

# Ramadan fasting and patients with renal diseases: A mini review of the literature

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Fasting during the month of Ramadan is one of the five pillars of Islam. During this month, adult Muslims are obligated to refrain from eating and drinking from dawn to dusk. Although based on Islamic principles patients are exempted from fasting, each year, many Muslim patients express their willingness to observe the fast in Ramadan month to respect the cultural customs. There are concerns about the impact of fluid restriction and dehydration during Ramadan fasting for patients with renal diseases. In this study, we reviewed the PubMed, Google Scholar, EBSCO, SCIRUS, Embase, and DOAJ data sources to identify the published studies on the impact of Ramadan fasting on patients with renal diseases. Our review on published reports on renal transplant recipients revealed no injurious effect of Ramadan fasting for the renal graft function. Nearly all studies on this topic suggest that Ramadan fasting is safe when the function of the renal graft is acceptable and stable. Regarding the impact of Ramadan fasting on patients with chronic kidney disease, there is concern about the role of renal hypoperfusion in developing tubular cell injury. Finally, there is controversy between studies about the risk of dehydration in Ramadan in developing renal stones. There are uncertainties about the change in the incidence of renal colic in Ramadan month compared with the other periods of the year. Despite such discrepancies, nearly all studies are in agreement on consuming adequate amounts of water from dusk to dawn to reduce the risk of renal stone formation.

**Key words:** Chronic kidney disease, fasting, Ramadan, renal, stone, transplantation

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## INTRODUCTION

Ramadan, the ninth lunar month of Islamic calendar, is a sacred month for Muslims all around the world. Fasting during Ramadan is one of the five pillars of Islam and a fundamental religious duty for Muslims. During this month, healthy adult Muslims are obligated to abstain from eating and drinking from dawn to dusk. The Islamic lunar calendar is 11 days shorter than the Gregorian solar calendar, and therefore, the month of Ramadan can occur in any season of the year. The hours spent on fasting can vary from 12 to 18 h, depending on the seasonal and regional features.

Based on Islamic principles, patients are exempted from fasting during Ramadan. However, each year, many Muslim patients express their willingness to observe the fast during Ramadan month to respect the traditional customs. There are concerns about the impact of dehydration and the subsequent renal hypoperfusion during Ramadan fasting for patients with renal diseases.<sup>[1]</sup> This concern particularly arises when Ramadan month occurs during hot and dry summers with long daytime duration.

In the literature, there is scarce scientific data about the safety of Ramadan fasting for patients with different renal diseases. The existing published reports are mainly focused on the impact of Ramadan fasting on patients with renal transplantation, patients with chronic kidney disease, and patients with renal stone disease. In this study, we comprehensively reviewed all published articles in the field and provide the readers with the current recommendations for renal patients who decide to fast during the month of Ramadan.

## METHODS AND SEARCHING STRATEGY

This review involved a search of the PubMed, Google Scholar, EBSCO, SCIRUS, Embase, and DOAJ data sources for all articles published in English language investigating the effect of Ramadan fasting in patients with renal diseases. The search terms that were used (either combined or separated) were as follows: Ramadan, Fasting, Kidney, Renal, Transplantation, Allograft, Stones, Nephrolithiasis, Colic, Glomerulonephritis, Chronic, Acute, Disease, Nephropathy, Glomerular, Urine, Urinary, Creatinine, and Filtration. Only those studies that concentrated on the impact of Ramadan

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fasting on patients with renal diseases were included. We excluded the studies that explored the impact of fasting on various serum/urinary biochemical markers in healthy populations. After reviewing the title and abstract of the eligible studies, we classified the articles into the following three categories: i) Ramadan fasting and renal transplant recipients; ii) Ramadan fasting and chronic kidney disease; and iii) Ramadan fasting and renal stone disease. Accordingly, we present the results of the eligible studies based on each category.

## RAMADAN FASTING AND RENAL TRANSPLANT RECIPIENTS

Renal transplant recipients are often concerned about the degree of stress that fluid and electrolyte deprivation can induce on the function of their grafted kidneys during Ramadan fasting. However, nearly all studies performed on patients with transplanted kidneys show that fasting during Ramadan is not associated with significant adverse effect on the renal allograft function. Said *et al.*<sup>[2]</sup> investigated the effect of Ramadan fasting on 71 renal transplant recipients with stable renal function and compared their clinical and biochemical profile with 74 renal transplant recipients who did not fast during Ramadan (November 2000; fasting duration of about 12 h). The included participants had a stable allograft function for more than 6 months prior to the beginning of the study and their baseline serum creatinine was lower than 2.26 mg/dl. The authors also monitored the fasting group for a period of 1 year in order to detect any remote complications. Their findings showed no significant change in serum creatinine, blood urea, blood sugar, and blood pressure between the fasting and non-fasting groups during the study period. The frequency of adverse events during 1 year follow-up was not significantly different between the two groups. There was no graft loss in the fasting patients during the study period. Subsequently, the authors suggested that fasting during Ramadan is safe for kidney transplanted patients who have a stable renal function for at least 6 months.<sup>[2]</sup> In another similar study, Einollahi *et al.*<sup>[3]</sup> compared the clinical characteristics of 19 renal transplant recipients who decided to fast during Ramadan with 20 age- and sex-matched recipients who did not fast. The study participants had a baseline serum creatinine lower than 1.5 mg/dl before enrollment in the study. No significant adverse effect on renal allograft was detected during Ramadan. After Ramadan month, serum creatinine level did not significantly change from the baseline value in both fasting and non-fasting groups. The authors suggested that Ramadan fasting is safe and has no harmful effect on renal allograft in patients with a stable allograft function.<sup>[3]</sup> The authors followed their research and published another study that comprised a relatively

larger number of studied participants. In their next work, Einollahi *et al.*<sup>[4]</sup> investigated the impact of Ramadan fasting on 41 kidney transplant recipients who decided to fast during Ramadan and compared their findings with 41 matched control recipients who did not fast (September–October 2007; fasting duration of about 14 h). All 82 participants of the study had a stable renal allograft function for at least 6 months prior to Ramadan. It is notable that in the fasting group, 16 patients (39%) had mild to moderate renal allograft impairment with an estimated glomerular filtration rate (GFR) of lower than 60 ml/min (ranging from 28.3 to 59.4 ml/min). After completing the Ramadan fasting, the authors evaluated the changes in serum creatinine and GFR between the two groups. Their observations revealed no significant change in the mean serum creatinine levels and estimated GFR values after Ramadan in either of the groups. The renal function remained stable during Ramadan fasting even in patients who had a baseline GFR lower than 60 ml/min. No episode of acute graft rejection or acute tubular necrosis occurred in the fasting group during Ramadan. Correspondingly, the authors suggested that Ramadan fasting is not associated with adverse effects in renal transplant recipients who have normal renal allograft function, as well as in those with mild to moderate impaired renal allograft function.<sup>[4]</sup>

Boobes *et al.*<sup>[5]</sup> investigated the impact of Ramadan fasting on 22 renal recipients who had undergone renal transplantation in more than 1 year prior to Ramadan (October–November 2004; fasting duration of about 12.5 h). No deleterious effect was observed during Ramadan fasting. The medications of the patients were given in two divided doses at dawn and dusk. No significant change was observed in serum creatinine, blood urea, blood pressure, plasma sodium, plasma potassium, and hemoglobin during the study period. The authors suggested that Ramadan fasting was safe for renal transplanted patients who have stable renal function for at least 1 year.<sup>[5]</sup> In another study, Ouziala *et al.*<sup>[6]</sup> researched the impact of Ramadan fasting on 14 renal recipients who were transplanted between 1 and 7 months before Ramadan. They explored the changes in 24-h urinary volume, blood pressure, serum creatinine, blood urea, uric acid, serum electrolytes (sodium, potassium, calcium), and the lipid profile variables during Ramadan fasting. The Ramadan month in the index study was during the winter season. Their observations revealed a statistically significant increase in blood urea, uric acid and triglyceride during the fasting period. Other clinical and biochemical variables showed no significant change from the baseline value. All subjects successfully completed the fasting with no adverse complication. The authors suggested that even during the first year of renal transplantation, the allograft kidney is able to endure the fluid restriction of Ramadan fasting. However, it is important to note that these results

have been obtained from a small number of subjects fasting during the winter season.<sup>[6]</sup> The authors have acknowledged this limitation and suggested that further studies with larger participants, and preferably during the summer season, are needed to evaluate the safety of Ramadan fasting in the first year of renal transplantation.

Another study was conducted by Argani *et al.*<sup>[7]</sup> on 30 renal transplant recipients who decided to fast during Ramadan (fasting duration of about 12 h). The authors investigated the changes in biochemical parameters as well as the immunologic features including total white blood cell counts, serum C<sub>3</sub>, serum IgA level, and serum IgM level. Participants had a baseline serum creatinine level lower than 1.8 mg/dl before enrollment in the study. The authors found no significant change in the serum creatinine, blood electrolytes, and urinary biochemistry during Ramadan fasting. With respect to the immunologic studies, the authors reported no significant change in the total white blood cell counts, T cell count, and IgA level during Ramadan fasting. There was a statistically significant decrease in B cell count, serum IgM concentration, and serum C<sub>3</sub> after Ramadan. The authors reported no adverse effects of Ramadan fasting on renal allograft function. As conclusion, they suggested that Ramadan fasting for renal transplant recipients is not associated with severe biochemical or immunologic complication.

In a study that was conducted in Riyadh, Saudi Arabia, Qurashi *et al.*<sup>[8]</sup> investigated the impact of Ramadan fasting on 43 renal transplant recipients who voluntarily decided to fast during Ramadan and compared them with 37 matched controls who did not fast. The index study was carried out when Ramadan was in the hottest month of the year (August) in that region. The mean GFR of the fasting and non-fasting groups before the beginning of the study were  $75.6 \pm 29.2$  and  $65.9 \pm 25.9$  ml/min, respectively. The fasting group tolerated the Ramadan month well and no adverse effect of fasting on renal allograft function was detected. Six months after Ramadan, the mean GFR in fasting and non-fasting groups were  $77.2 \pm 29.7$  and  $64.1 \pm 29$  ml/min, respectively; which showed no significant change from the baseline value in both the groups. In line with the results of previously mentioned studies, the authors suggested that Ramadan fasting is safe for renal transplant recipients who have a stable renal function.<sup>[8]</sup>

Finally, the effect of repeated Ramadan fasting in renal transplant recipients was investigated by Ghalib *et al.*<sup>[9]</sup> They compared the changes in GFR, mean arterial pressure (MAP), and urinary protein excretion between a group of 35 renal transplant recipients who fasted for three consecutive Ramadans and a group of 33 renal transplant controls who did not fast. Based on their findings, the

subjects who fasted for three consecutive Ramadans showed no significant change in their GFRs after the third Ramadan fasting in comparison with their baseline GFR values estimated before the first Ramadan. Additionally, after three consecutive Ramadans, no significant difference in GFR, MAP, and urinary protein excretion was observed between the fasting and non-fasting groups. The fasting group successfully tolerated Ramadan fasting and showed no episode of graft rejection or deterioration in renal function. The fasting patients also showed an acceptable compliance with their medications during the fasting period. Correspondingly, the authors suggested that repeated Ramadan fasting is safe for renal transplant recipients who have a stable renal function.<sup>[9]</sup>

## RAMADAN FASTING AND PATIENTS WITH CHRONIC KIDNEY DISEASE

Chronic kidney disease is associated with gradual loss of kidney function over time. Many physicians are concerned about the worsening effects of fluid deprivation and electrolyte disturbance during Ramadan on the remaining renal function in patients with chronic kidney disease. Our review of the literature revealed a paucity of data on the impact of Ramadan fasting in chronic kidney disease. In a study, El-Wakil *et al.*<sup>[10]</sup> investigated the changes in the renal function of 15 chronic kidney disease patients (baseline GFR <60 ml/min) who fasted during the month of Ramadan (November 2001), and compared their findings with a group of 6 matched controls who did not fast. The authors measured the GFRs of the study participants using a standard method of Diethylene Triamine Penta Acetic acid (DTPA) dynamic renal scan. In addition, they measured urinary *N*-acetyl-d-glucosaminidase (NAG) which is a marker for detection of renal tubular cell injury. After Ramadan month, the change in GFR from the baseline value was not significantly different between the fasting and non-fasting groups. However, the change in urinary NAG from the baseline was significantly higher in the fasting group in comparison with the non-fasting controls. These findings revealed that while GFR may not significantly change in patients with chronic kidney disease, Ramadan fasting may damage renal tubular cells in these patients. Correspondingly, the authors argued that the fluid deprivation in Ramadan may induce acute tubular cell injury in chronic kidney disease patients, while the value of GFR may remain unchanged due to renal compensatory mechanisms at the same time.

Although the results of El-Wakil *et al.*'s study demonstrated injurious effects of Ramadan fasting in patients with chronic kidney disease,<sup>[10]</sup> a survey conducted by Bernieh *et al.*<sup>[11]</sup> showed beneficial effects of Ramadan fasting in chronic kidney disease patients. Bernieh *et al.*<sup>[11]</sup>

investigated the changes in body weight, blood pressure, blood sugar, serum electrolytes, lipid profile variables, estimated GFR, and urinary protein excretion among 31 patients with chronic kidney disease who decided to fast during Ramadan (October–November 2005; fasting duration of about 12 h). These cases consisted of 14 patients with stage III (GFR between 30 and 59 ml/min), 12 patients with stage IV (GFR between 15 and 29 ml/min), and 5 patients with stage V (GFR lower than 15 ml/min) chronic kidney disease. The mean GFR of the patients was  $29.7 \pm 16.3$  ml/min. All patients completed fasting successfully with no adverse complication. After Ramadan, the authors observed a reduction in the mean of body weight, systolic and diastolic blood pressure, triglycerides, and urinary protein excretion; nevertheless, these changes did not reach the significant threshold. More interestingly, they reported that the mean GFR of the patients improved from the baseline value of  $29.7 \pm 16.3$  ml/min before Ramadan to  $32.7 \pm 17.4$  ml/min one month after Ramadan. In explaining this observation, the authors postulated three mechanisms that could have been involved in improving the GFRs of the fasting patients. First, they hypothesized that the tendency in blood pressure reduction, which was observed during the month of Ramadan, might have some beneficial effects on the patients' renal function. Second, they assumed that the body weight reduction during fasting can reduce the overhydration in patients with chronic kidney disease and, subsequently, can improve the renal perfusion. Third, they suggested that the reduction in dietary protein intake during the fasting month of Ramadan may be in charge of the decline in the serum creatinine values. With respect to these observations, the authors suggested that fasting during Ramadan is safe for patients with chronic kidney disease.

The observations in Bernieh *et al.*'s<sup>[11]</sup> study that demonstrated improvement in patients' GFR as well as a tendency for reduction in body weight, blood pressure, and triglycerides after Ramadan fasting is interesting. It is worth noting that many patients with chronic kidney disease are affected with metabolic syndrome and impaired lipid profile complications.<sup>[12-15]</sup> However, it should be borne in mind that the sample size of the Bernieh *et al.*'s study (31 participants) may not be large enough to draw a definite conclusion. Further studies with larger number of chronic kidney disease patients are needed to shed more light on the discrepancies found between the studies of Bernieh *et al.*<sup>[11]</sup> and El-Wakil *et al.*<sup>[10]</sup>

## RAMADAN FASTING AND RENAL STONE DISEASE

It is well-established that dehydration and low urinary volume are the main risk factors for the development of renal stones.<sup>[16,17]</sup> Nearly all epidemiological and

experimental studies suggest that patients with a history of renal stones should increase their water intake and have at least a 24-h urinary volume of 2 liters to avoid renal stone formation.<sup>[18-20]</sup> These recommendations may raise the question of whether the restricted water intake during the fasting month of Ramadan can increase renal stone formation or not. Our review of the literature revealed that there is scarce scientific evidence with conflicting results on this topic. In a study, Abdolreza *et al.*<sup>[21]</sup> compared the number of patients admitted with renal colic between the four periods of i) 2 weeks before Ramadan, ii) the first 2 weeks of Ramadan, iii) the second 2 weeks of Ramadan, and, iv) 2 weeks after the month of Ramadan (August–October 2008). Their investigations revealed that the number of renal colic admissions was the highest in the first 2 weeks of Ramadan in comparison with the other periods. Interestingly, after the first 2 weeks of Ramadan, the number of renal colic admissions decreased. This trend (i.e. reduction in renal colic admissions) continued during the second 2 weeks of Ramadan and also during 2 weeks after Ramadan. As a conclusion, the authors suggested that the sudden changes in dietary habits (primarily the reduction in water intake) may be responsible for increase in the renal colic admission during the first 2 weeks of Ramadan.

Although Abdolreza *et al.* demonstrated an association between Ramadan fasting and the incidence of renal colic admissions,<sup>[21]</sup> other studies on this topic did not find a similar relationship. As an example, Al-Hadramy *et al.*<sup>[22]</sup> investigated the variations in the incidence of renal colic in different seasons for three consecutive years in a western region of Saudi Arabia. They did not observe any significant change in the incidence of renal colic during the Ramadan months compared with the other periods of the year.<sup>[22]</sup> In another similar work, Basiri *et al.*<sup>[23]</sup> found no significant change in renal colic incidence during the month of Ramadan in Iran. Finally, Miladipour *et al.*<sup>[24]</sup> investigated the changes in urinary excretion of calcium, oxalate, citrate, uric acid, magnesium, phosphate, potassium, sodium, and creatinine in 57 men (including 37 recurrent stone formers and 20 healthy subjects) during Ramadan fasting. Their investigations revealed no evidence in favor of increased risk of stones formation during Ramadan fasting.<sup>[24]</sup>

In brief, there is still no strong evidence that reveals whether Ramadan fasting can induce renal stone formation in susceptible patients or not. Despite such controversies, nearly all studies are in agreement on consuming adequate amounts of water from dusk to dawn to attain the recommended 24-h urinary volume and reduce the potential risk of dehydration in developing renal stones.

## CONCLUSION

The impact of fasting during the holy month of Ramadan on Muslim patients with various diseases is under extensive discussion in the medical literature.<sup>[1,25,26]</sup> Patients with renal diseases are of special concern for physicians due to the fear of deleterious effects of dehydration on their renal function. In this study, we reviewed the current published reports on the impact of Ramadan fasting in patients with renal transplantation, patients with chronic kidney disease, and patients with renal colic.

Regarding patients with renal transplantation, nearly all available studies suggested that Ramadan fasting is safe when the function of the renal graft is acceptable and stable. No study has reported any deleterious effects of Ramadan fasting for the transplanted kidneys. Fasting should be under medical supervision and the graft function should be closely observed.<sup>[27,28]</sup> Considering the fact that the majority of renal transplant patients are receiving immunosuppressive therapies,<sup>[29]</sup> studies have suggested that the patients' medications should be given at two divided dosage during dusk or just before dawn when the Muslim patients are allowed to eat, drink, or consume their medications.

Regarding patients with chronic kidney disease, the existing data in the literature are scarce and give inconclusive results. Overall, it is argued that water restriction during Ramadan can induce acute tubular cell injury in these patients. Patients should be monitored closely by their physicians while fasting. If any signs/symptoms of acute tubular necrosis occurred, the fasting should be discontinued.

And finally, there is a discrepancy in the literature regarding the incidence of renal colic in the fasting month of Ramadan. Although one study<sup>[21]</sup> showed an association between Ramadan and the increase in renal colic admission, other studies<sup>[22-24]</sup> have failed to show such a relationship.

The major limitation of the existing studies in the literature is their small number of studied participants. More studies with a larger number of patients are warranted to investigate the pros and cons of Ramadan fasting for patients with different renal diseases.

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