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# Determining sleep quality and investigating its relationship with various demographic and biochemical factors in hemodialysis patients

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## Abstract

**Introduction:** Sleep disorders are one of the most common disorders among hemodialysis patients which is associated with the demographic and laboratory factors of such patients.**Objectives:** The present study aims to investigate the quality of sleep and its relationship with some demographic and biochemical factors in a group of hemodialysis patients.**Patients and Methods:** This study is cross-sectional conducted on end-stage renal disease (ESRD) patients who underwent regular and continuous hemodialysis in Amin hospital of Isfahan. The Pittsburgh Sleep Quality Index (PSQI) was completed face-to-face for each individual. Other data included age, hemoglobin and hematocrit, adequacy of hemodialysis, serum alkaline phosphatase, ferritin, iron, calcium, phosphorus, parathyroid hormone and body mass index were recorded too.**Results:** In this study, 110 hemodialysis patients were investigated (71 men). In this study, 41.8% of the patients had sleep disorder. We found, no difference between demographic and laboratory factors of patients with and without sleep disorder ( $P > 0.05$  for all parameters). No significant difference was detected among men and women regarding sleep disorder ( $P > 0.05$ ). Accordingly, no significant difference in sleep disorder between patients with and without diabetes was found too ( $P > 0.05$ ). However, our study showed a significant direct relationship between age and sleep disorder ( $P = 0.026$ ) particularly in women ( $P = 0.011$ ).**Conclusion:** Sleep disorder is common in patients undergoing hemodialysis and is directly related to the patients' age; however, larger studies in this field are necessary.**Citation:** Etesami S,  
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## Introduction

Chronic renal failure is an important health problem and the population of such patients is increasing every year. In the event of an irreversible or end-stage renal disease (ESRD), patients should undergo regular hemodialysis (1). In hemodialysis, the blood passed through a filter that separates excess fluid, then the refined blood is returned to the body. Hemodialysis is accompanied by removal of waste products and regulation of electrolyte imbalance and also removal of excess fluids which controls the blood pressure and keeps the balance of potassium and sodium (2,3). However, hemodialysis is associated with numerous complications while patients undergoing hemodialysis are not only experience numerous physiological changes, but also face various mental stresses such as anxiety and depression (4,5). Other complications of hemodialysis include chronic micro-inflammation, restless legs syndrome, foot drop and even

## Key point

In a cross-sectional study on 110 hemodialysis, we found that sleep disorder is common and is directly related to the patients' age.

complete paralysis that are important complications affecting the nervous system. Sleep disorder is another important and serious complication of hemodialysis and is a condition characterized by disordered patterns or sleep-related behaviors (6,7).

Sleep disorders in ESRD patients are manifested as insomnia, obstructive sleep apnea syndrome, restless legs syndrome, sleep apnea-hypopnea syndrome, excessive daytime sleepiness, narcolepsy, sleepwalking, night wakes, having nightmares, rapid eye movement sleep (REM) behavior disorder, periodic limb movement disorder and poor concentration (6,8). Sleep disorder may be

associated with patients' uremic status, though improving uremic status with dialysis or kidney transplantation does not necessarily recover sleep disorder.

Various studies have investigated the effects of different laboratory and sociodemographic factors. However, the effective factors have not been yet fully identified. Previous studies have indicated that patients undergoing hemodialysis suffer from sleep disorder because this disorder may be more prevalent in the elderly too (8,9). Studies have also shown that this disorder significantly increases the risk of subsequent problems such as depression too (10-12).

**Objectives**

Since factors influencing sleep disorders have not been yet fully identified; therefore, the present study aims to investigate the quality of sleep and its relationship with some demographic and biochemical factors in hemodialysis patients.

**Patients and Methods**

**Study design**

The present study is a cross-sectional one conducted in 2020 on ESRD patients who were undergoing regular and continuous hemodialysis in Amin hospital of Isfahan.

Inclusion criteria were such as cooperation of the participants throughout all parts of study; regular and continuous hemodialysis two or three sessions per week; and lack of infection and serious underlying diseases. Patients with the following conditions were excluded: incomplete demographic and laboratory information; Obvious sleep disorders on medical therapy; use of sedatives; and psychologic disorder.

The Pittsburgh Sleep Quality Index (PSQI) was completed face-to-face for each individual. In addition, data related to the patients' demographic and biochemical factors were obtained and entered into a checklist. Data included age, plasma hemoglobin and hematocrit concentration, serum alkaline phosphatase, ferritin, iron, calcium, phosphorus, parathyroid hormone and body

mass index and also adequacy of hemodialysis.

**Sleep quality questionnaire**

This questionnaire has been designed to assess the quality of sleep in the past month. In PSQI, individuals answer nine items related to their sleep quality. Item 5 of PSQI contains 10 sub-items. Therefore, the whole questionnaire has 19 items that are scored on a 4-point Likert scale from 0 (no problem) to 3 (severe problem).

This questionnaire has seven subscales including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, drugs administration, sleeping medications and daytime dysfunction. In each subscale, the patient's score will range from 0 to 3, interpreted as follows:

- Score 0; no sleep problems
- Score 1; poor sleep problem
- Score 2; moderate sleep problem
- Score 3; severe sleep problems

Obtaining a total score higher than five on whole questionnaire indicates a poor sleep quality.

**Data analysis**

The data were entered into Statistical Package for the Social Sciences (SPSS) (version 24). In this study, independent *t* test, Spearman's rho correlation, chi-square and Mann-Whitney U test were employed to determine the relationship and differences between variables. Additionally, *P* < 0.05 was considered significant.

**Results**

In this study, 110 hemodialysis patients were investigated (71 men). The age range of the patients was 17-85 years.

Table 1 indicates the correlation coefficient between sleep quality score and age, body mass index and blood factors by gender and diabetes.

Comparing the mean sleep quality score between the genders showed no significant difference (*P*=0.483). Accordingly, no significant difference in sleep quality among diabetics and non-diabetics was found (*P*=0.396).

**Table 1.** Correlation coefficient between sleep quality score and age, body mass index (BMI) and blood factors

Correlation coefficient	Female	Male	Diabetes mellitus	No diabetes mellitus	All
Age (year)	0.405*	0.444	0.130	0.261	0.212*
Hemoglobin (g/dL)	0.220	0.060	-0.008	0.286	0.117
Hematocrit (%)	0.176	0.125	0.024	0.298	0.153
KtV	-0.090	0.133	0.145	-0.020	0.072
Alkaline phosphatase (U/L)	0.157	-0.150	-0.061	-0.017	-0.033
Ferritin (ng/dL)	0.097	-0.028	0.002	0.065	0.020
Iron (µg/dL)	-0.054	-0.032	-0.079	0.019	-0.046
Calcium (mg/dL)	0.073	-0.017	-0.012	0.052	0.019
Phosphate (mg/dL)	-0.120	-0.087	-0.029	-0.198	-0.116
Parathormone (pg/mL)	-0.087	-0.032	-0.057	-0.015	-0.052
BMI (kg/m <sup>2</sup> )	0.309	0.004	0.021	0.200	0.118

\**P* value < 0.05, KtV; dialysis adequacy.

Table 2 shows the mean and median sleep scores by gender and diabetes.

According to sleep disorder, Table 3 shows the mean, median and *P* value of serum alkaline phosphatase, ferritin, iron, calcium, phosphorus, parathyroid hormone, plasma hemoglobin, hematocrit and other demographic data including age, hemodialysis adequacy and body mass index.

Table 4 indicates individuals with sleep disorder according to the gender and diabetes ( $P > 0.05$ ).

## Discussion

In this study, we found 41.8% of patients had sleep disorder. There was no difference between demographic and laboratory factors of patients with sleep disorder and those without sleep disorder. In terms of sleep disorder, no difference between men and women or diabetic and non-diabetic was seen. However, there was a significant direct relationship between age and sleep disorder particularly in women.

Numerous studies have been conducted on sleep disorder in people undergoing hemodialysis. In a previous study,

Abassi et al investigated 88 patients suffering from ESRD on hemodialysis. Their study indicated that at least 95% of the participants had at least one sleep-specific disorder. However, employing the scales and criteria, 59.09% of the cases had sleep disorder. Investigating the relationship between sleep disorder with clinical and laboratory factors indicated that sleep disorders had a significant relationship with elderly, dialysis dose, blood creatinine, upper airway obstruction, liver failure, thyroid-stimulating hormone levels and drugs such as levodopa, antihypertensive drugs, benzodiazepines, erythropoietin, Venofer and phosphate-binder agents (13). Moreover, a comprehensive review study on sleep disorders in people undergoing hemodialysis showed sleep disorder occurs in about 40% to 60% of patients undergoing hemodialysis (data of 18 studies). Their study showed, sleep disorder may be associated with various demographic factors including age, but no significant relationship has been reported between sleep disorder and the laboratory and also other demographic factors (14). Our study showed that sleep disorder was significantly associated with age, especially in women. Moreover, the present study indicated the high

**Table 2.** The mean and median sleep score by gender and diabetes

		Frequency	Mean $\pm$ SD	Median	<i>P</i> -value
Gender	Female	39 (35.46%)	5.94 $\pm$ 3.06	5.00	0.483
	Male	71 (64.54%)	5.46 $\pm$ 2.67	5.00	
Diabetes mellitus	Presence	67 (60.9%)	5.85 $\pm$ 2.87	5.00	0.396
	Absence	43 (39.1%)	5.30 $\pm$ 2.71	5.00	

**Table 3.** Evaluation of age, hemoglobin, hematocrit, adequacy of hemodialysis, alkaline phosphatase, ferritin, iron, calcium, phosphorus, parathyroid hormone and body mass index (BMI) by sleep disorder

Variable	Sleep disorder 46(41.8%)		No sleep disorder 64 (58.2%)		<i>P</i> value
	Mean $\pm$ SD	Median	Mean $\pm$ SD	Median	
Age (year)	63.37 $\pm$ 15.53	64.50	59.38 $\pm$ 14.00	61.00	0.162
Hemoglobin (g/dL)	10.75 $\pm$ 1.46	10.90	10.34 $\pm$ 1.80	10.60	0.203
Hematocrit (%)	34.68 $\pm$ 4.11	34.6	33.19 $\pm$ 5.59	33.55	0.129
KtV	1.30 $\pm$ 0.30	1.31	1.24 $\pm$ 0.34	1.22	0.336
Alkaline phosphatase (U/L)	468.65 $\pm$ 590.66	311.50	474.25 $\pm$ 444.58	346.50	0.465
Ferritin (ng/dL)	590.57 $\pm$ 482.05	433.50	638.36 $\pm$ 569.61	436.50	0.822
Iron ( $\mu$ g/dL)	105.45 $\pm$ 144.93	63.4	92.09 $\pm$ 114.43	59.85	0.929
Calcium (mg/dL)	8.89 $\pm$ 0.76	8.95	8.84 $\pm$ 0.88	8.95	0.767
Phosphate (mg/dL)	4.57 $\pm$ 1.40	4.65	5.01 $\pm$ 1.32	4.85	0.098
Parathormone (pg/mL)	531.72 $\pm$ 461.44	417.00	531.72 $\pm$ 461.44	417.00	0.798
BMI( kg/m <sup>2</sup> )	25.35 $\pm$ 5.61	24.57	23.98 $\pm$ 4.41	23.43	0.257

KtV; dialysis adequacy.

**Table 4.** Sleep disorder according to the gender and diabetes

		Sleep disorder	No sleep disorder	<i>P</i> value
Gender	Female	18	21	0.49
	Male	28	43	
Diabetes mellitus	Presence	30	37	0.43
	Absence	16	27	

prevalence of sleep disorders in dialysis patients, which is in agreement with previous studies.

More recently, Wang et al in a meta-analysis reviewing nine studies indicated that sleep disorder has significant frequency in hemodialysis patients. This study showed, little relationship of sleep disorder with demographic or laboratory factors. Notably, they found age and history of hemodialysis have positive effects on sleep disorder (16). We also showed the same results. In our study no significant difference of demographic and laboratory factors in patients with sleep disorder and without was found. However, sleep disorder was directly associated with age.

Another study conducted by Ezzat and Mohab demonstrated that sleep disorder might be found in up to 69% of patients undergoing hemodialysis, indicating a high prevalence of such disorder (17). Moreover, Al-Jahdali stated that about 40% of people on hemodialysis suffer from serious sleep disorder, most of which were apnea, insomnia and daytime sleepiness (18). Previous studies paid little attention to the relationship between demographic or laboratory factors with this disorder. In addition to investigating the prevalence of sleep disorder, we showed no significant difference between patients in terms of plasma hemoglobin and hematocrit, adequacy of hemodialysis, serum alkaline phosphatase, ferritin, iron, calcium, phosphorus, parathyroid hormone and body mass index.

In 2016, Hasheminasab et al assessed insomnia and restlessness leg syndrome in 45 patients under hemodialysis. By assessing different variables, they showed that restlessness leg syndrome was observed in 54.5% of patients and more often among patients with blood group type A but no significant correlations were observed among these sleep disorders and biochemical factors such as serum iron, total iron-binding capacity, blood urea nitrogen, creatinine, potassium, calcium and phosphorous levels (19). We also showed the same result.

In the present study, we found no meaningful difference in sleep disorder between men and women and also diabetic and non-diabetic patients. However, these results need further investigation by larger metacentric studies.

## Conclusion

In general, according to the results of the present study and those of the previous studies, sleep disorder is common in patients undergoing hemodialysis and it is directly associated with the patients' age. On the other hand, this disorder was not associated with demographic and laboratory factors. According to the significant effect of sleep quality on life or investigation; however, it requires multi-centric studies with larger population.

## Limitations of the study

This study was conducted in a single hemodialysis center and requires further investigation by larger studies.

## Authors' contribution

Conceptualization: HN, SE.  
Methodology: HN.  
Validation: HN, SE.  
Formal Analysis: MJT.  
Investigation: HN, SE.  
Resources: SE, MJT.  
Data curation: HN, SE, MJT.  
Writing—original draft preparation: SE.  
Writing—review and editing: HN, SE, MJT.  
Visualization: HN, SE.  
Supervision: HN, SE.  
Project administration: HN.

## Conflicts of interest

The authors declare that they have no competing interests.

## Ethical issues

The research followed the tenets of the Declaration of Helsinki. The Ethics Committee of Isfahan University of Medical Sciences approved this study. The institutional ethical committee at Isfahan University of Medical Sciences approved all study protocols (IR.MUI.MED.REC.1399.434). Accordingly, written informed consent was taken from all participants before any intervention. This study was extracted from M.D., thesis of Samaneh Etesami at this university (Thesis# 399348). Additionally, ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

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## Resources

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