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ORIGINAL RESEARCH

Factors Related to Fatigue among Chronic Kidney Disease Patients on Hemodialysis

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Abstract

Background: Fatigue is a common and distressing symptom among patients with chronic kidney disease (CKD) undergoing hemodialysis, significantly impacting their daily functioning and quality of life. Despite its prevalence, the contributing factors to fatigue remain unclear and underexplored in specific populations.
Purpose: This study aimed to identify factors associated with fatigue among CKD patients undergoing hemodialysis.
Methods: A cross-sectional study was conducted in two hemodialysis centers. A total of 164 patients were recruited using convenience sampling, with sample size determined through power analysis. Data were collected using the FACIT-Fatigue Scale, a health literacy questionnaire, and an observation sheet for hemoglobin (Hb), blood pressure, and interdialytic weight gain (IDWG). Patient characteristics were also recorded. T-tests and ANOVA were used to examine differences in fatigue levels across groups, while Spearman correlation and multiple linear regression were employed to analyze associations between fatigue and clinical variables.
Results: The mean fatigue score was 28.23(SD=7.46). Fatigue was significantly associated with age, education level, employment status, comorbidities, duration of hemodialysis, systolic blood pressure, HB, IDWG, and health literacy (p<0.05). Multiple linear regression identified employment status and hemoglobin levels as the strongest predictors of fatigue.
Conclusion: Fatigue is a prevalent issue among CKD patients undergoing hemodialysis and is influenced by a range of demographic, clinical, and behavioral factors. Employment status and hemoglobin levels were the most significant contributors. Interventions promoting physical activity, a healthy diet, and fluid adherence, alongside routine monitoring of hemoglobin levels, may help reduce fatigue and improve quality of life in this population.

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1. Introduction

Chronic Kidney Disease (CKD) continues to pose a significant global health challenge, with its prevalence increasing steadily each year (Burgos-Calderón et al., 2021). The World Health Organization (WHO) reported a 50% increase in the global number of CKD patients in 2018 compared to the previous year, estimating approximately 843.6 million individuals affected across stages 1 to 5 (World Health Organization, 2020). In Indonesia, data from the Social Security Agency for Health (*BPJS Kesehatan*) recorded 1,501,016 cases of chronic kidney failure in 2023. By 2021, CKD had become the second most common secondary diagnosis within the National Health Insurance program (Nurtandhee, 2023). These trends have contributed to a growing number of patients receiving hemodialysis (HD) as their primary treatment.

Hemodialysis, while essential for patients with chronic kidney disease, is associated with various adverse effects, including muscle cramps, nausea, dizziness, and, most commonly, fatigue (Parker et al., 2021; Tian et al., 2020). Fatigue affects between 60% and 97% of individuals undergoing HD (Jhamb et al., 2013), with other studies reporting prevalence rates ranging from 60% to 80% (Alvarez et al., 2020), and as high as 85% in Saudi Arabia (Almutary et al., 2016). This fatigue is often characterized by persistent tiredness, physical weakness, cognitive difficulties, low energy levels, and concentration challenges. In Indonesia, fatigue has emerged as

the most frequently reported physical complaint among hemodialysis patients (Mailani et al., 2022). A similarly high prevalence of fatigue (78.7%) has also been observed among patients undergoing peritoneal dialysis (Tian et al., 2020), indicating that fatigue is a common and burdensome symptom across dialysis modalities.

Previous research indicates that fatigue is influenced by a multitude of factors, encompassing demographics (age, gender, marital status, education), physiological factors (sleep disturbances, hemoglobin, creatinine levels), socio-economic elements (physical activity, smoking, alcohol history), situational aspects (duration of hemodialysis), and psychological factors (depression and anxiety) (Ali & Taha, 2017; Brys et al., 2019; Prastiwi et al., 2021). Comorbidities, knowledge of diseases, blood pressure, interdialytic weight gain, and changes in body image were indicated to cause fatigue (Bonner et al., 2008; Tian et al., 2020; Tsirigotis et al., 2022). Notably, individuals with kidney disease and restless leg syndrome exhibit higher fatigue levels (Giannaki et al., 2017).

Several studies have shown varying results regarding the factors influencing fatigue in hemodialysis patients in Indonesia. Some studies found a relationship between hemoglobin levels and fatigue (Maesaroh et al., 2020; Santoso et al., 2022), while others did not (Hasan & Tirtana, 2019; Prastiwi, 2021). Similarly, research findings on the relationship between the duration of hemodialysis and fatigue are also inconsistent. Darmawan et al. (2019) found a relationship between the duration of hemodialysis and fatigue, whereas Maesaroh et al. (2020) did not. Moreover, patients with limited health literacy may struggle to understand treatment plans, leading to poor symptom management and increased psychological burden, which intensifies fatigue. A previous study showed that health literacy is associated with medication adherence among hemodialysis patients (Mailani et al., 2024). Therefore, further research is needed to investigate the relationship between these factors and fatigue in hemodialysis patients.

Although previous studies have identified numerous fatigue-related factors such as demographics, physiological-socio-economic factors, situational aspects (duration of hemodialysis), and psychological factors (Ali & Taha, 2017; Brys et al., 2019; Prastiwi et al., 2021), it remains necessary to investigate individual characteristics (e.g., age, sex, comorbidities), blood pressure, hemoglobin levels, interdialytic weight gain (IDWG), and health literacy, especially in populations with differing cultural and socio-economic contexts. These variables remain highly relevant due to their dynamic and potentially modifiable nature in clinical practice. Health literacy is a critical yet underexplored determinant of fatigue in CKD patients, as it influences self-management behaviors, treatment adherence, and psychological well-being (Mailani et al., 2023). Understanding its role offers a more comprehensive perspective on how cognitive and behavioral factors contribute to fatigue alongside physiological processes. Focusing on Indonesia, specifically Padang, West Sumatra, this study contributes a vital regional perspective to the broader research on chronic kidney disease and fatigue. Due to Indonesia's distinctive demographic, environmental, and healthcare characteristics, the findings provide region-specific insights that may differ notably from those of other countries.

Given the subjective and often under-recognized nature of fatigue in individuals undergoing hemodialysis (Al Naamani et al., 2021; Wang et al., 2016; You et al., 2022), a comprehensive exploration of these factors is imperative. Therefore, this study aimed to examine the factors affecting fatigue in patients with chronic kidney disease undergoing hemodialysis, with a specific focus on demographic and clinical characteristics, blood pressure, hemoglobin levels, IDWG, and health literacy, to generate meaningful insights that can inform tailored interventions and improve patient outcomes.

2. Methods

2.1. Research design

This was a cross-sectional study with a descriptive design that examined factors related to fatigue among CKD patients undergoing hemodialysis in Padang, Indonesia. The study explored participant characteristics, blood pressure, hemoglobin (Hb), IDWG, health literacy, and fatigue.

2.2. Setting and samples

Hemodialysis patients were selected from two hemodialysis units in two tertiary hospitals in Padang, Indonesia. The sample size was calculated using a power analysis table, estimating 164 participants with 90% power, a 0.05 alpha level, and a medium effect size of 0.25 (two-tailed) (Polit & Beck, 2014). The study was conducted between June and July 2023. Inclusion criteria

comprised individuals with chronic kidney disease who underwent hemodialysis twice a week and received regular clinical examinations at the hospital. The study excluded expectant mothers, individuals with reported mental health conditions such as schizophrenia, and those with psychological or cognitive limitations, such as dementia.

2.3. Measurement and data collection

This study measures fatigue, respondents' characteristics, blood pressure, Hb levels, IDWG, and health literacy of CKD patients. It employed several instruments, including a demographic data questionnaire, the FACIT-Fatigue Scale for assessing fatigue levels, the Health Literacy Survey Europe Questionnaire 16 (HLS-EU-Q16), and an observation sheet. The demographic questionnaire gathered patient information through seven questions covering their name, age, gender, education level, employment status, duration of hemodialysis, and comorbid conditions.

The research instrument used to measure fatigue was the Functional Assessment of Chronic Illness Therapy (FACIT)-Fatigue Scale, a part of a set of health-related quality of life (HRQOL) questionnaires designed to assess body functional systems in managing chronic illnesses. Comprising 13 questions, the FACIT-Fatigue Scale measures fatigue levels on a 4-point scale: 4 for "not at all fatigued," 3 for "little," 2 for "somewhat," 1 for "quite a bit," and 0 for "very much fatigued." Scores range from 0 to 52, with lower scores indicating severe fatigue. Permission to use this instrument was obtained from the owner and documented on 7 March 2023 via the website. However, the Indonesian (FACIT)-Fatigue Scale Indonesian version was used in this research. This questionnaire had gone through a validity and reliability test specifically for chronic kidney disease patients undergoing hemodialysis, where the validity test of all questions by Pearson correlation obtained an r score ranging from 0.331 to 0.636. The reliability test was carried out using internal consistency with a Cronbach's alpha of 0.646 (Sihombing et al., 2016).

Health literacy was assessed using the Indonesian version of the Health Literacy Survey Europe Questionnaire 16 (HLS-EU-Q16), which has been tested for validity and reliability with a Cronbach's alpha value of 0.849 (Nasriyanto, 2018). Sixteen items are categorized into three scales (health care, disease prevention, and health promotion), rated on a Likert scale from 1 to 4. The scores range from 0 to 16, categorized into three levels: 0-8 as low-level health literacy, 9-12 as mid-level health literacy, and 13-16 as high-level health literacy (Pelikan et al., 2019). Hemoglobin levels, blood pressure (systolic and diastolic), and interdialytic weight gain (IDWG) were collected using observation sheets. Hemoglobin levels were obtained from the most recent laboratory results recorded in the medical records. Blood pressure was measured directly by the researchers prior to the start of hemodialysis using an Omron Digital Sphygmomanometer (HEM-7156A). IDWG was calculated using nursing records by subtracting the patient's post-hemodialysis weight from their pre-hemodialysis weight. The result was then expressed as a percentage by comparing it to the patient's dry weight.

The researcher coordinated with the head nurse of hemodialysis units regarding the number of patients undergoing hemodialysis and informed them of the inclusion criteria. After a discussion with the hemodialysis nurses, eligible respondents were selected to participate in the study. The researcher then met directly with the patients to explain the purpose of the study and distribute questionnaires. The questionnaires on respondents' characteristics, health literacy, and fatigue were administered one hour after the hemodialysis session. Completing the questionnaires took approximately 15-20 minutes, and almost all patients requested that the researcher read the questions aloud. Two trained field assistants supported the data collection process. They had received prior orientation and data collection training through two meetings.

2.4. Data analysis

The Kolmogorov-Smirnov test and Levene's test were used to determine the normality and homogeneity of the data. Among the variables, only the fatigue score exhibited a normal distribution. Consequently, the Spearman correlation test was applied to explore the relationships between fatigue, the duration of hemodialysis, HB, IDWG, systolic and diastolic blood pressure, and health literacy. T-tests were used for dichotomous variables (gender and employment status), while ANOVA assessed associations between overall fatigue and age, education level, and comorbidities. All variables in bivariate analysis that had $p<0.25$ were included in the multivariate analysis (Hosmer et al., 2013). Multivariate linear regression was employed to examine whether age, education level, employment status, comorbidities, duration of

hemodialysis, systolic blood pressure, Hb, IDWG, and health literacy could serve as predictors for fatigue scores.

2.5. Ethical consideration

The ethics committee of Dr. M. Djamil Padang General Hospital thoroughly reviewed and approved this study, granting ethical clearance with approval code LB.02.02/5.7/255/2023. During data collection, the researcher informed participants about the study's purpose and objectives and requested their voluntary participation. Those who agreed were asked to sign an informed consent form, indicating their willingness to participate, and were reminded of their right to refuse or withdraw at any time without consequences. All personal data were anonymized and securely stored to ensure confidentiality, with access limited to the research team. Participants' identities were not disclosed in any reports or publications resulting from the study.

3. Results

3.1 Participant characteristics and factors affecting fatigue

As presented in Table 1, among the 164 participating patients, the majority were aged 46–55 years (31.7%), male (54.3%), unemployed (81.7%), had completed senior high school (53.0%), and most commonly reported having two comorbidities (36%). The mean duration of hemodialysis was 29.33 months. The average systolic and diastolic blood pressures were 148.79 mmHg and 79.24 mmHg, respectively. Additionally, the mean Hb level was 9.38 g/dL, while the means of IDWG and health literacy score were 3.63 and 11.94, respectively. The mean of fatigue was 28.23 (range 0-52) (Table 1). Furthermore, fatigue demonstrated significant correlations with age (p=0.012), education level (p=0.026), employment status (p=0.035), comorbidities (p=0.001), duration of hemodialysis (p=0.001), systolic blood pressure (p=0.001), Hb levels (p=0.001), IDWG (p=0.040), and health literacy (p=0.001).

Table 1. Participant characteristics and fatigue affecting factors (n=164)

Variables	f (%)	Mean(SD)	Fatigue Mean (SD)	t/F/r	*p*
Age (year)					
≤25	5 (3)		32.60 (8.79)	3.037[b]	0.012
26-35	7 (4.3)		32 (5.80)		
36-45	40 (24.4)		30.70 (9.24)		
46-55	52 (31.7)		27.62 (6.42)		
56-65	46 (28)		27.09 (6.40)		
>65	14 (8.5)		23.79 (6.05)		
Gender					
Male	89 (54.3)		27.67 (7.64)	-1.043[a]	0.747
Female	75 (45.7)		28.89 (7.23)		
Education level					
Elementary School	25 (15.2)		26.45 (7.47)	2.84[b]	0.026
Junior High School	20 (12.2)		27.55 (8.11)		
Senior High School	87 (53.0)		28.14 (6.99)		
University	32 (19.5)		31.03 (7.40)		
Employment status					
Employed	30 (18.3)		34.87 (7.87)	5.927[b]	0.035
Unemployed	134 (81.7)		26.75 (6.52)		
Comorbidities					
No comorbidities	19 (11.6)		35.53 (8.161)	2.47[b]	0.001
1 comorbidity	57 (34.8)		31.72 (5.64)		
2 comorbidities	59 (36.0)		25.66 (5.23)		
>2 comorbidities	29 (17.7)		22.07 (6.68)		
Duration of HD (months)		29.33 (42.91)		-0.283[c]	0.001
Systolic blood pressure		148.79 (21.55)		-0.278[c]	0.001
Diastolic blood pressure		79.24 (13.06)		-0.058[c]	0.461
Hemoglobin level		9.38 (1.69)		0.406[c]	0.001
IDWG		3.63 (2.15)		-0.161[c]	0.040
Health literacy		11.94 (3.04)		0.334[c]	0.001
Fatigue		28.23 (7.46)			

Note. [a]t=t-test, [b]F=ANOVA, [c]r=Spearman-test. Statistically significant at p<0.05

3.2 Predictors of fatigue among CKD patients undergoing hemodialysis

Multiple regression analysis was conducted to identify factors influencing participants' fatigue, using several independent variables. Age, employment status, duration of hemodialysis, systolic blood pressure, hemoglobin levels, and health literacy were found to be significant predictors. Among these, employment status had the strongest influence on fatigue (β = -0.278), followed by hemoglobin levels (β = 0.239) and duration of hemodialysis (β = -0.189). Specifically, being employed was associated with a significant reduction in fatigue by 5.349 units. Also, higher hemoglobin levels were associated with decreased fatigue. These findings are detailed in Table 2.

Table 2. The predictors of fatigue among CKD patients undergoing hemodialysis

Dependent variables	Independent variable	B	SE	β	t	*p*
Fatigue	Constant term	37.053	6.099		6.075	<0.001
	Age	-1.208	0.407	-0.186	-2.970	0.003
	Education Level	0.683	0.500	0.090	1.367	0.173
	Employment Status	-5.349	1.225	-0.278	-4.367	<0.001
	Comorbidities	-0.100	0.062	-0.099	-1.617	0.108
	Duration of HD	-0.033	0.011	-0.189	-3.071	0.003
	Systolic blood pressure	-0.058	0.022	-0.168	-2.582	0.011
	Hemoglobin	1.055	0.298	0.239	3.536	0.001
	IDWG	-0.107	0.214	-0.031	-0.502	0.616
	Health Literacy	0.458	0.153	0.187	3.003	0.003

Note. B=Regression coefficient, *SE*=Standard error of *B*, *β*=Standardized regression coefficient
Statistically significant at $p<0.05$

4. Discussion

This study investigated the factors associated with fatigue among CKD patients undergoing hemodialysis. Fatigue was measured using the Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-Fatigue) Scale, which ranges from 0 to 52, where lower scores reflect more severe fatigue. The mean fatigue score among participants was 28.23 (SD=7.460), with individual scores ranging from 10 to 44, suggesting a considerable level of fatigue. This result indicates worse fatigue compared to previous studies. For instance, Prastiwi et al. (2022) reported a higher average FACIT-Fatigue score of 35.01, while Wang et al. (2016) found an even higher average score of 39. A previous study by Maesaroh et al. (2020) found that 80.7% of patients experienced moderate fatigue. Fatigue is a significant and often debilitating experience for patients undergoing dialysis. It arises from a complex interplay of biological, psychological, and social factors (Van der Borg et al., 2021).

This study's findings revealed significant associations between fatigue and several variables, including age, education, employment status, comorbidities, duration of hemodialysis, systolic blood pressure, hemoglobin levels, IDWG, and health literacy. Fatigue is a common and distressing symptom among individuals undergoing hemodialysis (HD), influenced by a variety of physical and psychosocial factors (Alshammari et al., 2024). These results were consistent with previous studies indicating that fatigue in hemodialysis patients is influenced by a range of demographic factors such as age, gender, marital status, and education, physiological factors including hemoglobin and creatinine levels, as well as the duration of hemodialysis (Ali & Taha, 2017; Brys et al., 2019; Prastiwi et al., 2022). Other studies also reported that comorbidities, limited disease-related knowledge, elevated blood pressure, IDWG, and changes in body image contribute to fatigue in this population (Bonner et al., 2008; Tian et al., 2020; Tsirigotis et al., 2022). Furthermore, fatigue in hemodialysis patients is widely acknowledged to be multifactorial, involving physiological contributors such as anemia, inflammation, and uremia, as well as treatment-related factors including post-dialysis discomfort and dialysis adequacy (Farragher et al., 2019). If it is left unaddressed, fatigue can accelerate health deterioration and significantly diminish patients' quality of life (Ritianingsih et al., 2023).

Age was positively correlated with fatigue, particularly in patients over 56 years, which is consistent with a study by Laksamana and Indriyawati (2022). Older adults typically experience more comorbidities, diminished physiological resilience, and limited stress-coping mechanisms,

all contributing to increased fatigue. Education level similarly influenced fatigue, with lower education correlating with greater mental fatigue. This aligns with Tsirigotis et al. (2022), who emphasized that limited education can hinder patients' ability to process health information. Health literacy, closely linked to education and knowledge, was also significantly associated with fatigue. Patients with limited health literacy may struggle to understand treatment plans, leading to poor symptom management and increased psychological burden, which intensifies fatigue. Systolic blood pressure showed a positive correlation with fatigue, potentially due to its effect on cardiovascular strain and overall energy levels. Prior research has demonstrated that blood pressure variability can reduce stamina and increase mortality risk in hemodialysis patients (Mayer et al., 2018; Selvarajah et al., 2014). Furthermore, IDWG was positively correlated with fatigue, emphasizing the importance of fluid balance. As the IDWG increased, the patient's body had more water, which provoked fatigue on the heart and body and could quickly result in symptoms like high blood pressure and heart failure (Joshwa et al., 2020).

This study identified employment status and hemoglobin level as the two most significant predictors of fatigue among hemodialysis patients. Employment status alone accounted for 27.8% of the variance in fatigue scores, while hemoglobin levels explained 23.9%. The finding that unemployment is significantly associated with higher fatigue levels aligns with Mardiyah (2022), who reported that many patients discontinued work due to fatigue related to dialysis. Employment appears to offer protective effects, not only by providing economic stability but also through its association with improved self-management behaviors in CKD patients (Mailani et al., 2023). It means having a job may provide financial stability, which allows individuals to afford medication, regular check-ups, and a healthier lifestyle. Additionally, being employed may contribute to better self-discipline and routine, which supports consistent treatment and self-care behaviors. Supporting this, Alshammari et al. (2024) observed that retired individuals reported significantly higher fatigue levels compared to those who remained employed. This underscores the potential benefits of physical and social engagement in mitigating fatigue among dialysis patients. The importance of employment in managing chronic illness is also evident in other populations. For instance, Merdawati et al. (2024) found that 59.2% of women with breast cancer did not return to work due to fatigue-related factors such as anxiety, frailty, and lack of social support. Similarly, Muliantino et al. (2024) demonstrated a strong association between employment and physical activity in coronary heart disease patients, with employment status emerging as the most significant factor negatively associated with physical inactivity.

In addition to employment, low hemoglobin levels were significantly linked to higher fatigue. This finding reinforces the well-established role of anemia in the pathophysiology of fatigue, as reduced hemoglobin levels impair oxygen transport to tissues, leading to decreased cellular energy (Parker et al., 2021). Previous studies have similarly identified low hemoglobin and erythropoietin levels, as well as elevated urea and creatinine, as key contributors to fatigue severity in CKD patients (Bonner et al., 2008; Maesaroh et al., 2020; Prastiwi et al., 2022). Although current clinical guidelines recommend maintaining hemoglobin levels between 10 and 11.5 g/dL in CKD patients (Davey et al., 2019), this relatively low target range may still contribute to persistent fatigue in this population.

Beyond physiological factors, the psychosocial dimensions of fatigue must also be addressed. A qualitative study by Van der Borg et al. (2021) emphasized the importance of enabling renal health professionals to recognize and communicate the complex, multifactorial nature of fatigue in dialysis patients. Dialysis nurses, who interact closely with patients, are often the first to detect signs of increasing fatigue or functional decline. Their role extends beyond technical tasks to include an understanding of patients' lived experiences within their social and emotional contexts.

However, despite its prevalence, fatigue is often not prioritized in clinical settings. Health professionals commonly attribute fatigue to medical causes or the burdens of treatment, but tend to focus their attention on more acute or technically complex issues. As a result, fatigue, though highly impactful on patients' quality of life, is frequently overlooked in routine care. This highlights the need for a more holistic, interdisciplinary approach that integrates physical, psychological, and social perspectives in the assessment and management of fatigue in CKD patients (Van der Borg et al., 2021).

5. Implications and limitations

The findings of this study have important implications for nursing practice, particularly in the management of patients with CKD undergoing hemodialysis. Identifying key factors associated with fatigue can help nurses design more targeted and individualized interventions. Employment status was identified as the most significant predictor of fatigue, suggesting that encouraging patient engagement in meaningful or productive activities may help mitigate fatigue. Additionally, the association between higher hemoglobin levels and reduced fatigue highlights the importance of regular clinical assessments in monitoring and managing anemia effectively. Supporting patients in maintaining physical activity, adhering to dietary recommendations, and following prescribed medications is essential to improving their overall energy and quality of life. These insights can enhance nurses' ability to conduct comprehensive assessments, inform personalized care plans, and collaborate with interdisciplinary teams to address both the physical and psychosocial dimensions of fatigue.

Several limitations of this study should be acknowledged. First, the analysis of predictors for fatigue among patients undergoing maintenance hemodialysis was limited to a relatively small set of variables, which may not fully capture the complexity of contributing factors. Second, hemoglobin levels were obtained solely from medical records, which may not accurately reflect the patients' most current clinical status at the time of data collection. Additionally, the findings of this study may be influenced by cultural and socio-economic factors specific to the Indonesian context, potentially limiting their generalizability to other settings. Further research in diverse geographic and cultural contexts is needed to validate and expand upon these findings. Despite these limitations, this study is among the few multicenter investigations exploring the predictors of fatigue in Indonesian maintenance hemodialysis patients, providing valuable insights for future research and clinical practice.

6. Conclusion

This study found significant associations between fatigue and several factors, including age, education level, employment status, comorbidities, duration of hemodialysis, systolic blood pressure, hemoglobin (Hb) levels, interdialytic weight gain (IDWG), and health literacy. Among these, employment status and hemoglobin levels emerged as the strongest predictors of fatigue based on multiple linear regression analysis. Targeted interventions should focus on optimizing hemoglobin levels through effective anemia management and promoting patient participation in appropriate work or social activities to help alleviate fatigue. Nurses play a central role in fatigue management by facilitating rest periods during dialysis sessions, encouraging physical activity, and addressing contributing factors such as anemia. Furthermore, comprehensive care should include blood pressure management, dietary counseling to control IDWG, and tailored health education that considers patients' literacy levels. Addressing fatigue requires a multidisciplinary approach involving nurses, nephrologists, dietitians, and social workers to tackle its multifactorial nature and enhance overall patient quality of life.

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Author contribution

FM and ARM were involved in the study design. FM and AR collected the data and conducted the data analysis. FM, ARM, and CMC contributed to drafting and revising the manuscript.

Conflict of interest

The authors declare that they have no potential conflicts of interest related to this study, the authorship of this article, and/or its publication.

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