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Effect of Ramadan Fasting on DNA Repair, Immune System, Inflammation and Cognitive Function in Chronic Kidney Disease Patients: A Systematic Literature Review

Drajad Priyono^{1*}, Harnavi Harun¹, Deka Viotra¹, Zaki Mahmudi Dasril²

¹Division of Kidney-Hypertension, Department of Internal Medicine, Faculty of Medicine, Universitas Andalas, Padang, Indonesia

²Department of Internal Medicine, Faculty of Medicine, Universitas Andalas, Padang, Indonesia

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*Corresponding author:

Drajad Priyono

E-mail address:

drajadpriyono17@gmail.com

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ABSTRACT

Background: There have been many studies that say Ramadan fasting has a positive effect on reducing BMI, blood sugar, inflammatory factors, and DNA Repair. However, there are still no guidelines for fasting in patients with chronic kidney disease (CKD) both nationally and internationally. This study aimed to conduct a review to explore the effects of Ramadan fasting against chronic kidney disease, specifically on DNA repair, Immune System, Inflammation, and Cognitive Function in patients with chronic kidney disease. **Methods:** This study is a systematic literature review (SLR) with sources obtained from various reputable journal databases such as PubMed, Cochrane Library, EBSCO, and Elsevier using relevant keywords. The selected articles have passed the inclusion and exclusion criteria. A total of 39 articles that discuss fasting were obtained from Ramadan in chronic kidney disease patients on metabolic response and inflammatory markers in the body. **Results:** Ramadan fasting has a positive effect on the response to anti-inflammatory, expression of protective genes, markers of kidney and liver function, protective proteome, and oxidative stress. **Conclusion:** Ramadan fasting may provide a short-term protective effect against levels of systemic inflammation.

1. Introduction

Ramadan is the holiest month for Muslims around the world, and the following practices are obligatory for all healthy believers. Globally, more than one billion Muslims fast during the month of Ramadan, with times ranging from less than 12 hours to 19 hours each day. Muslim patients with chronic kidney disease are often seen discussing their desire to fast Ramadan with the doctor who treated them. So far, there have been many studies related to Ramadan fasting as one of the factors to improve the biochemical parameters of inflammatory markers and reduce various metabolic disorders such as obesity, syndrome

metabolism, hypertension, hypercholesterolemia, cardiovascular disease, type 2 diabetes mellitus, and chronic kidney disease. However, there are also controversial studies that report increased inflammatory markers and a possible increased risk of cerebrovascular disease during Ramadan fasting. This is associated with several confounding factors such as gender, age, ethnicity, amount of days and length of fasting, climatic conditions, sociocultural influences, research subjects, sample size, background, genetics, and diet. Therefore the decision to fast is still returned to the patient.¹

Chronic kidney disease is a pathophysiological process with various etiologies, resulting in a progressive decline in kidney function, which generally ends in kidney failure. Kidney failure is a clinical condition characterized by an irreversible decline in kidney function, so that one-day permanent kidney therapy will be required, namely dialysis or kidney transplant. The pathophysiology of chronic kidney disease depends on the underlying disease. Renal fibrosis is the main pathological followed by inflammation.²

So far, there are no specific national or international guidelines for Ramadan fasting in chronic kidney disease patients. However, in its development, many studies have been reported with the results of reducing inflammatory markers and reducing risk cardiovascular that happened during the month of Ramadan, accompanied by improved kidney function, as well as increased eGFR.³⁻⁵ This study is a literature review conducted with various relevant sources to be able to describe the potential of Ramadan fasting as a positive factor against inflammation cells, oxidative stress, and DNA repair, particularly in patients with chronic kidney disease.

2. Methods

The literature search process was carried out on various databases (PubMed, Web of Sciences, EMBASE, Cochrane Libraries, and Google Scholar) regarding the effect of fasting in chronic renal failure. The search was performed using the terms: (1) "fasting" OR "stress oxidative" OR "immunity" OR "the effect of fasting in chronic renal failure " AND (2) "fasting" OR "chronic renal failure." The literature is limited to clinical studies and published in English. The literature selection criteria are articles published in the form of original articles, a study in chronic renal failure, the control group without therapeutic effect or no treatment, studies were conducted in a timeframe from 1990-2021, and the main outcome was the effect fasting in immunity, preventing inflammation, preventing stress oxidative in chronic renal failure. Meanwhile, the exclusion criteria were studies that were not related to chronic renal failure, the effect of fasting with other conditions, the absence of a control group, and duplication of publications. This study follows the preferred reporting items for systematic reviews and meta-analysis (PRISMA) recommendations.

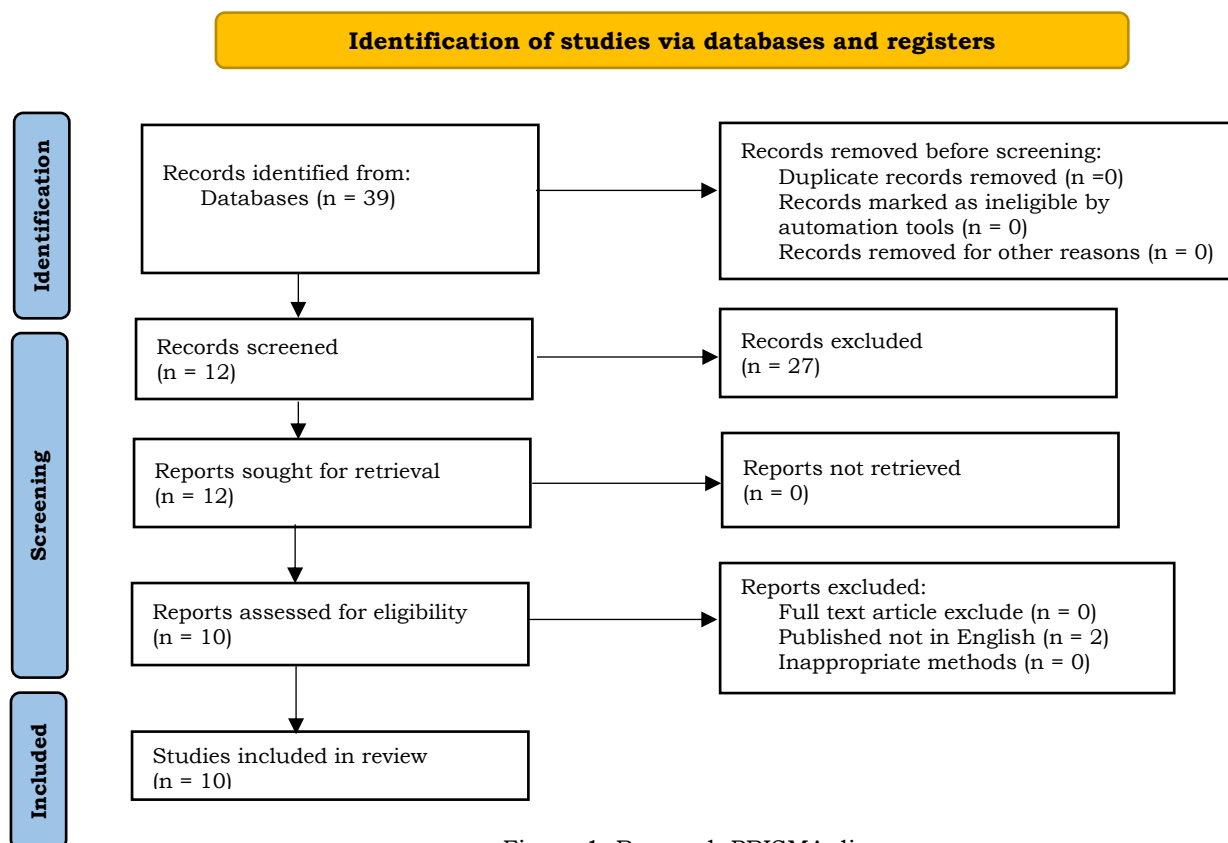


Figure 1. Research PRISMA diagram.

3. Results

Figure 1 presents the PRISMA of this systematic literature review. Based on searches from various databases, Reputable journals found 39 manuscripts found based on searches with the appropriate keywords in the method. A total of 27 publication manuscripts did not fulfill inclusion criteria, where 12 publications were conducted on experimental animals, 11 publications did not include a comparison or control group, and 4 publications assessed the effects of fasting in healthy patients, not chronic renal failure patients. So that 12 publications were obtained that met the inclusion criteria. As many as 2 publications were excluded from this study because they did not use English, so 10 publications were obtained for systematic review.

4. Discussion

Many studies have shown that Ramadan fasting has a positive impact on the body's response by maintaining cell homeostasis. Cells respond to long-term fasting by carrying out a coordinated adaptive stress response to increase antioxidant expression, DNA repair, degrade inflammatory regulators, mitochondrial biogenesis, and autophagy. Here are presented some studies that describe the effect of Ramadan fasting on the body's response of patients with CKD and not.^{6,7}

Table 1. Systematic review studies.

No.	Author	Results
1.	Madkour et al. ⁸	At the end of Ramadan, BMI, fat mass, IGF-1, along with cholesterol, triglyceride, and HDL levels decreased significantly when compared to before fasting (P<0.05). But fasting blood sugar, insulin, and HOMA-IR did not show any changes in this study. In addition, there were significant changes in the expression of 3 antioxidant genes at the end of Ramadan. There was an increase in SOD2 (+53.8%, 95%, CI 1.7-2.76) and an increase in TFAM (+90.4%, 95% CI 1.53-2.22) and Nrf2 (+411.8 %, 95% CI 4.93-10.66) at the end of Ramadan.
2.	Mohammadzade et al. ⁹	There were no significant changes in total cholesterol, blood pressure, IL6, and Hs CRP values. However, Ramadan fasting significantly has a positive effect on decreasing BMI, fasting blood sugar, triglycerides, erythrocyte sedimentation, insulin, and HOMA-IR.
3	Mohajer et al. ¹⁰	There were significant differences in BMI, total cholesterol, fasting blood sugar, triglycerides, and LDL before and after Ramadan. In addition, the hematological examination showed a decrease in platelet levels. In addition, there was a decrease in the levels of the pro-inflammatory chemokine CXC but it was not accompanied by significant homeostatic changes.
4.	Ibrahim et al. ¹¹	There was a significant decrease in MDA erythrocytes, blood sugar, triglycerides, and total carotenoids after fasting (<0.05) on day 28 of fasting. However, for other examination markers, there was no significant change in Ramadan fasting.
5.	Aksungar et al. ¹²	There is no significant change to results examination of serum total cholesterol, triglycerides, and LDL. However, there was a decrease in TC/HDL (HDL risk factor) during and after Ramadan in both genders when compared to the non-fasting group, thereby reducing cardiovascular risk factors. There were low significant changes for IL-6, CRP, and homocysteine (P<0.01) when compared to pre-fasting values.
6.	Mindikoglu et al. ¹³	Fasting of 14 hours for 4 weeks is associated with serum anticancer proteomic, insulin signaling, and key regulation of protein metabolism, glucose, circadian rhythms, DNA repair, cytoskeleton remodeling, system immune, and cognitive function, resulting in a protective proteome such as LATS1, CFHR1, B4GALT1, ASAP1, FMO5 RRB2 and suppression of other tumor markers. Besides that, it can also inhibit the course of metabolic syndrome, inflammation, Alzheimer's disease, and neuropsychiatric disorders.
7.	Fakhrzadeh et al. ¹⁴	There was a decrease in BMI and waist circumference in the participants, but no significant changes were found in blood pressure. There is a significant relationship between caloric intake and the patient's blood sugar level, accompanied by an increase in HDL, and a decrease in LDL and Triglycerides.
8.	Zouhal et al. ¹⁵	There was a decrease in interleukin-6 (p:0.02 d:1.4) and TNFα (p:0.01, d:0.7) with no change in CRP (p:0.3, d:0.1) in treatment and control groups. However, no significant changes were found in markers of kidney and liver function in the control and treatment groups.
9.	Faris et al. ¹⁶	There was a significant reduction in pro-inflammatory factors in patients undergoing Ramadan fasting (IL1β, IL-6, TNFα), BMI, and body fat and blood pressure with p<0.05 when compared before and after Ramadan, but cell immunity was also obtained. Decreased but still within the reference value range.
10.	Karatas et al. ¹⁷	There was significant change in changes in patients' BUN values before fasting (median BUN: 26.65) and after undergoing Ramadan fasting (median BUN: 24.05) with p: 0.004. Decreased creatinine from 1.5 mg/dl to 1.42 mg/dl (p:0.038) accompanied by an increase in eGFR 14.826 in patients undergoing Ramadan fasting.

Ramadan fasting has a positive effect on the anti-inflammatory response, protective gene expression, markers of kidney and liver function, protective proteome, and oxidative stress. So this shows that Ramadan fasting may provide a short-term protective effect against levels of systemic inflammation and changes in various metabolic parameters.

5. Conclusion

Ramadan fasting may provide a short-term protective effect against levels of systemic inflammation.

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