Clinical Research

Kidney function profile before, during, and after Ramadan fasting in healthy elderly: a prospective cohort study

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pISSN: 0853-1773 • eISSN: 2252-8083
https://doi.org/10.13181/mji.oa.225730
Med J Indones. 2022;31:115–9

Received: August 20, 2021
Accepted: July 02, 2022

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ABSTRACT

BACKGROUND Kidney function profile is one of the important parameters in determining the health of the elderly. In Indonesia, no study has been conducted on kidney function profile during Ramadan fasting to determine the safety of Ramadan fasting in the elderly. This study aimed to determine the kidney function profile in the elderly who fasted during Ramadan.

METHODS This study used a prospective cohort design. The inclusion criteria were elderly aged >60 years undergoing Ramadan fasting in Jatinegara, Jakarta from April to July 2019. Patients with end-stage renal failure who had an acute infection, hypertension crisis, or refused to participate in the study were excluded. Patients who did not fast for 3 consecutive days were dropped out. The kidney function profile was calculated by the estimated glomerular filtration rate (eGFR) using the CKD-EPI formula 1 week before the first day of Ramadan, 3 weeks after the first day of fasting, and 2 weeks after the last day of fasting. Decreased eGFR was defined as having a minimum of 20% eGFR decline during or after the fasting period. Bivariate analysis was performed using McNemar or Cochran tests.

RESULTS 2 patients had eGFR decline during fasting, and 7 patients had eGFR decline after fasting. The median eGFR before, during, and after fasting were 81.5, 88.7, and 76.8 ml/min/1.73 m^2, respectively. A total of 1.4% of subjects had decreased eGFR during Ramadan, while 9.1% had decreased eGFR after Ramadan. However, the changes were not statistically significant.

CONCLUSIONS Although most elderly had lower eGFR following Ramadan fasting compared to before and during Ramadan, only individuals with several comorbidities had significant changes of kidney function.

KEYWORDS elderly, fasting, glomerular filtration rate, Islam

As a Muslim-majority country, most Indonesians fast during the month of Ramadan. During this period, Muslims cannot eat, drink, and do sexual activity from dawn until dusk. In Indonesia, Ramadan fasting lasts for 29–30 days. Fasting during Ramadan brings changes in various physiological aspects of the body. Hassan et al[1] found reduced hydration status and brain natriuretic peptide level in those doing Ramadan fasting.

The elderly is one of the special populations who fast during Ramadan. The effects of fasting on health require special precautions, including its impact on kidneys. However, previous studies have shown contradictory results. Previous research in Saudi Arabia showed no changes in kidney function in elderly patients who fast during Ramadan.[2] However, other studies have shown a decrease in kidney function in the elderly during the fasting period.[3]

Adequate fluid and protein intakes in elderly patients have a protective effect on kidney function. A study showed that dehydration during Ramadan fasting resulted in reduced creatinine clearance in the elderly. However, the value was returned after the fasting period.[4] Therefore, the chronic lack of fluid and protein consumption in the long term requires serious concerns for elderly patients who fast during Ramadan.

Until now, no studies have investigated kidney function profile in the elderly who fast during Ramadan in Indonesia. Therefore, this study aimed to assess the kidney function profile in the elderly who fasted during Ramadan.

METHODS

This was a prospective cohort study conducted from May to June 2019 (1440 Hijri according to the Islamic calendar), with an average fast of 15 hours for 30 days. It was a dry season with an average temperature of 30°C in East Jakarta, Indonesia. The inclusion criteria were elderly aged >60 years who fasted for at least 15 days during the Ramadan period. The exclusion criteria were subjects with end-stage kidney failure having an estimated glomerular filtration rate (eGFR) of ≤15 ml/min/1.73 m^2, severe acute infection, or systolic blood pressure of more than 180 mmHg during either examination. Furthermore, subjects who failed to fast for three consecutive days or passed away were dropped out of the study. The subjects were recruited using a consecutive sampling method.

The fasting criterion was not consuming any foods and fluids from dawn until dusk (approximately 12 hours). The kidney function profile was measured by eGFR, which was calculated using the Chronic Kidney Disease Epidemiology Collaboration equation based on serum creatinine level.[5] Decreased eGFR was defined as having a minimum of 20% eGFR decline during or after compared to before the fasting period.[6]

Age, sex, body mass index (BMI), diabetes mellitus status, hypertension status, smoking history, protein intake, and fluid intake were documented from initial examination. BMI was categorized according to the Asia-Pacific classification.[7] Diabetes status was determined according to the Indonesian Society of Endocrinologists (PERKENI) guidelines measured by capillary blood A1c level (A1C EZ 2.0®, BioHermes, China).[8] Hypertension status was determined as having blood pressure >140/90 mmHg. Frailty was determined using the Indonesian version of the 40-items frailty index.[9] The protein and fluid intakes of the subjects were measured using food records. Daily nutritional intake was converted into protein and fluid intakes using Nutrisurvey® program (EBISpro, Germany) for Windows. Fluid intake sufficiency was calculated using Watson formula,[10] while protein intake was considered sufficient if it was at least 1.0 g/kg body weight/day.[11] Average intake was calculated as a mean intake from all records during the study.

Evaluation of serum creatinine was done 1 week before the first day of Ramadan, 3 weeks

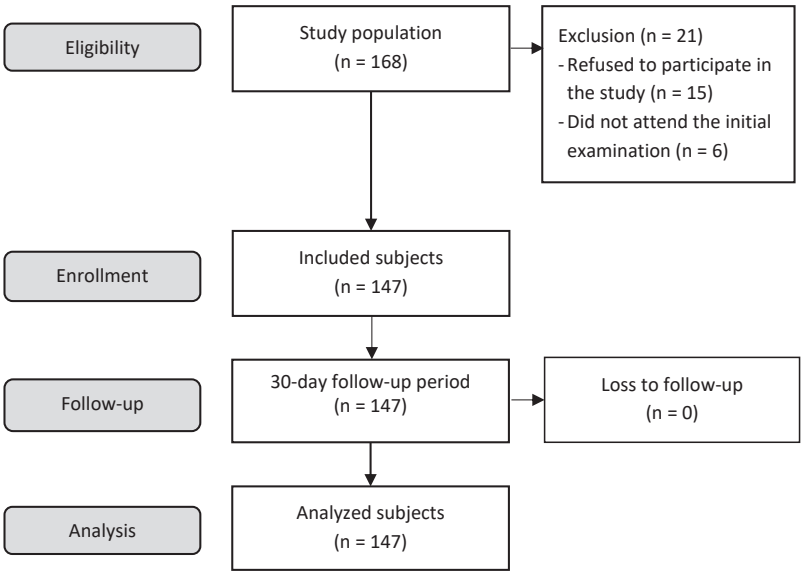

Figure 1. Recruitment flowchart

after the first day of fasting, and 2 weeks after the last day of fasting. Bivariate analysis was done using either McNemar or Cochran tests. The data were analyzed using SPSS® for Windows version 21 (IBM Corp., USA). This study had been approved by the Medical Research Ethics Committee of the Faculty of Medicine, Universitas Indonesia, Cipto Mangunkusumo Hospital, Indonesia (No. 0062/UN2.F1/ETIK/2019). All subjects had approved of being included in the study and had signed written informed consent letter.

RESULTS

A total of 168 subjects were included in the study. However, 15 subjects refused to participate, while 6 were dropped out because they did not attend the initial test. Therefore, a total of 147 subjects were analyzed for this study. The recruitment flowchart of this study can be found in Figure 1.

The median eGFR value before, 2 weeks during, and 1 week after fasting were 81.5, 88.7, and 76.8 ml/min/1.73 m^2, respectively (Figure 2). Characteristics of the subjects are shown in Table 1. There were 2 patients having decreased eGFR during and 7 patients after fasting.

Most of the cases with decreased kidney function had overweight/obese BMI, noticeably shorter fasting days, insufficient protein intake, a minimum of one comorbidity, and were categorized as pre-frail (Table 2).

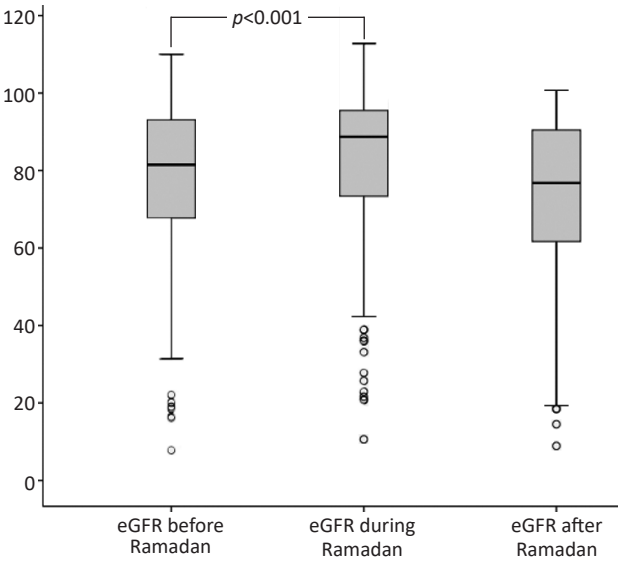

Figure 2. Subjects' estimated glomerular filtration rate (eGFR) before, during, and after Ramadan

DISCUSSION

From this study, it was known that 7.5% of patients had decreased eGFR during and after Ramadan fasting in the healthy elderly. There were 2 (1.4%) subjects who had decreased kidney function during Ramadan fasting, while 7 (9.1%) had decreased eGFR after Ramadan fasting. Based on previous studies worldwide on eGFR changes during Ramadan, four studies found no eGFR changes, one study found decreased eGFR, and one study found increased eGFR.[12–14] However, those were conducted in subtropical countries; hence, there may be some different results from the study conducted in Indonesia with hotter weather and shorter fasting duration. A shorter and more intense period of

Table 1. Baseline characteristics of the subjects

Variables	n (%) (N = 147)
Age (years)	
60–70	130 (88.4)
>70	17 (11.6)
Male sex	47 (32.0)
BMI	
<23 kg/m^2	60 (40.8)
≥23 kg/m^2	87 (59.2)
DM	37 (25.2)
Hypertension	79 (53.7)
Smoking history	37 (25.2)
Protein intake	
Excessive (1–1.2 g/kgBW)	74 (50.3)
Normal (<1 g/kgBW)	73 (49.7)
eGFR category	
<60 ml/min/1.73 m^2	27 (18.4)
≥60 ml/min/1.73 m^2	120 (81.6)
Fluid intake	
Sufficient	48 (32.7)
Insufficient	99 (67.3)
Kidney function change	
Decreased	99 (67.3)
No changes/increased	48 (32.7)
Frailty status	
Pre-frail	116 (78.9)
Robust	31 (21.1)
Average fasting period (days), median (min–max)	29 (25–30)

BMI=body mass index; BW=body weight; DM=diabetes mellitus; eGFR=estimated glomerular filtration rate

Table 2. Factors affecting eGFR changes during and after Ramadan

Case number	Age	Gender	BMI	Fasting days	Fluid intake	Protein intake	Frailty status	Comorbidities	eGFR in Ramadan (ml/min/1.7 m²)		
									Before	During	After
1	63	Female	Obese	25	Insufficient	Sufficient	Pre-frail	HT, DM	77.30	64.60	61.40*
2	65	Female	Overweight	26	Insufficient	Insufficient	Pre-frail	HT	89.40	89.40	69.90*
3	62	Female	Overweight	25	Sufficient	Sufficient	Pre-frail	HT, DM	93.30	70.40*	61.10
4	77	Female	Underweight	26	Sufficient	Insufficient	Pre-frail	-	87.90	84.40	67.00*
5	60	Female	Overweight	30	Sufficient	Insufficient	Robust	-	101.30	102.60	55.70*
6	61	Male	Overweight	28	Insufficient	Insufficient	Pre-frail	Smoking, HT	96.40	95.40	68.30*
7	67	Male	Overweight	26	Sufficient	Insufficient	Pre-frail	HT, DM	81.50	91.50	62.00*
8	60	Male	Obese	26	Sufficient	Sufficient	Pre-frail	DM	81.40	93.40	64.00*
9	63	Female	Normal	25	Insufficient	Insufficient	Pre-frail	-	90.60	69.00*	53.40

BMI=body mass index; DM=diabetes mellitus; eGFR=estimated glomerular filtration rate; HT=hypertension
*Patients having >20% eGFR decline

Ramadan fasting is expected to have a greater impact on Indonesians.

A study by Setiati et al[15] showed decreased creatinine clearance in the first and second weeks of Ramadan fasting, but it began to improve at the end of Ramadan fasting. Meanwhile, Al Muhanna[14] showed a worsening of serum creatinine, urea, and uric acid during and 2 weeks after Ramadan. A decreased renal function in the early weeks of Ramadan might be due to a sudden decrease in water intake during fasting in the elderly. Prolonged dehydration will lower blood pressure and activate the renin-angiotensin-aldosterone system, causing a decrease in kidney function. However, along with continuing fasting, the body will adjust itself by reducing basal metabolism along with increasing water consumption.[3,16] Therefore, the impact of Ramadan fasting on physiologic changes is expected to be more pronounced during the early days of Ramadan. However, it is also expected to be reversible and return to normal function after a longer fasting period.

Das et al[17] showed that a decrease in the nutrient intake during Ramadan fasting in the elderly could generally reduce BMI, thereby reducing complications of obesity and other comorbidities, such as hypertension and diabetes. On the other hand, the elderly may consume higher carbohydrate and protein intake during than before Ramadan. This phenomenon was associated with higher commodity prices, especially vegetables and fruits.[17] In this study, most of the elderly with reduced kidney function had insufficient protein intake during Ramadan. Kiuchi et al[18] showed that decreased dietary protein intake was associated with older patients, worse geriatric nutritional risk index, and higher mortality risk. Therefore, previous studies have shown that Ramadan fasting could alter renal function in the elderly because of changes in nutrient and water consumption.[17]

Moreover, the elderly with declined kidney function in this study were pre-frail. A previous study by Malik et al[19] showed that although no significant adverse effects were observed in the fasting elderly, difficulties imposed with dietary restrictions might aggravate the frailty status of that population. Furthermore, those with frailty were categorized as a high-risk population and should be advised not to fast.

The limitation of this study was the possibility of recall bias due to the use of food records in collecting data on the amount of fluid and food consumed by the subjects. In addition, the subjects were taken from one region, so there could be bias due to the similar demographic data. Furthermore, eGFR calculation based on creatinine might have some potential bias, especially in the older population, due to decreased body lean mass. A study with a longer follow-up period (i.e., 6 months following Ramadan fasting) may also reveal that the changes are reversible. However, it could not be concluded in this study as the follow-up period was rather short.

In conclusion, although most elderly had lower eGFR following Ramadan fasting compared to

before and during Ramadan, only individuals with several comorbidities had significant changes of kidney function. Therefore, thorough examination is necessary prior to Ramadan fasting for the elderly.

Conflict of Interest

The authors affirm no conflict of interest in this study.

Acknowledgment

The authors would like to express the sincerest gratitude to all patients and supporting staffs of the Department of Internal Medicine, Faculty of Medicine, Universitas Indonesia, Cipto Mangunkusumo Hospital.

Funding Sources

None.

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