Similar results were obtained in the female group, that is, by the 15th day there was not any significant change in creatinine level. Nevertheless, unlike the male group, there was a significant increase in creatinine level by the end of Ramadan in females (27). El Hazmi et al. examined the effects of Ramadan fasting on the biochemical and hematological parameters. They explained that fasting during the holy month of Ramadan does not have any adverse effects on creatinine level (33). As well as, Ghalib et al. examined the effects of Islamic fasting on the renal function in kidney transplant patients. They explained that plasma creatinine hadn't notable difference between fasting and non-fasting group (34).

## Discussion

The results of studies indicate that during fasting in Ramadan, it was not changed level of creatinine (30, 35-43), except one case that in end Ramadan is by increasing creatinine level (28). Also fasting influence urea level without increasing effects (30, 35-42, 44, 45) and in some cases, it was decreased impact (28, 36, 46). Furthermore, fasting during holy month of Ramadan had not adverse effects on the uric acid level and in some cases, it had decreasing impact (20, 23, 36, 40, 47-51). Although, according to studies results, it can be considered fasting without unsuitable effects for people with kidney transplantation (52-54) but it is suggested that they be monitored by physicians during Ramadan fasting.

Table 1 presents effects of fasting on the three mentioned parameters.

**Table 1.** Effects of fasting on uric acid, urea, and creatinine levels

| Scholars                    | Parameters | Fasting effects   |
|-----------------------------|------------|---|
| Babaei et al. (20)          | Uric acid  | Reduction of uric acid level.   |
| Akanji et al. (21)          | Uric acid  | Uric acid concentration decreases after Ramadan month compared to before it.  |
| Boobes et al. (22)          | Uric acid  | Serum uric acid does not remarkably change in fasting renal graft patients.   |
| Boobes et al. (22)          | Creatinine | Creatinine level has no remarkable change in fasting renal graft patients.  |
| Boobes et al. (22)          | Urea       | There was no remarkable increase in serum urea level.   |
| Bermieh et al. (23)         | Uric acid  | There was no notable reduction or increase in the serum uric acid level.  |
| Bermieh et al. (23)         | Creatinine | Creatinine level had no remarkable changes in fasting renal graft patients.   |
| Bermieh et al. (23)         | Urea       | There was not any significant increase of serum urea level.   |
| Said et al. (24)            | Urea       | There was not any significant increase of serum urea level.   |
| Said et al. (24)            | Creatinine | There was not any significant increase of serum creatinine level.   |
| Salahuddin and Javed (25)   | Urea       | Serum urea returns to the baseline by the end of Ramadan.   |
| Rokaya et al. (26)          | Urea       | Serum urea returns to the baseline by the end of Ramadan.   |
| Chamsi-Pasha et al. (27)    | Urea       | Serum urea returns to the baseline by the end of Ramadan.   |
| Shirpoor and Eskandari (28) | Urea       | Urea level had a remarkable reduction on the 15th and 29th days of Ramadan compared to the first day.   |
| Shirpoor and Eskandari (28) | Creatinine | In the female group, there was no significant change in the creatinine level on the 15th day of Ramadan, but there was a significant increase at the end of Ramadan. In the male group, there was no significant change in the creatinine level during Ramadan. |
| Azizi (29)                  | Creatinine | There was no significant increase in the serum creatinine level.  |

Continuous of table 1.

|                         |            |  |
|-------------------------|------------|--|
| Cheah et al. (30)       | Creatinine | There were no adverse effects on renal function and creatinine level.  |
| Cheah et al. (30)       | Urea       | There were no adverse effects on urea level.   |
| Abdalla et al. (31)     | Creatinine | Creatinine level did not significantly change.   |
| Einollahi (32)          | Creatinine | There was not any significant difference between fasted and control group in relevance to creatinine level and renal function. |
| El Hazmi et al. (33)    | Creatinine | Fasting during holy month of Ramadan had not adverse effects on the creatinine level.  |
| Ghalib et al.(34)       | Creatinine | Plasma creatinine hadn't notable difference between fasting and non-fasting group.   |
| Al-Khader et al.(35)    | Creatinine | There was no significant increase in the serum creatinine level.   |
| Al-Khader et al.(35)    | Urea       | There were no adverse effects on urea level.   |
| Navaei et al.(36)       | Creatinine | There was no significant increase in the serum creatinine level.   |
| Navaei et al.(36)       | Uric acid  | Reduction of uric acid level.  |
| Navaei et al.(36)       | Urea       | There were no adverse effects on urea level and it had a remarkable reduction.   |
| Ziaee et al.(37)        | Creatinine | There was no significant increase in the serum creatinine level.   |
| Ziaee et al.(37)        | Urea       | There were no adverse effects on urea level.   |
| Al Hourani et al.(38)   | Creatinine | There was no significant change in the serum creatinine level.   |
| Al Hourani et al.(38)   | Urea       | There was no remarkable change in serum urea level.  |
| Mohammed (39)           | Creatinine | There was no remarkable change in serum creatinine level.  |
| Mohammed (39)           | Urea       | There was no remarkable change in serum urea level.  |
| Maislos et al.(40)      | Urea       | There was no significant change in the serum urea level.   |
| Maislos et al.(40)      | Creatinine | There was no remarkable change in serum creatinine level.  |
| Maislos et al.(40)      | Uric acid  | There was no significant change in the serum uric acid level.  |
| Khoshdel et al.(41)     | Creatinine | There was no difference between creatinine level at the end of Ramadan and after it.   |
| Khoshdel et al.(41)     | Urea       | There was no difference between urea level at the end of Ramadan and after it.   |
| Yousuf et al.(41)       | Creatinine | Creatinine level has no remarkable change before and during Ramadan.   |
| Yousuf et al.(41)       | Urea       | Urea level has no remarkable change before and during Ramadan.   |
| Sliman and Khatib.(43)  | Creatinine | Creatinine level has no remarkable change.   |
| Bermieh et al.(44)      | Urea       | Urea level has no remarkable change.   |
| Al Muhanna (45)         | Urea       | There were no adverse effects on urea level.   |
| Vardarli et al.(46)     | Urea       | Reduction of urea level.   |
| Davidson (47)           | Uric acid  | Uric acid level has no remarkable change.  |
| Zare and Mohammadi (48) | Uric acid  | There was no significant change in the serum uric acid level at the beginning and ending of Ramadan.                           |
| Nagra et al.(49)        | Uric acid  | There was no remarkable change in the serum uric acid level.   |
| Mustafa et al.(50)      | Uric acid  | Uric acid level has no notable change.   |
| Janghorbani (51)        | Uric acid  | Uric acid level has no remarkable change.  |
| Salem et al.(52)        | Creatinine | Creatinine level has no remarkable change in fasting renal graft.  |
| Salem et al.(52)        | Urea       | Urea level has no remarkable change in fasting renal graft.  |
| Einollahi et al.(53)    | Creatinine | Creatinine level has no remarkable change in fasting renal graft patients.   |
| Hejailli et al.(54)     | Creatinine | Creatinine level has no remarkable change in fasting renal graft patients.   |

## Conclusion

It can be concluded that fasting does not have adverse effects on the urea, uric acid, and creatinine levels according to the above-mentioned studies. It is suggested that further studies carried out on this topic

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## References

- Mirsane SA, Shafagh S, Ajorpaz NM. Efficacy of pomegranate ingredients in treatment and prevention of diseases. *Avicenna J Med Biochem.* 2016; 4(2):e37992.
- Mirsane SA, Shafagh S. Effects of helicobacter pylori infection and western diet on migraine. *Gene Cell Tissue.* 2016; 3(3):e39212.
- Mirsane SA, Shafagh S, Oraei N. Fasting in the holy month of Ramadan and lipid profile. *J Fasting Health.* 2016; 4(2):93-4.
- Mirsane SA, Shafagh S. A narrative review on fasting of pregnant women in the holy month of Ramadan. *J Fasting Health.* 2016; 4(2):53-6.
- Mirsane SA, Shafagh S. The relationship between XRCC1 Arg399Gln polymorphism, alcohol consumption and colorectal cancer: one of the alcohol forbidding reasons in Islam. *Gene Cell Tissue.* 2016; 3(3):e40607.
- Bajaj S, Khan A, Fathima FN, Jaleel MA, Sheikh A, Azad K, et al. South Asian consensus statement on women's health and Ramadan. *Indian J Endocrinol Metab.* 2012, 16(4):508-11.
- Wallace KL, Riedel AA, Joseph-Ridge N, Wortmann R. Increasing prevalence of gout and hyperuricemia over 10 years among older adults in a managed care population. *J Rheumatol.* 2004; 31(8):1582-7.
- Becker M, Roessler BJ. Hyperuricemia and gout. In: Scriver CR, editor. *The metabolic and molecular bases of inherited disease.* 7<sup>th</sup> ed. New York: McGraw-Hill; 1995. P. 1655-77.
- Nakagawa T, Hu H, Zharikov S, Tuttle KR, Short RA, Glushakova O, et al. A causal role for uric acid in fructose-induced metabolic syndrome. *Am J Physiol Renal Physiol.* 2006; 290(3):F625-31.
- Borghini C, Verardi FM, Pareo I, Bentivenga C, Cicero AF. Hyperuricemia and cardiovascular disease

- risk. *Expert Rev Cardiovasc Ther.* 2014; 12(10):1219-25.
11. Stewart G. The emerging physiological roles of the SLC14A family of urea transporters. *Br J Pharmacol.* 2011; 164(7):1780-92.
  12. Rosner MH, Bolton WK. Renal function testing. *Am J Kidney Dis.* 2006; 47(1):174-83.
  13. Meyer TW, Hostetter TH. Uremia. *N Engl J Med.* 2007; 357(13):1316-25.
  14. Almeras C, Argiles A. Progress in uremic toxin research: the general picture of uremia. *Semin Dial.* 2009; 22(4):321-2.
  15. Depner TA. Uremic toxicity: urea and beyond. *Semin Dial.* 2001; 14(4):246-51.
  16. Edmund L, David J. Kidney function tests. In: Carl AB, Edward RA, David EB, Tietz NW, editors. *Textbook of clinical chemistry and molecular diagnostics.* 4<sup>th</sup> ed. New Delhi: Elsevier Inc; 2006. P. 797-808.
  17. Mohamed NA, Elhafiz JM, Ahmed FB. Serum creatinine in normal Sudanese athletes and soldiers. *Am J Clin Med Res.* 2014; 2(4):84-6.
  18. Murray RK, Granner DK, Mayes PA, Rodwell VW. *Harper's illustrated biochemistry.* 27<sup>th</sup> ed. New York: McGraw-Hill; 2007. P. 274.
  19. Wen X, Liu A, Yu C, Wang L, Zhou M, Wang N, et al. Inhibiting post-translational core fucosylation prevents vascular calcification in the model of uremia. *Int J Biochem Cell Biol.* 2016; 79:69-79.
  20. Babaei AA, Ghasemi M, Tavakoli Ghouchani H, Yousefi A. Evaluation of the effects of Islamic fasting on the biochemical markers of health. *J Fasting Health.* 2016; 4(2):88-91.
  21. Akanji AO, Mojiminiyi OA, Abdella N. Beneficial changes in serum apo A-1 and its ratio to apo B and HDL in stable hyperlipidaemic subjects after Ramadan fasting in Kuwait. *Eur J Clin Nutr.* 2000; 54(6):508-13.
  22. Boobes Y, Bernieh B, Al Hakim MR. Fasting Ramadan in kidney transplant patients is safe. *Saudi J Kidney Dis Transpl.* 2009; 20(2):198-200.
  23. Bernieh BO, Mohamed AO, Wafa AM. Ramadan fasting and renal transplant recipients: clinical and biochemical effects. *Saudi J Kidney Dis Transpl.* 1994; 5(4):470-3.
  24. Said T, Nampoory MR, Haleem MA, Nair MP, Johny KV, Samhan M, et al. Ramadan fast in kidney transplant recipients: a prospective comparative study. *Transplant Proc.* 2003; 35(7):2614-6.
  25. Salahuddin M, Javed MU. Effects of Ramadan fasting on some physiological and biochemical parameters in healthy and hypertensive subjects in Aurangabad district of Maharashtra, India. *J Fasting Health.* 2014; 2(1):7-13.
  26. Rokaya OA, El-Batae HE, Tawfeek S. Ramadan fasting improves kidney functions and ameliorates oxidative stress in diabetic patients. *World J Med Sci.* 2012; 7(1):38-48.
  27. Chamsi-Pasha H, Ahmed WH. The effect of fasting in Ramadan on patients with heart disease. *Saudi Med J.* 2004; 25(1):47-51.
  28. Shirpoor A, Eskandari M. The effect of fasting on albumin, creatinine and urea level of serum. *Iran J Endocrinol Metab.* 2001; 3(Suppl 2):9-10.
  29. Azizi F. Research in Islamic fasting and health. *Ann Saudi Med.* 2002; 22(3-4):186-91.
  30. Cheah SH, Ch'ng SL, berain R, Duncan MT. Effects of fasting during Ramadan on urinary excretion in Malaysian Muslims. *Br J Nutr.* 1990; 63(2):329-37.
  31. Abdalla AH, Shaheen FA, Rassoul Z, Owda AK, Popovich WF, Mousa DH, et al. Effect of Ramadan fasting on Moslem kidney transplant recipients. *Am J Nephrol.* 1998; 18(2):101-4.
  32. Einollahi B. Effect of Ramadan fasting on function of transplanted kidney. *Trauma Mon.* 1999; 4(2):61-71.
  33. El Hazmi MA, Al-Faleh FZ, Al-Mofleh IA. Effect of Ramadan fasting on the values of hematological and biochemical parameters. *Saudi Med J.* 1987; 8(2):171-6.
  34. Ghalib M, Qureshi J, Tamim H, Ghamdi G, Flaiw A, Hejaili F, et al. Does repeated Ramadan fasting adversely affect kidney function in renal transplant patients? *Transplantation.* 2008; 85(1):141-4.
  35. Al-Khader A, Al-Hasani M, Dhar J, Al-Sulaiman M. Effect of diet during Ramadan on patients on chronic haemodialysis. *Saudi Med J.* 1991; 12(1):30-1.
  36. Navaei L, Mehrabi Y, Azizi F. Changes in body weight, blood pressure, consumption pattern and biochemical parameters in diabetic patients during fasting in Ramadan. *Iran J Endocrinol Metab.* 2001; 3(2):125-32.
  37. Ziaee V, Yousefi R, Ahmadinejad Z, Shaikh H, Rezaei M, Behjati MJ. The effect of Ramadan fasting on serum osmolarity, some electrolytes and hematological parameters. *Iran J Endocrinol Metab.* 2007; 9(1):47-53.
  38. Al Hourani HM, Atoum MF, Akel S, Hijjawi N, Awawdeh S. Effects of Ramadan fasting on some haematological and biochemical parameters. *Jordan J Biol Sci.* 2009; 2(3):103-8.
  39. Mohammed Z. The influence of Ramadan fasting on some hematological and biochemical parameters in healthy adult males. *Iraqi Nat J Nursing Special.* 2011; 24(1):45-51.
  40. Maislos M, Abou-Rabiah Y, Zuili I, Iordash S, Shany S. Gorging and plasma HDL-cholesterol-the Ramadan model. *Eur J Clin Nutr.* 1998; 52(2):127-30.
  41. Khoshdel A, Kheiri S, Nasiri J, Mobasheri M. The effect of Ramadan fasting on biochemical substances relating to the renal and bone function of fasting pregnant women, 2011-2012. *J Fasting Health.* 2013; 1(2):79-84.
  42. Rathor MY, Rani A, Fauzi M, Shah M, Shah A, How

- SH. Metabolic changes during Ramadan fasting in normal people and diabetic patients. *Int Med J Malaysia*. 2003; 2(2):1-6.
43. Sliman NA, Khatib FA. Effect of fasting Ramadan on body weight and some blood constituents of healthy Muslims. *Nutr Rep Int*. 1988; 38(6):1299-1306.
44. Bernieh B, Al Hakim MR, Boobes Y, Abu Zidan FM. Fasting Ramadan in chronic kidney disease patients: clinical and biochemical effects. *Saudi J Kidney Dis Transpl*. 2010; 21(5):898-902.
45. Al Muhanna FA. Ramadan fasting and renal failure. *Saudi Med J*. 1998; 19(3):319-21.
46. Vardarli MC, Hammes HP, Vardarli I. Possible metabolic impact of Ramadan fasting in healthy men. *Turk J Med Sci*. 2014; 44(6):1010-20.
47. Davidson JC. Muslims, Ramadan, and diabetes mellitus. *Br Med J*. 1979; 2(6203):1511-2.
48. Zare M, Mohammadi GR. Study of some biochemical parameters in male university students affected by Ramadan fasting. *J Sabzevar Univ Med Sci*. 2002; 9(3):30-5.
49. Nagra SA, Rahman ZU, Javaria M, Qadri AJ. Study of some biochemical parameters in young women as affected by Ramadan fasting. *Int J Ramadan Fasting Res*. 1998; 2(1):1-5.
50. Mustafa KY, Mahmoud NA, Gumaa KA, Gader AM. The effects of fasting in Ramadan. 2. Fluid and electrolyte balance. *Br J Nutr*. 1978; 40(3):583-9.
51. Janghorbani M. Effect of Islamic fasting on body weight, blood pressure, electrolytes, blood cell count and certain serum biochemical variables in males. *J Kerman Univ Med Sci*. 1995; 2(4):183-92.
52. Salem EE, Akhili IM, Akikli AB. The effect of Ramadan fasting on the kidney function of renal transplant recipients. *Arab J Nephrol Transplant*. 2010; 3(1):29-32.
53. Einollahi B, Lessan-Pezeshki M, Pourfarziani V, Aghdam B, Rouzbeh J, Ghadiani MH, et al. Ramadan fasting in kidney transplant recipients with normal renal function and with mild-to-moderate renal dysfunction. *Int Urol Nephrol*. 2009; 41(2):417-22.
54. Hejaili F, Qurashi S, Binsalih S, Jaradt M, Al Sayyari A. Effect of repeated Ramadan fasting in the hottest months of the year on renal graft function. *Nephrourol Mon*. 2014; 6(2):e14362