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Comparison of fatigue among chronic kidney disease patients on hemodialysis and continuous ambulatory peritoneal dialysis in Indonesia

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ΑΡΧΕΙΑ ΕΛΛΗΝΙΚΗΣ ΙΑΤΡΙΚΗΣ 2026, 43(Συμπλ 1):76–81

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OBJECTIVE **To assess the difference of fatigue in patients with chronic kidney disease (CKD) undergoing hemodialysis (HD) versus continuous ambulatory peritoneal dialysis (CAPD) in Indonesia.** METHOD **This cross-sectional study was conducted at Saiful Anwar Hospital Malang, Indonesia between August 2024 and January 2025. Data were collected from the Fatigue Severity Scale (FSS) questionnaire, demographic data, and laboratory results. Statistical analyses included Chi-square, Mann-Whitney, and multivariate analysis for differences and fatigue-associated factors.** RESULTS **This study included 139 CKD patients, of whom 50 on CAPD and 89 on HD. The prevalence (p=0.0233) and severity (p=0.021) of fatigue were found to be higher in the CAPD group than in the HD group. Hemoglobin level (p=0.005) and age (p<0.001) were significantly linked to fatigue in the HD group, whereas employment status (p=0.013), age (p=0.017), and hemoglobin level (p=0.015) were significant factors in the CAPD group.** CONCLUSIONS **Hemoglobin level, age, and work status are significant determinants of fatigue risk in CAPD patients, which is higher than in HD patients. These results emphasize the necessity of tailored and interdisciplinary strategies for CKD patients' fatigue management.**

Σύγκριση της κόπωσης ασθενών με χρόνια νεφρική νόσο υπό αιμοκάθαρση ή περιτοναϊκή κάθαρση στην Ινδονησία

Περίληψη στο τέλος του άρθρου

Key words

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Quality of life

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Chronic kidney disease (CKD) is an increasing global health problem, and the prevalence and mortality from it is rising across the globe. According to the 13th Report of the Indonesia Renal Registry (IRR) in 2020, there were 61,786 stage 5 chronic kidney disease cases in Indonesia.[2] This demonstrates that CKD is becoming an urgent public health issue. Renal replacement therapy, including hemodialysis (HD) and continuous ambulatory peritoneal dialysis (CAPD), plays a crucial role in the management of end-stage renal disease (ESRD).[1,2] CKD is already affected by many factors, especially hypertension, diabetes, age, and lifestyle, and older people are more prone to all of these factors; thus, increasing age does not only put older people at additional risk of developing CKD, but also intensifies complications of CKD, fatigue in particular, which is a common symptom and routine disruptor in activities of daily living and quality of life.[3,4]

Fatigue associated with CKD refers to ongoing feelings of weakness, low energy, and impaired physical and mental capacity.[5] It may result from anemia, metabolic disorders, accumulation of uremic toxins, as well as psychosocial factors like stress and depression.[6] Fewer than 60% of dialysis patients experience severe fatigue.[7] However, the relationship between fatigue and dialysis modality is controversial.[7] Some studies report no difference in fatigue between HD and CAPD, while others report increased fatigue severity among patients receiving CAPD.[8] Therefore, additional research is required to further characterize this relationship and the factors involved.[9]

This study aimed to compare fatigue levels between HD and CAPD patients and to identify associated factors in both groups. The findings are expected to offer a clearer understanding of fatigue determinants in CKD patients and to serve as a foundation for developing more effective

interventions to improve patient outcomes.

MATERIAL AND METHOD

Design

This cross-sectional study was conducted at Saiful Anwar General Hospital, Malang, Indonesia; we observed and collected data from participants over a short period of time, from August 2024 to January 2025. Data collection involved demographic surveys, fatigue assessment using the Fatigue Severity Scale (FSS), and laboratory tests. The research protocol adhered to the STROBE checklist.[10]

Ethical approval

The study was approved by the Institutional Ethics Committee (approval no 400/056/K.3/102.7/2024) and conducted in accordance with the Declaration of Helsinki. All participants received information about the study's objectives, potential risks, and benefits, and provided written informed consent voluntarily. They were informed of their right to withdraw at any time without any consequences. No financial incentives were given.

Participants and eligibility criteria

The study involved 139 CKD patients undergoing dialysis: 89 on HD and 50 on CAPD. Participants were recruited using consecutive sampling. Inclusion criteria were age 18–70 years old, undergoing dialysis for at least three months, and the ability to perform daily activities independently. Exclusion criteria included hospitalization, recent blood transfusion (within the last three months), pregnancy, or severe illnesses such as liver cirrhosis, lupus, cancer, tuberculosis, depression, or anxiety disorders.

Data collection

Data were collected on-site at Saiful Anwar General Hospital during the study period. Participants completed the FSS questionnaire under the direct supervision of the research team. Demographic and laboratory data were obtained from medical records. Data consistency was ensured through direct verification by the research team. The research was conducted by three teams (AA, BB, CC). The FSS questionnaire was filled out directly by participants and supervised directly by researchers.

Covariates

The primary outcome was fatigue level, measured using the FSS, which assesses the impact of fatigue on daily functioning. This scale asks respondents to rate the extent to which they agree with statements related to fatigue, with a total score ranging from 9 to 63. Participants must circle one number (1 to 7) for each question. The higher the score, the greater the degree of fatigue. The cutoff values used are: <36 indicates no fatigue/mild fatigue, 36–52 indicates moderate fatigue, and >52 indicates severe fatigue.[11] Predictor variables included age, sex, as well as duration of dialysis, employment status, and laboratory parameters such as hemoglobin levels. All variables were measured using standardized instruments and interpreted according to current clinical guidelines.

Statistical analysis

Data are presented as frequencies, percentages, median, and interquartile range (IQR). Data normality was tested using the Kolmogorov-Smirnov test. Baseline analysis between groups was performed using the Chi-square test for categorical data and the Mann-Whitney test for numerical data that were not normally distributed or median (IQR) for numerical data that were not normally distributed. To avoid bias, consecutive sampling was performed and multivariate analysis was used to control confounding variables. Differences in fatigue levels between groups were analyzed using the Chi-square test and odds ratios (OR) with 95% confidence intervals (CI). All statistical analyses were conducted using GraphPad Prism software (GraphPad Software, Inc; California, USA).

RESULTS

Baseline characteristics of the study subjects

The total sample in this study consisted of 139 patients, with 89 patients in the HD group and 50 patients in the CAPD group. The analysis of baseline characteristics showed significant differences in several variables between the HD and CAPD groups, namely age (p=0.001), employment status (p=0.0279), and age distribution by category <40, 40–49, 50–59, ≥60 (p=0.018), while other variables such as gender (p=0.209), body mass index (BMI) (p=0.395), dialysis duration (p=0.741), education (p=0.256), and hemoglobin level (p=0.500) did not show significant differences. Detailed comparisons of these baseline characteristics can be seen in table 1.

Differences in fatigue occurrence among continuous ambulatory peritoneal dialysis and hemodialysis patients

The proportion of fatigue occurrence was higher in CAPD patients (p=0.0233). The OR indicated a tendency for a higher risk of fatigue in CAPD patients (OR=2.34; 95% CI: 1.14–4.89) compared to HD patients (OR=0.43; 95% CI: 0.20–0.88). The complete results of this analysis can be found in table 2.

Table 1. Baseline characteristics of the study subjects.

Variable	HD (n=91)	CAPD (n=51)	Total (n=142)	p value
Gender				
Woman	42 (46.2%)	18 (35.3%)	60 (42.3%)	0.209
Men	49 (53.8%)	33 (64.7%)	82 (57.7%)	0.209
Work status				
Working	40 (44.0%)	33 (64.7%)	73 (51.4%)	0.0279
Not working	51 (56.0%)	18 (35.3%)	69 (48.6%)	0.0279
Age (mean±SD) (years)	50.4±11.38	43.55±11.11	47.91±11.72	0.001
<40	17 (18.7%)	18 (35.3%)	35 (24.6%)	0.018
40–49	20 (22.0%)	15 (29.4%)	35 (24.6%)	0.018
50–59	29 (31.9%)	13 (25.5%)	40 (28.2%)	0.018
≥60	25 (27.5%)	5 (9.8%)	30 (21.1%)	0.018
BMI (mean±SD)	23.47±6.16	22.4±3.81	23.09±5.45	0.395
<18.5	7 (7.7%)	5 (9.8%)	12 (8.5%)	0.814
18.5–22.9	56 (61.5%)	30 (58.8%)	86 (60.6%)	0.814
23–24.9	23 (25.3%)	13 (25.5%)	36 (25.4%)	0.814
>25	5 (5.5%)	3 (5.9%)	7 (4.9%)	0.814
Dialysis vintage (mean±SD)	47.03±46.8	46.31±37.91	46.77±43.44	0.741
3–24 months	37 (40.7%)	15 (29.4%)	52 (36.6%)	0.246
24–48 months	17 (18.7%)	18 (35.3%)	35 (24.6%)	0.246
>48 months	37 (40.7%)	18 (35.3%)	55 (38.7%)	0.246
Education				
Elementary School	29 (31.9%)	14 (27.5%)	43 (30.3%)	0.256
Junior High School	21 (23.1%)	13 (25.5%)	34 (23.9%)	0.256
Senior High School	27 (29.7%)	13 (25.5%)	40 (28.2%)	0.256
Bachelor's Degree	14 (15.4%)	11 (21.6%)	25 (21.8%)	0.256
Hb (mean±SD)	9.85±1.42	9.75±1.27	9.81±1.36	0.500
8–<10	50 (54.9%)	27 (52.9%)	77 (54.2%)	0.818
10–12	41 (45.1%)	24 (47.1%)	65 (45.8%)	0.818

HD: Hemodialysis, CAPD: Continuous ambulatory peritoneal dialysis, SD: Standard deviation, BMI: Body mass index, Hb: Hemoglobin

Table 2. Differences in fatigue occurrence among continuous ambulatory peritoneal dialysis (CAPD) and hemodialysis (HD) patients.

Group	Occurrence of fatigue		OR	95% CI	p value
	No fatigue	Fatigue			
HD	21 (24.20%)	68 (75.80%)	0.43	0.20–0.88	0.0233
CAPD	21 (43.10%)	29 (56.90%)	2.34	1.14–4.89	0.0233

OR: Odds ratio, CI: Confidence interval

Difference in fatigue degree between hemodialysis and continuous ambulatory peritoneal dialysis patients adjusted for covariates (tab. 3)

The analysis of fatigue levels adjusted for covariates showed that in the HD group hemoglobin level (p=0.005) and age (p<0.001) had a significant effect on fatigue, while other variables such as dialysis duration (p=0.540), BMI (p=0.701), education (p=0.340), gender (p=0.682), and employment status (p=0.340) were not significant. Mean-

Table 3. Difference in fatigue degree between hemodialysis (HD) and continuous ambulatory peritoneal dialysis (CAPD) groups.

Group	Severity of fatigue			p value
	No Fatigue	Moderate	Severe	
HD	21 (24.20%)	23 (26.40%)	45 (49.50%)	0.021
CAPD	21 (43.10%)	15 (29.40%)	14 (27.50%)	0.021
Total	42 (31.00%)	38 (27.50%)	59 (41.50%)	0.021

while, in the CAPD group, hemoglobin level (p=0.015), age (p=0.017), and employment status (p=0.013) showed a significant effect, while other variables were not significant. A summary of this analysis can be seen in table 4.

The results of the regression analysis also showed that HD modality was significantly associated with an increased incidence of fatigue, with an adjusted OR of 2.379 (95% CI: 1.134–4.952; p=0.017). This indicates that patients undergoing HD have a 2.4 times higher risk of experiencing fatigue compared to those undergoing CAPD, after controlling for other variables. A summary of this analysis can be seen in table 5.

DISCUSSION

In this study, with a total sample of 139 CKD patients undergoing HD and CAPD, it was found that the incidence of fatigue was higher in the CAPD group compared to the HD group, both in terms of prevalence and severity. This result differs from several previous studies which reported no significant difference between the two dialysis modalities in relation to fatigue.[12] However, there are also other studies that showed similar results to this study, in which CAPD patients tend to experience more severe fatigue compared to HD patients.[8] Some reports have also indicated that nutritional status, fluid burden, and differences in treatment regimens may play a role in fatigue level among both patient populations.[13,14] While reports from Western countries showed more varied results, some reports from Asian countries suggest that patients on CAPD may experience more fatigue.[15] Disparities in populations, methods of measuring fatigue, and social and cultural elements that may affect how fatigue is experienced globally are probably the causes of the variation in research findings.[16,17] Furthermore, the observed variations in fatigue levels among dialysis patients are probably also influenced by differences in social support, exercise levels, and access to medical care.[18] Thus, our results emphasized the significance of incorporating the dialysis modality in the evaluation of fatigue in Indonesian patients with CKD, as well as the necessity of a customized strategy that takes into account regional factors to manage fatigue among dialysis patients.

Table 4. Difference in fatigue degree between hemodialysis (HD) and continuous ambulatory peritoneal dialysis (CAPD) patients.

Group	Factors	p value
HD	Hb	0.005
	Age	<0.001
	Dialysis vintage	0.540
	BMI	0.701
	Education level	0.340
	Gender	0.682
	Work status	0.340
CAPD	Hb	0.015
	Age	0.017
	Dialysis vintage	0.890
	BMI	0.194
	Education level	0.520
	Gender	0.520
	Work status	0.013

Hb: Hemoglobin, BMI: Body mass index

Table 5. Multivariate regression analysis on fatigue incidence.

Variable	p-value	Adjusted OR (95% CI)
Dialysis vintage (HD)	0.017	2.379 (1.134–4.952)
Age	<0.001	2.65 (1.03–1.10)
Hb 8–<10 g/dL	<0.001	4.489 (2.07–9.60)

HD: Hemodialysis, Hb: Hemoglobin, OR: Odds ratio, CI: Confidence interval

The potential pathways of fatigue in CKD patients are highly theorized, with theorized pathways including uremic toxin accumulation, anemia, endothelial dysfunction, chronic inflammation, and metabolic disorders which impact the central nervous system and directly and or indirectly affect muscles.[19] Toxins like creatinine and urea can affect muscle metabolism and neurotransmission, while anemia results in decreased oxygen delivery oozing to the tissue, resulting in further muscle fatigue and weakness.[20] Endothelial dysfunction and chronic inflammation will extenuate fatigue by further decreasing tissue perfusion and accelerating catabolic pathways.[21] Nutritional well-being, advanced age, and comorbidities, including other primary diseases, can exacerbate fatigue and impact patient quality in this cohort.[22] Although a dialysis modality may lead to differences in toxin clearance or hemodynamic stability, our study suggested that other patient specific

non-dialysis related characteristics (i.e., age, hemoglobin value, employment status) play a significant role in determining patients fatigue level in CKD patients.[23] Therefore, a multidisciplinary health care team approach considering medical, psychosocial aspects is essential in patient care to optimize CKD patients' quality of life.[24]

The findings of the present study had several important benefits and clinical implications in nephrology practice and CKD patient management. First, this study highlighted the need for routine fatigue screening in dialysis patients, particularly in CAPD patients who are at higher risk of fatigue. Second, the finding that hemoglobin level and age significantly affect fatigue in both groups indicated that interventions to optimize anemia status and provide special attention to elderly patients could help reduce fatigue levels. Third, the identification of employment status as a significant factor in CAPD patients suggested the importance of a multidisciplinary approach, including psychosocial support and work activity adjustments for patients who are still actively working. Fourth, the results of this study could serve as a foundation for developing more individualized education and rehabilitation programs, so that interventions can be tailored to each patient's specific needs. Fifth, this study opened opportunities for further research on more effective fatigue prevention and management strategies and encouraged interprofessional collaboration in improving the quality of life of CKD patients in Indonesia.

This study had a number of limitations. First, there were potential confounding variables that were not able to be controlled for e.g., nutritional status, level of physical activity, social support that may contribute to the level of fatigue experienced by the participants. Second, the small sample and data collection from one healthcare center might limit the generalizability of findings to larger populations. Third, the chosen methodology was cross-sectional, which limits our ability to make causal connections regarding the association and contributions to fatigue. Fourth, data collection to assess fatigue was accomplished using subjective questionnaires, which may have led to some perception bias from the participants. Fifth, no longitudinal data collection was completed and therefore we could not observe longitudinal changes in fatigue. For these reasons, further studies incorporating a prospective design, sufficient sample size, and with controlled variables are necessary to enhance the findings of this study.

In conclusion, this study demonstrated that fatigue is more prevalent and severe in individuals with CAPD compared to those that are on HD treatment. Factors such as hemoglobin, age and work status were identified as significant correlates to fatigue based on dialysis. These preliminary findings may provide the platform for the development of more thorough and sophisticated interventions for the prevention and management of fatigue in CKD patients in Indonesia.

ΠΕΡΙΛΗΨΗ

Σύγκριση της κόπωσης ασθενών με χρόνια νεφρική νόσο υπό αιμοκάθαρση ή περιτοναϊκή κάθαρση στην Ινδονησία

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Αρχεία Ελληνικής Ιατρικής 2026, 43(Συμπλ 1):76–81

ΣΚΟΠΟΣ Να αξιολογηθεί η διαφορά στην κόπωση ασθενών με χρόνια νεφρική νόσο (XNN) που υποβάλλονται σε αιμοκάθαρση (HD) έναντι της συνεχούς περιτοναϊκής κάθαρσης (CAPD) στην Ινδονησία. **ΥΛΙΚΟ-ΜΕΘΟΔΟΣ** Η μελέτη διεξήχθη στο Νοσοκομείο Saiful Anwar, στο Malang της Ινδονησίας, μεταξύ Αυγούστου 2024 και Ιανουαρίου 2025. Τα δεδομένα συλλέχθηκαν από το ερωτηματολόγιο της κλίμακας σοβαρότητας κόπωσης (FSS), από δημογραφικά δεδομένα και εργαστηριακά αποτελέσματα. Οι στατιστικές αναλύσεις περιλάμβαναν x^2, Mann-Whitney και πολυπαραμετρική ανάλυση για διαφορές και παράγοντες που σχετίζονται με την κόπωση. **ΑΠΟΤΕΛΕΣΜΑΤΑ** Στη μελέτη συμμετείχαν 139 ασθενείς με XNN, από τους οποίους 50 υποβάλλονταν σε CAPD και 89 σε HD. Η συχνότητα εμφάνισης (p=0,0233) και η σοβαρότητα (p=0,021) της κόπωσης βρέθηκαν υψηλότερες στην ομάδα CAPD απ' ό,τι στην ομάδα HD. Το επίπεδο αιμοσφαιρίνης (p=0,005) και η ηλικία (p<0,001) συσχετίστηκαν σημαντικά με την κόπωση στην ομάδα HD, ενώ η επαγγελματική κατάσταση (p=0,013), η ηλικία (p=0,017) και το επίπεδο αιμοσφαιρίνης (p=0,015) ήταν

σημαντικοί παράγοντες στην ομάδα CAPD. **ΣΥΜΠΕΡΑΣΜΑΤΑ** Το επίπεδο αιμοσφαιρίνης, η ηλικία και η επαγγελματική κατάσταση είναι σημαντικοί παράγοντες που καθορίζουν τον κίνδυνο κόπωσης σε ασθενείς υπό CAPD, ο οποίος είναι υψηλότερος απ' ό,τι σε ασθενείς υπό HD. Αυτά τα αποτελέσματα υπογραμμίζουν την αναγκαιότητα εξατομικευμένων και διεπιστημονικών στρατηγικών για τη διαχείριση της κόπωσης των ασθενών με ΧΝΝ.

Λέξεις ευρετηρίου: Αιμοκάθαρση, Αναιμία, Κόπωση, Περιτοναϊκή κάθαρση, Ποιότητα ζωής, Χρόνια νεφρική νόσος

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