

The effect of Ramadan fasting on clinical and laboratory parameters in chronic kidney disease patients underwent hemodialysis

El efecto del ayuno de Ramadán en los parámetros clínicos y de laboratorio en pacientes con enfermedad renal crónica sometidos a hemodiálisis

Langgeng Perdhana^{1*}, Shofa Chasani^{2*}

SUMMARY

Background: *Despite getting relief from not fasting during Ramadan, some hemodialysis patients will ask questions about how fasting affects their health and whether they are allowed to fast. This study aims to determine the relationship between Ramadan fasting on clinical and laboratory parameters in chronic kidney disease (CKD) patients undergoing hemodialysis.*

DOI: <https://doi.org/10.47307/GMC.2021.129.s2.22>

ORCID: 0000-0002-6627-9054¹

ORCID: 0000-0003-0161-8155²

^{*}Hemodialysis Unit, Roemani Muhammadiyah Hospital, Semarang 50242, Indonesia

• Corresponding Author: Langgeng Perdhana
Hemodialysis Unit, Roemani Muhammadiyah Hospital, Semarang,
Indonesia. Jl. Wonodri Baru Raya No.22, Semarang 50242,
Indonesia
Tel: +6224-8444623; Fax: +6224-8415752
E-mail : langgeng.p@gmail.com

Recibido: 8 de junio 2021

Aceptado: 22 de junio 2021

Methods: *The cohort design study was carried out from April to May 2020 at the Hemodialysis Unit of Roemani Muhammadiyah Hospital Semarang. The dependent variables included pre-dialysis weight, Inter Dialytic Weight Gain (IDWG), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), hemoglobin level (Hb).*

Result: *Among 33 respondents, it was found that 11 (33.3 %) respondents were fasting during Ramadan, and 22 (66.7 %) respondents were not fasting. The respondents consisted of 17 males (51.5 %) and 16 females (48.5 %). The mean age was 55.4 ± 10.5 years. The duration of hemodialysis was 24 ± 20.1 months. The independent t-test showed a significant relationship between Ramadan fasting and pre-dialysis weight ($p=0.003$). As for the variables IDWG, SBP, DBP, and Hb, there was an insignificant relationship ($p>0.05$).*

Conclusion: *Ramadan fasting does not relate to IDWG, SBP, DBP, and Hb level parameters. These results indicate that the condition of hemodialysis patients who are fasting is the same as those who are not fasting, so it is safe if hemodialysis patients wish to fast in Ramadan.*

Keywords: *Chronic kidney disease, hemodialysis, Ramadan fasting.*

RESUMEN

Antecedentes: *A pesar de sentirse aliviado por no ayunar durante el Ramadán, algunos pacientes en hemodiálisis harán preguntas sobre cómo el ayuno afecta su salud y si se les permite ayunar. Este estudio tiene como objetivo determinar la relación entre el ayuno de Ramadán y los parámetros clínicos y de laboratorio en pacientes con enfermedad renal crónica (ERC) sometidos a hemodiálisis.*

Métodos: *El estudio de diseño de cohortes se llevó a cabo de abril a mayo de 2020 en la Unidad de Hemodiálisis del Hospital Roemani Muhammadiyah Semarang. Las variables dependientes incluyeron el peso previo a la diálisis, el aumento de peso interdiálisis (IDWG), la presión arterial sistólica (PAS), la presión arterial diastólica (PAD), el nivel de hemoglobina (Hb).*

Resultados: *Entre los 33 encuestados, se encontró que 11 (33,3 %) encuestados estaban ayunando durante el Ramadán, y 22 (66,7 %) encuestados no estaban ayunando. Los encuestados fueron 17 hombres (51,5 %) y 16 mujeres (48,5 %). La edad media fue de 55,4 ± 10,5 años. La duración de la hemodiálisis fue de 24 ± 20,1 meses. La prueba t independiente mostró una relación significativa entre el ayuno de Ramadán y el peso previo a la diálisis ($p=0,003$). En cuanto a las variables IDWG, PAS, PAD y Hb, hubo una relación no significativa ($p>0,05$).*

Conclusión: *El ayuno de Ramadán no se relaciona con los parámetros de nivel de IDWG, PAS, PAD y Hb. Estos resultados indican que la condición de los pacientes en hemodiálisis que están en ayunas es la misma que la de los que no lo hacen, por lo que es seguro si los pacientes en hemodiálisis desean ayunar en Ramadán.*

Palabras clave: *Enfermedad renal crónica, hemodiálisis, ayuno de Ramadán.*

INTRODUCTION

Ramadan, the ninth month of the Muslim lunar calendar (Hijra), represents the holiest month for Muslims. Ramadan's length varies, as the Islamic lunar year is 354 days long and the Ramadan month is 29 or 30 days long. There is an order to fast during the month of Ramadan, which is one of Islam's five pillars, along with the faith of profession (Shahada), the five regular ritual prayers (Salat), charity (Zakat), and the pilgrimage to Mecca (Hajj). Muslims fast every day for a whole month during Ramadan (1).

Ramadan fasting involves abstaining not only

from food and drink, but also from smoking, medication use, and sexual activity. Ramadan fasting is a unique form of fasting that consists of alternate cycles of abstinence and refeeding. Muslims start their fast by eating a pre-dawn meal called suhoor and end their fast by eating an after-sunset meal called iftar. It means that the mean fasting duration during abstinence periods is usually 12-14 hours per day. However, it also depends on the place and the time of the year (1).

Ramadan fasting is obligatory for every adult Muslim who has no medical or religious barriers. However, some groups are allowed not to fast in Ramadan, including travelers, children, women who are menstruating, pregnant, or breastfeeding, and anyone with an illness. In the Al-Quran, it is explained that if a person is sick and cannot fast according to the testimony of an expert and trusted doctor, he is allowed not to fast (1). Even so, sometimes the patient still wishes to fast. As a doctor in Indonesia, a country with a Muslim majority population, we will often get questions from patients, "Can I fast? and How does fasting affect my health?". This question will often be asked by patients, including patients with Chronic Kidney Disease (CKD) who are undergoing hemodialysis (2).

Chronic kidney disease is an incurable and chronic disease that is a significant public health concern in both developed and developing countries, where the prevalence of the disease continues to rise year after year (3).

CKD was described as kidney damage and/or a glomerular filtration rate (GFR) of 60 ml/men/1.73 m² for more than three months. CKD is classified into six stages based on the GFR value (4). CKD is also classified according to its severity, diagnosis, treatment, and prognosis (5). Renal function decreases in CKD as a result of progressive glomerular damage induced by maladaptive responses to functional cells in the kidneys to a variety of stresses, including inflammation, oxidative stress, and hypertension (6). CKD leads to irreversible retrograde of renal function that finally becoming an end-stage renal disease (ESRD). Hemodialysis (HD) is one of the therapies needed for patients with end-stage renal disease (ESRD). Indonesia is a country in South-East Asia, consisting of more than 13 600 islands and 400 ethnicities (7). In Indonesia, the

prevalence of HD patients increased from 9396 in 2013 to 11 689 in 2014, while the incident rate increased from 15 128 in 2013 to 17 193 in 2014 (8).

The primary issue that patients undergoing hemodialysis face is weight gain between two hemodialysis sessions, referred to as Interdialytic Weight Gain (IDWG). IDWG is an increase in fluid volume manifested by weight gain as a proxy for the amount of fluid ingested during the interdialytic cycle and the client's compliance with fluid control in hemodialysis patients (9). Fluid restriction is recommended for hemodialysis patients due to the inability of the kidneys to remove excess body fluids, and the risk of increased complications from the excess fluid as a fluid overload can lead to lower-extremity edema, ascites, and pulmonary vascular congestion, increased morbidity, and mortality in CKD patients (10).

Eventually, as Ramadan fasting imposes lifestyle changes in terms of meal timing, frequency, food availability, and food culture, it is reasonable to predict that dietary and fluid restriction can result in deterioration of nutritional and health status in patients with chronic kidney disease who practice fasting. Additionally, this study reported that Ramadan fasting results in a substantial decrease in IDWG (11). Based on a study (12), Ramadan fasting is beneficial for health in the general population. It can reduce the risk factor of atherosclerosis like reducing Triglycerid, body weight, and systolic blood pressure. However, Ramadan fasting does not affect cholesterol, fasting blood glucose, and diastolic blood pressure changes in general populations. Nevertheless, several studies mention that the impact of Ramadan fasting on CKD patients is still controversial. A study (2) found that Ramadan fasting in patients with CKD stage 3 or more can lead to a more progressive deterioration of kidney function. This is probably due to dehydration caused by limiting fluid and food intake during Ramadan fasting. In a healthy person, the body responds by secreting antidiuretic hormones that affect decreasing the production of urine and increasing urine concentration without any injurious effect on kidney function. However, in patients with different renal diseases, Ramadan fasting can affect body homeostasis and metabolism.

Yet, the safety study of Ramadan fasting in CKD patients on maintenance hemodialysis is still controversial. Commonly, patients with chronic kidney disease who receive hemodialysis are advised not to fast during Ramadan due to the increased risk of dehydration during the long fasting hours and the risk of fluid overload due to increased fluid intake after sunset (13). In other research, it was discovered that Ramadan fasting had no clinically significant effects on hemodialysis patients and was not associated with significant clinical complications. It is because spirituality plays a significant role in the lives of patients with chronic kidney disease, serving as a coping mechanism and contributing to the psychosocial adjustment to illness, thus allowing individuals to have a higher quality of life (13).

According to the definition above, publications examining the impact of Ramadan fasting on the health of hemodialysis patients remain scarce and contentious. There are no standards or guidelines in place. Additionally, knowledge available on the internet is often deceptive or inconsistent. In Indonesia, we have not found a similar study. So that further study is needed relating to this matter in Indonesia to answer these problems. This study aims to determine the effect of Ramadan fasting on clinical and laboratory parameters in CKD patients undergoing hemodialysis.

METHODS

This study was an analytical observational study with a cohort design conducted from April 1st to May 27th, 2020. It was held in the hemodialysis unit of Roemani Muhammadiyah Hospital Semarang, Indonesia. The sampling technique used in this study was consecutive sampling. The inclusion criteria were patients who underwent hemodialysis ≥ 3 months, frequency of hemodialysis twice a week, and willing to participate in the study. Meanwhile, patients with incomplete data who underwent fasting 1-29 days, got a blood transfusion, underwent a change in therapy regimen, died, and moved to other hemodialysis units during the study period were excluded from this study. In this study, there was no intervention in determining patient decisions and abilities to fast during Ramadan.

FASTING EFFECT IN CKD PATIENTS

The independent variable in this study was fasting status which was categorized into fasting (fasting 30 days) group and non-fasting group. In comparison, the dependent variable in this study was clinical parameters which include pre-dialysis weight, Inter Dialysis Weight Gain (IDWG), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), and laboratory parameters which include hemoglobin (Hb) levels. Pre dialysis weight, IDWG, SBP, and DBP were recorded a month before and during Ramadan. IDWG is calculated by calculating the difference in body weight in kilograms between pre-dialysis weights minus post-dialysis weight in the previous hemodialysis period. SBP and DBP were checked before the patient underwent hemodialysis, where the patient was asked to rest for at least 10 minutes before, and the measurement was done in an upright sitting position on the patient's arm where Cimino was not available as hemodialysis access. We took the differences between at the beginning of Ramadan and once after Ramadan is over for the clinical parameters. While Hb was measured using a peripheral blood sample

taken before hemodialysis and examined using the spectrophotometry method. The collected data then tested for normality test and analyzed bivariate using SPSS 18.0.

RESULTS

In this study, 109 respondents underwent hemodialysis in Roemani Muhammadiyah Hospital, Semarang, Indonesia. Of them, 16 respondents did not meet inclusion because 6 respondents underwent hemodialysis <2x a week, and 10 respondents underwent hemodialysis <3 months. Of 93 respondents who met inclusion, 60 respondents were excluded from the study because 9 respondents died, 5 respondents got a blood transfusion, 5 respondents had incomplete data, and 41 respondents were observed 1-29 days of Ramadan fasting. After going through inclusion and exclusion, there were 33 respondents whose data could be analyzed. The sample selection flow chart in this study is shown in Figure 1.

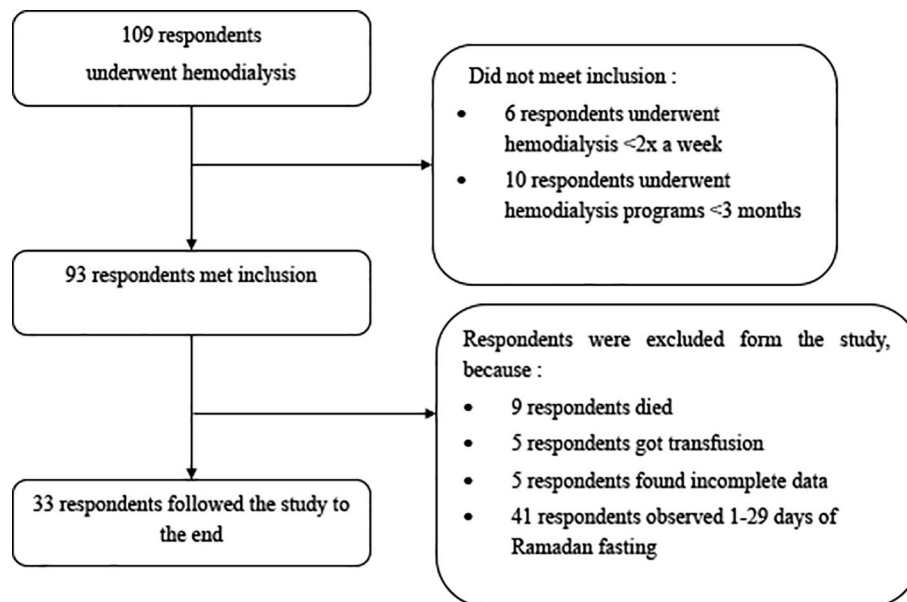


Figure 1. Sample selection flow Chart.

Of the 33 respondents, 11 (33.3 %) respondents were categorized into the fasting and 22 (66.7 %) respondents in the non-fasting group. Of them, 17 (51.5 %) respondents were male, and 16 (48.5 %) respondents were female. The mean age of respondents was 55.4 ± 10.5 years. The

duration of hemodialysis was 24 ± 20.1 months. The mean eGFR was 6.2 ± 2 mL/min/1.73m². The mean urea and creatinine were 134.2 ± 30 mg/dL and 11.4 ± 2.9 U/L. The sociodemographic data are shown in Table 1.

Table 1
Sociodemographic Data

Variables	Mean \pm SD
Age (years)	55.4 ± 10.5
Duration of hemodialysis (months)	24 ± 20.1
eGFR	6.2 ± 2
Ureum (mg/dL)	134.2 ± 30
Creatinine (mg/dL)	11.4 ± 2.9
Sex	
Male	17 (51.5%)
Female	16 (48.5%)

Descriptions data relate to the differences in pre-dialysis weight, IDWG, SBP, DBP, and Hb in the period before and during Ramadan are presented in Table 2. The normality test results using Shapiro-Wilk were carried out from all these data, and all data showed normal data ($p > 0.05$). A statistical test was carried out using an independent t-test to see the effect of Ramadan

fasting on clinical and laboratory parameters in CKD patients undergoing hemodialysis. From these data, it was found that there was a significant relationship between Ramadan fasting and pre-dialysis weight ($p = 0.003$). On the other hand, we found no significant relationship between Ramadan fasting and other variables like IDWG, SBP, DBP, and Hb with $p > 0.05$.

Table 2
Relationship of Ramadan fasting to clinical and laboratory parameters

Variable	Category	N	Mean \pm SD	Mean difference	CI 95%	p-Value
Pre Dialysis Weight	Fasting	11	-0.5 ± 1.9	-0.3	-1.19 – 0.66	0.003
	Non fasting	22	-0.2 ± 0.7			
IDWG	Fasting	11	-0.3 ± 0.6	-0.2	-0.72 – 0.42	0.796
	Non fasting	22	-0.1 ± 0.8			
SBP	Fasting	11	-2.9 ± 10.6	-1.8	-8.3 – 4.7	0.632
	Non fasting	22	-1.1 ± 7.6			
DBP	Fasting	11	-0.8 ± 7.6	-0.7	-5.82 – 3.73	0.076
	Non fasting	22	-0.1 ± 4.8			
Hb	Fasting	11	0.2 ± 0.8	0.2	-0.44 – 0.84	0.726
	Non fasting	22	0 ± 0.8			

Note: N=Number of Respondents, SD=Standard Deviation, CI=Confident Interval, IDWG=Inter Dialytic Weight Gain, SBP=Systolic Blood Pressure, DBP=Diastolic Blood Pressure, Hb=Hemoglobin

DISCUSSION

This study found a significant relationship between Ramadan fasting and pre-dialysis weight, and similar results have been obtained in the previous report (14). In contrast, other studies showed no association between Ramadan fasting and pre-dialysis weight (15,16). This may be due to differences in eating habits during Ramadan as well as varying levels of activity during Ramadan (14).

In this study, there was no significant relationship between Ramadan fasting and IDWG, similar to other studies (15,16). In this study, it was found that the IDWG decreased both in the fasting and non-fasting group. In contrast, a study (13) showed an increase in IDWG. It is suspected that this is closely related to the changes in the patient's daily fluid intake. However, in this study, no data were collected regarding fluid consumption before and during Ramadan (13).

In this study, there was no significant relationship between Ramadan fasting and SBP. This is similar to previous studies (15,16). However, a report showed a significant relationship between Ramadan fasting and SBP (17). The systolic period is a period of filling in the heart which followed by a period of contractions. Self-control, carried out by people who fast in Ramadan, can make us calm, can control ourselves, and not be reckless, so we do not get angry easily. This can prevent the release of the hormone adrenaline or epinephrine so that vasoconstriction does not occur and affects SBP. It is suspected that the vasodilation mechanism of blood vessels does not affect the SBP of respondents during Ramadan fasting (12).

In this study, it was found that there was no significant relationship between Ramadan fasting and DBP, which is similar to the previous study (15). In contrast, another reported study showed a significant relationship between Ramadan fasting and DBP (17,18). Diastolic is the phase when the heart relaxes. There is a decrease in oxidative stress during fasting so that Nitric Oxide (NO) function is not disturbed. One of the functions of NO is to cause vasodilation. It is suspected that the vascular vasodilation mechanism does not affect DBP in respondents during Ramadan fasting (12).

In this study, it was found that there was no significant relationship between Ramadan fasting and Hb level, in line with other reports (15,17). However, this finding was in contrast to recent studies, which showed a significant relationship between fasting Ramadan and Hb levels (19,20). There was a decrease in Hb levels in hemodialysis patients in the fasting and non-fasting groups, while there was an increase in Hb levels in both fasting and non-fasting group hemodialysis patients, although it was not statistically significant. This is probably because Ramadan is a special month for Muslims so that they will prepare a menu with better nutritional value during Ramadan (20).

CONCLUSION

In this study, it was found that there was a significant relationship between Ramadan fasting and pre-dialysis weight in CKD patients undergoing hemodialysis. However, on the other hand, Ramadan fasting does not relate to IDWG, SBP, DBP, and Hb level parameters in CKD patients undergoing hemodialysis. These results indicate that hemodialysis patients who are fasting are the same as those who are not fasting, so it is safe if hemodialysis patients wish to fast in Ramadan.

Acknowledgments

We acknowledge the staff and patients at the Hemodialysis Unit of Roemani Muhammadiyah Hospital, Semarang, Indonesia, to support and cooperate in this study.

REFERENCES

1. Kharisman AU. *Ramadhan Bertabur Berkah*. Probolinggo: Pustaka Hudaya; 2013.
2. Bakhit AA, Kurdi AM, Wadera JJ, Alsuwaida AO. Effects of Ramadan fasting on moderate to severe chronic kidney disease. A prospective observational study. *Saudi Med J*. 2017;38(1):48-52.
3. Thaha M, Imroati TA, Wardana A, Widodo S, Pranawa S, Irwanadi C. Comparison of high-sensitivity C-reactive protein level between chronic kidney

- Disease Stages. *Biomol Heal Sci J*. 2018;1(1):1-9.
4. Kahdina M, Mardiana N, Fauziah D. Levels of hemoglobin, leukocytes, and platelets of chronic kidney disease patients undergoing hemodialysis in Surabaya. *Biomol Heal Sci J*. 2018;1(1):29.
 5. Oktaviono YH, Kusumawardhani N. Hyperkalemia associated with angiotensin converting enzyme inhibitor or angiotensin receptor blockers in chronic kidney disease. *Acta Med Indones*. 2020;52(1):74-79.
 6. Empitu MA, Kadariswantiningsih IN, Thaha M, Nugroho CW, Cahyaning Putri EA, El Hakim Z, et al. Determiner of poor sleep quality in chronic kidney disease patients links to elevated diastolic blood pressure, hs-CRP, and blood-count-based inflammatory predictors. *Indones Biomed J*. 2019;11(1):100-106.
 7. Waskito LA, Miftahussurur M, Lusida MI, Syam AF, Suzuki R, Subsomwong P, et al. Distribution and clinical associations of integrating conjugative elements and cag pathogenicity islands of *Helicobacter pylori* in Indonesia. *Sci Rep*. 2018;8(1):1-9.
 8. Nisak UK, Cholifah, Kusumawardani PA, Aditiawardana. Health-related quality of life in life hemodialysis patients: A single-center study. *Indian J Public Heal Res Dev*. 2018;9(12):2610-2614.
 9. Wahyuni ED, Haloho FNW, Asmoro CP, Laili NR. Factors affecting interdialytic weight gain (IDWG) in hemodialysis patients with precede-proceed theory approach. *IOP Conf Ser Earth Environ Sci*. 2019;246(1).
 10. Widyawati IY, Nursalam, Kusnanto, Hargono R. Personal factors that affect adherence of fluid restriction in patient with hemodialysis. *Indian J Public Heal Res Dev*. 2019;10(3):465-470.
 11. Adanan NIH, Md Ali MS, Lim JH, Zakaria NF, Lim CTS, Yahya R, et al. Investigating physical and nutritional changes during prolonged intermittent fasting in hemodialysis patients: A prospective cohort study. *J Ren Nutr Off J Counc Ren Nutr Natl Kidney Found*. 2020;30(2):e15-26.
 12. Mughni A. Pengaruh Puasa Ramadhan terhadap Faktor-Faktor Resiko Aterosklerosis: Studi pada Profil Lipid, Gula Darah, Tekanan Darah dan Berat Badan. program Pascasarjana Universitas Diponegoro; 2007.
 13. Khazneh E, Qaddumi J, Hamdan Z, Qudaimat F, Sbitany A, Jebrin K, et al. The effects of Ramadan fasting on clinical and biochemical markers among hemodialysis patients: A prospective cohort study. *PLoS One*. 2019;14(6):e0218745.
 14. Tashkandi B, Kaur D, Latifi E, Tallman DA, Chinna K, Daud ZAM, et al. Lipids, Lipoprotein Distribution and Nutritional Parameters over the Ramadan Period in Hemodialysis Patients. *Nutrients*. 2019;11(9):2225.
 15. Wan Md Adnan WAH, Zaharan NL, Wong MH, Lim SK. The Effects of Intermittent Fasting during the Month of Ramadan in Chronic Haemodialysis Patients in a Tropical Climate Country. *PLoS One*. 2015;9(12):e114262.
 16. Alshamsi S, Binsaleh F, Hejaili F, Karkar A, Moussa D, Raza H, et al. Changes in biochemical, hemodynamic, and dialysis adherence parameters in hemodialysis patients during Ramadan. *Hemodial Int*. 2016;20(2):270-276.
 17. Megahed AF, El-Kannishy G, Sayed-Ahmed N. Status of fasting in Ramadan of chronic hemodialysis patients all over Egypt: A multicenter observational study. *Saudi J Kidney Dis Transplant*. 2019;30(2):339.
 18. Imtiaz S, Salman B, Dhrolia MF, Nasir K, Abbas HN, Ahmad A. Clinical and biochemical parameters of hemodialysis patients before and during Islamic Month of Ramadan. *Iran J Kidney Dis*. 2016;10(2):75-78.
 19. el kannishy MDG, Farouk Megahed A, Sayed-Ahmed N. Fasting The Holy Month of Ramadan Among Diabetic Patients on Hemodialysis : An Observational Multicenter Study in Egypt. *Kidney Int Reports*. 2020;5(3):S279.
 20. 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):877-881.