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Interrelations of Itch, Sleepiness, and Fatigue in Hemodialysis: A Cross-Sectional Study Itch, Sleepiness, and Fatigue in Hemodialysis

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Abstract

Background

There are some studies on sleep, fatigue, and itching in hemodialysis patients. However, these studies generally considered the problems separately. This study focused on the circumstances affecting these factors and their association. This study also focused on the variables affecting these factors and the association among these factors.

Methods

A total of 199 hemodialysis patients were enrolled in this descriptive cross-sectional study. Patients reported sociodemographic data and clinical characteristics and completed the Epworth Sleepiness Scale (ESS), Fatigue Severity Scale (FSS), and 5-D Itch Scale.

Results

Data were analyzed using SPSS version 24. Female sex and illiteracy were associated with FSS and 5-D itch. Morning dialysis was linked to increased daytime sleepiness, and the presence of itch increases day sleepiness and itch. Correlation analyses indicated a positive and significant association between day sleepiness and fatigue. There was also significant positive correlation between fatigue and itching.

Conclusion

Certain sociodemographic characteristics that affect sleepiness, fatigue, and itching in hemodialysis patients. These factors also influence each other. Therefore, they should be routinely assessed, and counseling and education should be provided to the patient.

1. Introduction

Itching is an unpleasant complication associated with chronic kidney disease and is commonly observed in hemodialysis patients [1, 2]. The incidence of itching in hemodialysis patients varies but can be up to 55% [3]. Itching can occur pre-, intra-,or post- hemodialysis, may persist for 6–12 hours [1, 4]. Patients describe itching as uncomfortable, painful, irritating, burning, numb, tingling, stinging, and acompanied by dry skin [5]. Itching in hemodialysis is multifactorial. Toxin accumulation, immune system irregularities, calcium or phosphate imbalance, peripheral neuropathy, parathyroid hormone levels, opioid imbalance, dialysis adequacy, and dry skin are among the various factors reported to cause itching [6]. This unpleasant condition affecting the skin negatively impacts the individual's quality of life, daily activities, fatigue, sleep, and contributes to anxiety and depression [2, 5, 7, 8].

In hemodialysis patients, itching gives rise to various sleep disruptions. Sleep quality is significantly impaired in hemodialysis patients. The prevalence of sleep disorders associated with hemodialysis ranges from 9% to 76%, indicating poorer sleep quality [2]. Itching prolongs sleep onset latency and causes some negative effects such as nocturnal awakening, disruption of social life, and occasional interference with household chores [1]. Itching is categorised as mild, moderate, or severe and its severity affects patients' sleep. Patients with severe itching have shorter sleep duration [7]. Itching also affects individuals' quality of life and predisposes to secondary infections [2]. In hemodialysis patients, factors such as primary kidney disease, systolic blood pressure, the presence of itching in the last month, frequency of itching, and restless legs syndrome have been have been associated with sleep quality [9]. Another significant adverse effect of itching is that it causes patients skip or shorten dialysis sessions, and reduces their likelihood of returning to work. There is a significant association between the severity of itching and prolonged recovery time after dialysis, decreased physical and mental quality of life, increased depressive symptoms, and sleep quality [10] itching and the associated disruption of sleep contribute to the development of fatigue.

Fatigue is one of the most commonly reported symptoms among hemodialysis patients and has adverse effects on their quality of life. Fatigue is particularly important in individuals undergoing hemodialysis due to the debilitating and exhausting burden of dialysis, limitationsnin in daily-life participation, reduced capacity to fulfill roles, and susceptibility to misinterpretation. Many cognitive, emotional, behavioral, and physiological issues in hemodialysis patients can cause fatigue. Poor sleep quality, which is a behavioural factor, is one such factor [11]. Fatigue is particularly prevalent post-hemodialysis, especially in patients suffering from insomnia [12]. Fatigue shows significant positive associations with daytime sleepiness and nocturnal sleep [13].

Itching, sleep disruption, and fatigue occur frequently in hemodialysis patients. These symptoms have adversely affect on individuals' quality of life and daily activities. There are studies on sleep, itching, and fatigue. However, there is lack of studies examining the interrelationship between itching, daytime sleepiness, and fatigue. Therefore, the aim of this study is to investigate the impact of itching on sleep in hemodialysis patients and the subsequent daytime sleepiness. This study aims to birdge this gap in the evidence base. To this end, the study addresses the following questions;

1. What factors influences itching, daytime sleepiness, and fatigue in hemodialysis patients?
2. How does fatigue change in patients who have itching and daytime sleepiness?
3. What are the association between itching, daytime sleepiness, and fatigue in hemodialysis patients?

2. Methods

2.1. Study Design, Setting, and Sample

This study was designed as a descriptive, cross-sectional study. The aim of the study was to determine the factors influencing itching, fatigue, and sleep in hemodialysis patients and to reveal theassociation

between them. The study was conducted in a city in the eastern Turkey with a population of 283,276 and an area of 8,277 km². A total of 199 dialysis patients who received treatment at two dialysis centers in the city center and three dialysis centers in the districts were included. No sample calculation was performed; a cencsus sampling approach was used. Patients received treatment at dialysis centers between 01.09.2024 and 01.05.2025 were included. Patients aged ≥ 18 years old, who volunteered to participate in the study, could be contacted, and underwent dialysis at least once a week were included. Those undergoing acute hemodialysis or with a clinical diagnosis of psychiatric illness were excluded. Eligibility was determined by-self report.

2.2. Measurements

2.2.1. Sociodemographic Data and Clinical Characteristics

The sociodemographic and clinical information form consisted of 14 questions, encompassing sociodemographic characteristics such as age, sex, educational level, monthly income, marital status, and employment status, along with items on smoking status and dialysis treatment.

2.2.2. Epworth Sleepiness Scale (ESS)

The scale is a brief, eight-item measure developed by Johns in 1991[14]. It is simple and easy to understand and is used used to assess general sleepiness levels. The scale is a four-point Likert-type measure that evaluates individuals' daytime sleepiness in daily life. Scores range from 0 to 24, with a total ESS score of 11 or above indicating excessive daytime sleepiness. The Turkish validity and reliability study was conducted by Izgi et al. (2008), and the scale has a Cronbach's alpha coefficient of 0.86 [15].

2.2.3. Fatigue Severity Scale

The Fatigue Severity Scale was developed by Krupp et al. (1989). The Turkish psychometric validation of the scale was demostrated by Gencay Can and Can (2012)[16]. The scale consists of nine items on a seven-point Likert scale. Each item is rated on a scale of 1 = strongly disagree to 7 = strongly agree. The scale can yield a minimum score of 9 and a maximum score of 63, with higher scale scores indicating greater fatigue levels. The Cronbach's alpha value for the scale was reported as 0.85.

2.2.4. 5-D Itch Scale

The 5-D Itch Scale was developed by Elman and colleagues [17]. The Turkish validity and reliability study was conducted by Ersoy and Akyar [1]. The scale assesses the duration, severity, course, distribution, and disability caused by itching experienced in the last two weeks. The total score of the scale ranges from a minimum of 5 points (no itching) to a maximum of 25 points (maximum severity). The duration, severity, direction, and disability dimensions are each rated from 1 to 5. The disability score is calculated as the average of four (sleep, social/leisure time, household/chores, work/school). The distribution score is based on the number of affected body regions, with a maximum of 5 points, 0–2: 1 point, 3–5: 2 points, 6–10: 3 points, 11–13: 4 points, and 14–16: 5 points, by examining 16 b

2.3. Data Collection and Ethical Considerations

Ethical committee approval was obtained from the Bingol University Health Sciences Scientific Research and Publication Ethics Committee under code: E-60543243-044-170174 version date: August 13, 2024 in accordance with the Declaration of Helsinki. Ten minutes after patients were connected to dialysis machines, the researcher explained the study's aim, and importance of the study, and provided information about the questionnaires. Prior to completing the forms, informed witten consent was obtained from all participants. Patients who agreed to participate in the study were assured that their data would be kept confidential and that the study results would be used for scientific research purposes. Completing the questionnaires took approximately 15–20 minutes. Each questionnaire was checked for completeness after completion. Any missing items were completed. Considering climate and transportation conditions, data collection was conduct first from the districts and finally from the two dialysis centers in the city center.

2.4. Data Analysis

IBM SPSS statistical software 24 version the was used to analyze data, and $p \leq 0.05$ was considered statistically significant with 95% confidence intervals. The clinical and sociodemographic variables were first analyzed using descriptive statistics. For ESS, FSS and 5-D Itch scale the mean scores and associated standard deviations (SDs) were calculated. Data normality was also assessed using the Kolmogorov-Smirnov Test Data Analysis. The Mann-Whitney U test was used for pairwise comparisons that did not show a normal distribution, and the Kruskal-Wallis H test was used for comparisons involving more than two groups. Post hoc pairwise comparisons were used for multiple comparisons within groups. Spearman's rho coefficient was used to examine the association between ESS, FSS, and 5-D Itch.

3. Results

The average age of participants was 59, 56.8% were male, 45.7% were illiterate, 75.4% were married, and 97% were unemployed. The range of housewives and retirees was equal at 36.2%, 68.3% had an income lower than their expenses, and 79.9% were non-smokers. 36.2% of these individuals had kidney failure of 2–5 years' duration, 38.2% have been on dialysis for 2–5 years, 96.5% undergo three dialysis sessions per week, 54.3% received treatment in the morning session, and all patients underwent 4-hour dialysis sessions. Itching is present in 63.8% of participants, mean Kt/v averages 1.53, and itching is most commonly observed before dialysis at 42.2%. (Tablo 1).

Table 2 shows that while there is no significant difference in ESS scores by gender, there is a difference in FSS and 5-D scores, and this difference is statistically significant ($p < 0.01$ and $p < 0.05$, respectively). By the education level, there was no difference in ESS scores, but there was a statistically significant difference in FSS and 5-D scores ($p < 0.001$, $p < 0.05$). Differences are statistically significant between illiterate and those with high school and elementary school education. Both FSS and 5-D scores were found to be higher among illiterate, and the difference was driven by this group. There was a statistically

significant difference in FSS scores between the official-housewives and retirees-housewives based on occupation. Only FSS scores showed a statistically significant difference by marital status, employment status, occupation, and income status. Pairwise comparisons within income categories, a significant difference was found between those whose income was equal to their expenses and those whose income was less than their expenses. Regarding smoking status, a statistically significant difference was found in 5-D scores. No significant difference was found between scores for duration of renal failure, years on dialysis, and weekly dialysis sessions. A statistically significant difference was found between ESS scores based on the dialysis sessions and the presence or absence of itching. There were a statistically significant difference in ESS and 5-D Itching scores, and in 5-D itching scores according to time period during which itching was most prevalent ($p<.05$, $p<.01$, $p<.05$, respectively). (Tablo 2).

Table 1

Participant characteristics and distributions Age, mean (range): 59 years (18–90); Kt/V, mean: 1.53; Dialysis session duration: 4 hours for all participants.

Characteristic	Category	n	%
Sex	Female	86	43.2
	Male	113	56.8
Education level	No formal literacy	91	45.7
	Primary school	74	37.2
	High school or higher	34	17.1
Marital status	Married	150	75.4
	Single	49	24.6
Employment status	Employed	6	3.0
	Unemployed	193	97.0
Occupation	Official	28	14.1
	Housewife	72	36.2
	Retired	72	36.2
	Other	27	13.6
Income level	Less than expenses	136	68.3
	Equal to expenses	50	25.1
	More than expenses	13	6.5
Smoking status	Yes	40	20.1
	No	159	79.9
Duration of kidney failure	≤ 1 year	29	14.6
	2–5 years	72	36.2
	6–10 years	63	31.7
	≥ 11 years	35	17.6
Years on hemodialysis	≤ 1 year	24	12.1
	2–5 years	76	38.2
	6–10 years	64	32.2
Symptom scales: ESS mean ± SD: 4.97 ± 3.93; FSS mean ± SD: 47.75 ± 14.65; 5-D Itch mean ± SD: 8.78 ± 5.63.			

Characteristic	Category	n	%
	≥ 11 years	35	17.6
Weekly dialysis sessions	Two	7	3.5
	Three	192	96.5
Usual dialysis shift	Morning	108	54.3
	Noon	91	45.7
Pruritus (itching) status	Yes	127	63.8
	No	72	36.2
Period when pruritus most intense	No pruritus	72	36.2
	Pre-dialysis	84	42.2
	Intra-dialysis	12	6
	Post-dialysis	31	15.6
Symptom scales: ESS mean ± SD: 4.97 ± 3.93; FSS mean ± SD: 47.75 ± 14.65; 5-D Itch mean ± SD: 8.78 ± 5.63.			

Table 2
Factors associated with Sleep (ESS), fatigue (FSS), and pruritus severity (5-D Itch)

Variable	Category	ESS (Median, range)	p (ESS)	FSS (Median, range)	p (FSS)	5-D Itch (Median, range)	p (5-D)
Sex	Female	4 (0–24)		56.5 (11–63)		9.25 (2.25–25)	
	Male	5 (0–12)	0.37	45 (4–63)	**0.000**	7 (2.25–24)	**0.04**
Education	No formal literacy	5 (0–24)		56 (13–63)		9.5 (2.25–25)	
	Primary school	5 (0–12)		46.5 (5–63)		9 (2.25–22.5)	
	High school or higher	4 (0–10)	0.20	39 (4–63)	**0.000**	5.75 (2.25–24)	**0.006**
Marital status	Married	4.5 (0–24)		54 (11–63)		8 (2.25–24)	
	Single	4 (0–24)	0.717	48 (4–63)	**0.005**	9.25 (2.25–25)	0.538
Employment status	Employed	3.5 (0–8)		20.5 (5–54)		8 (2.25–11.75)	
	Unemployed	5 (0–24)	0.360	53 (4–63)	0.004	8.5 (2.25–25)	0.767
Occupation	official	5 (0–12)		45.5 (4–63)		9.12 (2.25–19.5)	
	Housewife	4.5 (0–24)		57 (11–63)		9.12 (2.25–25)	
	Retired	4 (0–12)		49 (13–63)		7.62 (2.25–24)	
	Other	4 (0–9)	0.821	46 (12–63)	< 0.001	4 (2.25–24)	0.114
Income level	Less than expenses	5 (0–24)		54 (4–63)		9 (2.25–24)	
	Equal to expenses	4 (0–12)		45 (5–63)		7 (2.25–19.5)	
	More than expenses	5 (0–8)	0.635	53 (18–63)	0.003	6 (2.25–25)	0.494

ESS = Epworth Sleepiness Scale; FSS = Fatigue Severity Scale; 5-D Itch = 5-D Itch Scale.

Variable	Category	ESS (Median, range)	p (ESS)	FSS (Median, range)	p (FSS)	5-D Itch (Median, range)	p (5-D)
Smoking status	Yes	5 (0–12)		45 (4–63)		8 (2.25–24)	
	No	4 (0–24)	0.297	54 (5–63)	**0.002**	9 (2.25–24)	0.772
Duration of kidney failure	≤ 1 year	4 (0–14)		50 (18–63)		7 (2.25–19.5)	
	2–5 years	4 (0–24)		50.5 (11–63)		9 (2.25–25)	
	6–10 years	5 (0–24)		53 (5–63)		9.25 (2.25–24)	
	≥ 11 years	6 (0–12)	0.469	54 (4–63)	0.436	7 (2.25–24)	0.515
Years on hemodialysis	≤ 1 year	4 (0–14)		54 (18–63)		4.87 (2.25–19.5)	
	2–5 years	4.5 (0–24)		50 (11–63)		9 (2.25–25)	
	6–10 years	5 (0–24)		54 (5–63)		9.37 (2.25–25)	
	≥ 11 years	5 (0–12)	0.948	54 (4–63)	0.549	7 (2.25–24)	0.292
Weekly dialysis sessions	Two	1 (0–8)		59 (22–63)		7.25 (5.25–24)	
	Three	5 (0–24)		53 (4–63)		8.5 (2.25–25)	
Dialysis shift	Morning	5 (0–24)		52.5 (5–63)		8.75 (2.25–25)	
	Noon	4 (0–24)	**0.023**	53 (4–63)	0.085	8 (2.25–24)	0.520
Pruritus status	Yes	5 (0–24)		54 (5–63)		10.75 (4.25–25)	
	No	4 (0–14)	**0.042**	50 (4–63)	0.293	3 (2.25–10.25)	**.000**
Pruritus timing	Pre-dialysis	5 (0–24)		51 (11–63)		10.25 (4.25–	

ESS = Epworth Sleepiness Scale; FSS = Fatigue Severity Scale; 5-D Itch = 5-D Itch Scale.

Variable	Category	ESS (Median, range)	p (ESS)	FSS (Median, range)	p (FSS)	5-D Itch (Median, range)	p (5-D)
						22.5)	
	Intra-dialysis	6.5 (0–12)		51 (5–63)		12.12 (8–22)	
	Post-dialysis	4 (0–24)	0.056	57 (27–63)	0.073	11 (6–25)	**0.019**
ESS = Epworth Sleepiness Scale; FSS = Fatigue Severity Scale; 5-D Itch = 5-D Itch Scale.							

Table 3 presents correlations among the scales. ESS showed a significant positive correlation with FSS (r=.158, p<.05), whereas 5-D Itch Scale (r=.100, p>.05) did not show significant correlation with ESS. There was also significant positive significant correlation between FSS and 5-D Itch Scale (r=.197, p<.01). (Table 3).

Table 3
Correlations among ESS, FSS, and 5-D Itch

ESS	Mean	Sd	ESS	FSS	5-D
	4.97	**3.93**	**1**		
FSS	47.75	14.65	.158*	1	
5-D	8.78	5.63	.100	.197**	1
ESS:Epworth sleep scale, FSS: Fatigue severity scale, 5-D: 5-D Itch scale					
*. P < 0.05					
**. P < 0.01					

4. Discussion

There are many factors associated with sleep, fatigue, and itching in dialysis patients. In this study, both fatigue and itching were found to be higher in female patients. Sleep disturbances have been linked to fatigue and itching [9, 18]. Itching compromises comfort. Fatigue is more common in women paricipants than in males thereby further impairing quality of life [19]. Both fatigue and itching have been reported to be higher in non-literate individuals. Those with lower educational attainments find it more difficult to manage their condition, resulting in a lower quality of life [19]. Itching not only compromises comfort but also affects their sleep [20]. However, in this study, sleep was unaffected. This may be associated to participants' average age. The severity of fatigue varies among hemodialysis patients by marital status; fatigue severity is greater in married patients. Many factors affect fatigue, such as dialysis duration, electrolyte abnormalities, sleep quality, and age [21]. Fatigue is more common in

divorced/widowed/married individuals. In this sense, the findings of this study are consistent with the literatüre [12]. Greater fatigue in married participants may reflect greater personal and family responsibilities. Fatigue severity was greater in hemodialysis patients based on employment status, occupation, and income level. The greater fatigue in those who are enemployment may be associated to insufficient clearance of uremic toxins. Fatigue following dialysis is particularly associated with endurance, appetite, potassium levels, sleep quality, history of fistula surgery, diastolic blood pressure, and comorbidity [22]. In comparisons between official/housewives and retirees/housewives, fatigue severity was higher. Similarly, in the literature, employment status is associated with fatigue. In particular, the higher fatigue levels among unemployment have been explained by physical activity. However, it has been stated that income status affects fatigue severity [23]. It can be argued that this may affect socioeconomically. Income status can worsen nutritional status, which can lead to fatigue in the long term. In this study, itching was higher among non-smokers. Contrary to our findings, there are studies reporting higher levels of itching among smokers [24]. Therefore, there are conflicting results in the literature regarding the association between smoking and itching [7]. Further studies are needed to determine whether this is related to smoking or electrolyte imbalance. Daytime sleepiness is more common in patients who undergo dialysis in the morning, by dialysis timing. Post-dialysis fatigue is linked to sleep in dialysis patients [22]. Fatigue is a major cause of poor sleep quality [18]. Early awakening among those in the morning session, as well as other sleep effecting factors, lead to daytime sleepiness. Both daytime sleepiness and itch scores were found to be higher in those with itching. This finding is consistent with the literature. Itching has edversely effects the sleep quality of hemodialysis patients [18]. Consequently, daytime sleepiness scores were found to be high in these participants. In particular, as itching creates obstacles in individuals' daily lives, their sleep quality deteriorates [20]. Itching in hemodialysis patients have been observed before, during, and after dialysis. The period when itching is most intense differs from patient to patient. Sometimes itching increases in more than one time frame[1, 25]. In this study, the time period when itching is most severe is described before dialysis. The timing of itching can impact daily life in different ways; for example nighttime itching can more strongly affect sleep and cause daytime sleepiness.

This study reported association between fatigue and itching. There was a positive relationship between daytime sleepiness and fatigue severity. Similarly, studies in the literature indicate that fatigue impairs sleep quality [18]. These two conditions are mutually reinforcing: poor sleep quality can cause fatigue, and fatigue can cause a person's sleep quality to deteriorate [26]. With the influence of different risk factors, hemodialysis patients report more sleep-and fatigue-related complaints. Morever, fatigue severity changes before, during and after dialysis, and therefore the effect on sleep also varies [27]. This study found a positive association between fatigue severity and itching: as itching increases in hemodialysis patients, fatigue also increases. Itching and fatigue adversely affect the individual's quality of life [28]. In particular, itching, fatigue, and sleep are closely related conditions and warrant integrated and management.

This study has some limitations. This single-center cross-sectional study limits the generalizability of the findings. Another limitation is that, apart from patient self-reportss, no objective measures were

evaluated regarding the exclusion of factors other than dialysis related to itching. Other factors affecting sleep, itching, or fatigue could not be controlled for. Therefore, it should be noted that there may be unmeasured confounders may have influenced our results.

5. Conclusion

There was several factors affecting daytime sleepiness, fatigue severity, and itching in patients undergoing hemodialysis. Fatigue severity and itching were more prevalent in women. Non-literates perceive fatigue severity and itching more intensely. Therefore, fatigue and itching should be properly assessed in individuals with lower educational levels, and support should be provided to help them manage these symptoms. Fatigue severity was higher in married, housewives, or retired, and who had low or equal income their expenses. Idenifying the underlying reasons is important to alleviate patients' symptoms. Itching was more common in non-smokers. However, the literature does not support this, the main problem should be identified and patients should be encouraged to quit smoking. In this study, the duration of renal failure, years on dialysis, and weekly dialysis sessions were not effective variables. Daytime sleepiness was more common among those undergoing morning dialysis session. Planning individuals' sleep schedules might improve their sleep quality. Daytime sleepiness was higher among individuals with itching, and naturally, their itching scores were also higher. Therefore, relieving or managing itching will contribute to improving the individual's sleep quality. Participants' itching levels were found to be high before dialysis. Further studies are needed to clarify why dialysis-time itching is high.

6. Implications for practice

The results revealed that sleep, fatigue, and itching were observed at different levels in hemodialysis patients according to certain sociodemographic and clinical characteristics. In light of the findings, sleep, fatigue, and itching should be screened routinely and the results monitored in the care of hemodialysis patients. It is also important to asses other itching-related contributers. The timing of itching should be identified, and the patients should be educated on personalized care accordingly. This may include measures such as warm showers, moisturizing, relaxation exercises, and sleep hygiene optimization. Determinants of sleep, fatigue, and itching should likewise be evaluated. These three factors can influence one other and should be addressed together.

Declarations

Conflicts of interest:

None

Ethics approval:

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Consent for publication

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Conflicts of Interest

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Author Contribution

Ş:Ö. : Conception and design of the study, data collection, data analysis, interpretation of results, and drafting of the manuscript.B.A. : Contributed to data collection, literature review, and assisted in data interpretation and manuscript preparation.H.K. : Critically reviewed the manuscript, data collection, and contributed to the final revision.

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The authors have nothing to report.

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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