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Factors Associated with Fatigue and Dialysis Symptom Burden Among Patients Undergoing Hemodialysis

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Abstract

Fatigue and dialysis symptom burden are common among patients undergoing hemodialysis and may adversely affect quality of life. However, evidence regarding the relationship between patient characteristics and these outcomes remains inconsistent. Therefore, this study aimed to examine the associations between patient characteristics, fatigue, and dialysis symptom burden among patients undergoing hemodialysis. This cross-sectional study included 70 patients receiving hemodialysis. Variables assessed were age, sex, educational level, occupation, duration of hemodialysis, and sleep disturbances. Fatigue was measured using the Functional Assessment of Chronic Illness Therapy–Fatigue (FACIT-F), while dialysis symptom burden was assessed using the Dialysis Symptom Index (DSI). Data were analyzed using Spearman's rank correlation, Mann–Whitney U, and Kruskal–Wallis tests. The median age was 47 years (IQR=12), and the median duration of hemodialysis was 16 months (IQR=29). Most participants were female (54.3%), had secondary education (61.4%), were self-employed (41.4%), and reported sleep disturbances (72.9%). Age, sex, occupation, and duration of hemodialysis were not significantly associated with fatigue or dialysis symptom burden ($p>0.05$). Educational level was significantly associated with dialysis symptom burden ($p=0.044$) but not fatigue ($p=0.249$). Sleep disturbances were significantly associated with both fatigue ($p=0.032$) and dialysis symptom burden ($p=0.021$). Sleep disturbance was the only factor significantly associated with both fatigue and dialysis symptom burden. Interventions targeting sleep quality may help reduce fatigue and symptom burden among patients undergoing hemodialysis.

Keywords: Hemodialysis, Fatigue, Dialysis Symptom Burden, Sleep Disturbance

1. Introduction

As one of the leading non-communicable diseases, chronic kidney disease (CKD) continues to pose a growing global health challenge. Recent estimates from the 2023 Global Burden of Disease Study indicate that approximately 788 million individuals worldwide are affected by CKD, highlighting a marked increase in disease burden over time [1]. The consequences of CKD extend beyond progressive renal impairment, encompassing higher risks of morbidity and mortality as well as significant healthcare expenditures and societal costs [2, 3].

In Indonesia, chronic kidney disease (CKD) remains a substantial public health concern and continues to exert considerable pressure on the healthcare system. Data from the 2023 Indonesian Health Survey (Survei Kesehatan Indonesia, SKI) indicated a CKD prevalence of 0.18% among individuals aged 15 years and older, with notable variations across provinces. In Aceh Province, the reported prevalence was 0.20% (95% CI: 0.14–0.30). Nationally, approximately 21.1% of individuals diagnosed with CKD have received or are currently receiving renal replacement therapy in the form of hemodialysis [4]. Moreover, the number of patients undergoing hemodialysis has continued to rise over time, reflecting the growing burden of end-stage kidney disease (ESKD) in the country [5].

As CKD progresses to advanced stages, renal replacement therapy, particularly hemodialysis, becomes essential for sustaining life. While hemodialysis effectively facilitates the removal of metabolic waste products and helps maintain fluid and electrolyte homeostasis, it does not fully replicate normal kidney function. Consequently, patients undergoing hemodialysis frequently experience a wide range of physical and psychological complications that may adversely affect their quality of life

and overall well-being [6, 7].

Fatigue is widely recognized as one of the most prevalent and distressing symptoms experienced by individuals undergoing hemodialysis. It is characterized as a persistent and multidimensional feeling of exhaustion that is not completely relieved by rest. Beyond its physical effects, fatigue can impair cognitive, emotional, and social functioning. In patients receiving hemodialysis, fatigue has been identified as one of the most burdensome symptoms because it can reduce functional capacity, restrict daily activities, increase dependence on others, and negatively affect quality of life [8-10].

Patients receiving hemodialysis also frequently experience various dialysis symptom burden, including pruritus, sleep disturbances, muscle cramps, pain, nausea, appetite loss, and anxiety [11-13]. The coexistence of these symptoms often creates a substantial symptom burden that negatively impacts quality of life and overall health outcomes [13-15].

Patients receiving hemodialysis often exhibit substantial differences in the severity of fatigue and dialysis symptom burden, even when exposed to similar treatment regimens and clinical conditions. Such variations suggest that symptom experiences are shaped not only by disease and treatment factors but also by individual patient characteristics [16, 17].

Previous studies have demonstrated that sociodemographic and clinical factors, including age, sex, education, employment status, marital status, comorbidities, and dialysis duration, are associated with variations in fatigue and dialysis symptom burden among hemodialysis patients [14, 17]. In particular, female sex, unmarried status, poor nutritional condition, and longer duration of hemodialysis have been linked to greater dialysis symptom burden, whereas age, physical activity, employment status, and comorbidities have been identified as significant predictors of fatigue [13, 16, 18, 19].

Although previous studies have examined predictors of fatigue and dialysis-related symptoms separately, evidence simultaneously assessing both outcomes remains limited, particularly in developing countries. Understanding shared factors associated with fatigue and dialysis symptom burden may facilitate the development of more comprehensive symptom-management strategies for patients undergoing hemodialysis.

Accordingly, this study aimed to investigate the relationship between patient characteristics and fatigue and dialysis symptom burden among patients receiving hemodialysis.

2. Methods

Study Design and Setting

This quantitative study employed a cross-sectional design. Data were collected between January and February 2026 at the Hemodialysis Unit and inpatient wards of Dr. Zainoel Abidin Regional General Hospital, Banda Aceh, Indonesia.

Participants and Sampling

The study population consisted of patients with chronic kidney disease undergoing maintenance hemodialysis at the Hemodialysis Unit of Dr. Zainoel Abidin Regional General Hospital. The minimum sample size was determined using Cohen's power analysis table with a significance level of 0.05, statistical power of 0.80, and a medium effect size (0.50), resulting in a required sample of 64 participants. To account for potential incomplete data, the sample size was increased by 10%, yielding a final target sample of 70 participants. Participants were recruited using purposive sampling based on predefined inclusion and exclusion criteria.

Data Collection

Data collection was conducted after obtaining ethical approval and institutional permission. Eligible participants received information regarding the study objectives, procedures, and potential benefits before providing written informed consent. Data were subsequently collected through structured interviews using questionnaires on patient characteristics, fatigue, and dialysis symptom burden.

Instruments

Data were collected using three research instruments categorized into Sections A, B, and C. Section A consisted of a patient characteristics questionnaire that gathered sociodemographic and clinical information, including sex, age, educational attainment, employment status, duration of hemodialysis, and sleep disturbances.

Section B assessed fatigue using the Functional Assessment of Chronic Illness Therapy–Fatigue (FACIT-F) questionnaire. The FACIT-F is a 13-item instrument designed to evaluate fatigue experienced by patients during the previous seven days. Each item is rated on a Likert scale, and higher total scores indicate lower levels of fatigue.

Section C measured dialysis symptom burden using the Dialysis Symptom Index (DSI). The DSI is a 30-item instrument developed to assess the physical and psychological symptoms commonly experienced by patients undergoing dialysis therapy. In the present study, two items related to sexual functioning were omitted due to cultural considerations and concerns regarding participants' comfort when responding to the questionnaire. Consequently, dialysis symptom burden was assessed using 28 items. Higher DSI scores indicate a greater burden of dialysis symptom burden.

Statistical Analysis

Data were analyzed using PSPP statistical software. Normality testing using the Shapiro–Wilk test indicated that the study variables were not normally distributed ($p < 0.05$). Therefore, nonparametric analyses were performed to examine the associations between patient characteristics, fatigue, and dialysis symptom burden. Spearman's rank correlation, Mann–Whitney U, and Kruskal–Wallis tests were applied according to the level of measurement and distribution of the variables. Statistical significance was set at $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the Health Research Ethics Committee of Dr. Zainoel Abidin Regional General Hospital, Banda Aceh (No. 389/ETIK-RSUDZA/2025). Written informed consent was obtained from all participants prior to enrollment. Participant anonymity and data confidentiality were maintained throughout the study.

3. Results and Discussion

Seventy patients receiving maintenance hemodialysis participated in the study. The majority were women (54.3%), had a secondary level of education (61.4%), were self-employed (41.4%), and experienced sleep disturbances

(72.9%). The median age was 47 years (IQR = 12), whereas the median duration of hemodialysis was 16 months (IQR = 29). The demographic and clinical characteristics of the study participants are summarized in Table 1.

Table 1: Sociodemographic and Clinical Characteristics of Participants Undergoing Hemodialysis (n = 70)

Variable	f (%)	Median (IQR)
Sex		
Male	32 (45.7%)	
Female	38 (54.3%)	
Age (years)		47 (12)
Educational level		
Primary	3 (4.3%)	
Secondary	43 (61.4%)	
Higher education	24 (34.3%)	
Occupation		
Housewife	24 (34.3%)	
Civil servant/Military/Police	6 (8.6%)	
Self-employed	29 (41.4%)	
Farmer	2 (2.9%)	
Retired	6 (8.6%)	
Teacher	3 (4.3%)	
Sleep disturbances		
Yes	51 (72.9%)	
No	19 (27.1%)	
Duration of hemodialysis session on		
5 hours	38 (54.3%)	
4,5 hours	32 (45.7%)	
Hemodialysis frequency		
Twice weekly	69 (98.6%)	
Three times weekly	1 (1.4%)	
Duration of hemodialysis (months)		16 (29)
Medication use		
Antihypertensive drugs	70 (100%)	
Antidiabetic drugs	26 (37.1%)	
Antihyperuricemic drugs	8 (11.4%)	
Antiplatelet drugs	3 (4.3%)	
Antihyperlipidemic drugs	4 (5.7%)	
Companion During Hemodialysis		
Yes	68 (97.1%)	
No	2 (2.9%)	

***Notes:** Categorical variables are presented as frequencies and percentages [n (%)], whereas continuous variables are presented as median and interquartile range (IQR). Respondents may have used more than one type of medication; therefore, the total percentage for medication use does not equal 100%

In this study, the median age of participants was 47 years (IQR = 12), suggesting that most patients undergoing hemodialysis were within the adult age range. This finding is comparable to previous reports indicating that hemodialysis populations are predominantly composed of adults and older individuals [20]. No statistically significant associations were observed between age and fatigue (r = -0.221, p = 0.066) or dialysis symptom burden (r = 0.177, p = 0.142). This finding is consistent with previous studies suggesting that dialysis symptom burden among patients undergoing hemodialysis is influenced by multiple clinical and psychosocial factors rather than chronological age alone [19, 20].

Women represented a slightly larger proportion of the study population than men (54.3% vs. 45.7%). Despite this difference, sex was not significantly associated with either fatigue (p = 0.184) or dialysis symptom burden (p = 0.781), consistent with previous findings indicating that symptom experiences among hemodialysis patients are more strongly influenced by clinical and psychosocial factors than by sex alone [19-21].

Most participants had attained a secondary level of education (61.4%), a finding consistent with previous studies involving patients with chronic kidney disease [17]. While educational level was not significantly related to fatigue (p = 0.249), a significant association was observed between educational level and dialysis symptom burden (p = 0.044). Patients with different educational backgrounds may vary in their health literacy, access to health information, and ability to manage symptoms, which could contribute to differences in dialysis symptom burden [19]. However, caution is warranted when interpreting this finding because of the relatively uneven distribution of participants across educational categories. Furthermore, post hoc comparisons were not performed because of the limited number of participants in certain educational categories, particularly the primary education group (n = 3) Table 2 summarizes the relationships between patient characteristics and both fatigue and dialysis symptom burden among patients undergoing hemodialysis.

Table 2: Associations Between Patient Characteristics and Fatigue and Dialysis Symptom Burden Among Patients Undergoing Hemodialysis

Variable	Fatigue		Dialysis Symptom Burden	
	Statistic	p-value	Statistic	p-value
Age	r = -0.221	0.066	r = 0.177	0.142
Sex	Z = -1.329	0.184	Z = -0.278	0.781
Educational level	H = 1.331	0.249	H = 4.047	**0.044**
Occupation	H = 11.016	0.051	H = 6.239	0.284
Duration of hemodialysis	r = 0.118	0.333	r = 0.072	0.552
Sleep disturbances	Z = -2.147	**0.032**	Z = -2.306	**0.021**

***Note:** r = Spearman's rank correlation coefficient; Z = Mann–Whitney U test statistic; H = Kruskal–Wallis test statistic. A p-value < 0.05 was considered statistically significant

Regarding occupation, self-employment was the most common occupational category among participants (41.4%), suggesting that a substantial proportion of patients remained economically active despite undergoing regular hemodialysis treatment. This finding is consistent with previous studies reporting that many patients receiving hemodialysis are employed in informal occupations or experience unstable employment due to physical limitations and the demands of ongoing treatment [22]. Statistical analysis demonstrated no significant association between occupation and fatigue (p = 0.051) or dialysis symptom burden (p = 0.284). Although the association between occupation and fatigue approached statistical significance, the result did not meet the predefined threshold for significance. This observation contrasts with the findings of Lu *et al*. (2024), who reported that employment status was associated with dialysis symptom burden among dialysis patients [23]. Differences in participant characteristics, socioeconomic conditions, and other influential factors, such as sleep quality and clinical status, may explain this discrepancy.

The median duration of hemodialysis was 16 months (IQR = 29), indicating that most participants had been receiving treatment for an extended period. However, no significant associations were observed between dialysis duration and fatigue (r = 0.118, p = 0.333) or dialysis symptom burden (r

= 0.072, p = 0.552). These findings are consistent with previous studies reporting that dialysis vintage was not a significant predictor of fatigue among patients undergoing hemodialysis [20]. Evidence from other studies suggests that fatigue is more closely related to psychological factors, sleep quality, and quality of life than to treatment duration alone [24]. In addition, Molfino *et al*. (2023) reported that fatigue may be associated with inflammatory processes and physical health status [25]. Taken together, these findings suggest that fatigue and dialysis symptom burden are influenced by a complex interplay of clinical, biological, and psychosocial factors rather than the length of time patients have been receiving hemodialysis.

Sleep disturbances were common among the study participants, affecting nearly three-quarters of the sample (72.9%). The high prevalence of sleep-related problems may be attributable to a combination of physical and psychological factors frequently experienced by patients undergoing hemodialysis, including pruritus, discomfort, uremic manifestations, and emotional distress [26]. A significant relationship was observed between sleep disturbances and both fatigue (p = 0.032) and dialysis symptom burden (p = 0.021), suggesting that impaired sleep may contribute substantially to adverse symptom experiences. This finding supports previous evidence demonstrating that sleep disturbances are among the most influential factors associated with fatigue and dialysis symptom burden in hemodialysis populations [19, 27]. According to Bossola *et al*. (2023), fatigue in patients receiving hemodialysis arises from a complex interaction of sleep disorders, inflammatory processes, depressive symptoms, and diminished quality of life [10]. Therefore, addressing sleep disturbances may represent an important strategy for reducing fatigue and overall dialysis symptom burden in this population.

4. Conclusions

This study demonstrated that most sociodemographic and clinical characteristics, including age, sex, occupation, and duration of hemodialysis, were not significantly associated with fatigue or dialysis symptom burden. Educational level was associated with dialysis symptom burden but showed no significant relationship with fatigue. Notably, sleep disturbances were the only factor significantly associated with both outcomes. These findings suggest that sleep-related problems were more strongly associated with fatigue and dialysis symptom burden than most demographic characteristics. Therefore, interventions targeting sleep disturbances may represent an important strategy for improving symptom outcomes among patients undergoing hemodialysis.

5. Limitations

This study has several limitations. First, the cross-sectional design precludes causal inferences between patient characteristics, fatigue, and dialysis symptom burden. Second, the study was conducted at a single center with a relatively small sample, which may limit the generalizability of the findings. Third, the unequal distribution of participants across some educational and occupational categories may have affected statistical power. Finally, fatigue, dialysis symptom burden, and sleep disturbances were assessed using self-reported measures and several relevant clinical and psychosocial variables, including hemoglobin levels, dialysis adequacy, nutritional status, depression, and anxiety, were not evaluated. Therefore, the findings should be interpreted with caution.

6. Implications for Practice and Future Research

The findings highlight the importance of routinely assessing sleep disturbances, fatigue, and dialysis symptom burden in patients undergoing hemodialysis. Given the significant association between sleep disturbances and both outcomes, interventions aimed at improving sleep quality may help reduce fatigue and dialysis symptom burden. Future studies should employ longitudinal or multicenter designs with larger samples and incorporate relevant clinical and psychosocial factors, such as anemia, dialysis adequacy, nutritional status, depression, anxiety, and sleep quality, to provide a more comprehensive understanding of factors associated with fatigue and dialysis symptom burden.

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