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The Effect of Sleep Hygiene Education on Sleep Quality, Depression, and Fatigue of Hemodialysis Patients

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Abstract

Background: One of the conservative treatment methods for patients with end-stage renal failure is hemodialysis. Although hemodialysis contributes to patients' lives, it has adverse emotional and psychological effects, including sleep problems, fatigue, and depression.

Objectives: The present study aimed to examine the effect of sleep hygiene education on sleep quality, depression, and fatigue among hemodialysis patients admitted to hospitals affiliated with Zahedan University of Medical Sciences in 2021.

Methods: This quasi-experimental study was conducted on 80 hemodialysis patients in Khatam Al-Anbia and Ali Ibne Abi Talib hospitals affiliated with Zahedan University of Medical Sciences in 2021. The participants were selected through convenience sampling and randomly assigned to intervention and control groups using permuted block randomization. The data were collected using a demographic information form, Pittsburgh sleep quality index (PSQI), Multidimensional Fatigue Inventory (MFI), and Beck Depression Inventory-II (BDI-II). The patients in the control group received routine care, and the patients in the intervention group attended a sleep hygiene education program in three consecutive face-to-face dialysis sessions using educational pamphlets for 40 to 60 minutes, depending on the patient's tolerance. Two months after the training program, the quality of sleep, fatigue, and depression were measured for patients in both groups. The patients' data were analyzed with SPSS software (version 25) using the paired samples *t*-test, independent samples *t*-test, chi-square test, and analysis of covariance (ANCOVA) at a significant level of 0.05 ($P < 0.05$).

Results: The mean scores of sleep quality for the patients in the intervention and control groups changed from 12.05 ± 2.18 to 10.85 ± 2.00 and from 10.28 ± 1.85 to 10.45 ± 1.85, respectively, and the paired samples *t*-test showed significant differences in both groups before and after the intervention, but the sleep quality scores increased for the patients in the intervention group ($P = 0.001$). Moreover, the mean fatigue scores for the patients in the intervention and control groups changed from 57.98 ± 13.48 to 52.25 ± 13.23 and from 48.88 ± 8.97 to 52.20 ± 8.80, respectively. The paired samples *t*-test showed significant differences in both groups before and after the intervention, but fatigue scores increased for the control group ($P = 0.001$). The data also indicated that the mean depression scores for the patients in the intervention and control groups changed from 24.20 ± 6.26 to 22.28 ± 5.26 and from 25.18 ± 7.70 to 25.68 ± 7.54, respectively. The independent samples *t*-test showed significant differences in both groups before and after the intervention ($P = 0.001$). By controlling the pre-test effect, the analysis of covariance (ANCOVA) revealed significant differences in the mean scores of sleep quality ($P = 0.001$), fatigue ($P = 0.001$), and depression ($P = 0.001$) in hemodialysis patients in both intervention and control groups after two months.

Conclusions: The study's findings indicated that sleep hygiene education significantly improves sleep quality, depression, and fatigue in hemodialysis patients. Given that sleep hygiene education is a simple and easy-to-use method, sleep hygiene training courses need to be organized and held for dialysis patients.

Keywords: Hemodialysis, Sleep Disorders, Sleep Hygiene Education, Sleep Quality, Fatigue, Depression

1. Background

Renal failure refers to temporary or permanent kidney damage that leads to the loss of normal kidney function. When the kidneys cannot function properly, alternative treatment methods are used, including kidney transplantation, hemodialysis, and peritoneal dialysis (1). From 1990 to 2017, the global prevalence of chronic kidney disease increased by 29.3 percent and the global mortality

rate by 41.5 percent (2). According to the Iranian Society of Nephrology (IrSN), in December 2017, 32,832 hemodialysis patients were undergoing hemodialysis in 571 units, which is said to increase by 15 percent annually (3). Even though hemodialysis increases the life span of patients with renal failure, it also has adverse physical and psychological complications. Research has shown that several factors, such as fatigue, depression, and sleep disorders, play a role in reducing the quality of life of hemodialysis patients (4, 5).

One of the problems with hemodialysis patients is sleep disorders (6, 7). Sleep is a state of unconsciousness in which a person can be aroused by sensory or other stimuli (8). Sleep is an important factor in human health and is one of the most basic human needs in Maslow's hierarchy of needs (9). The prevalence of sleep disorders in dialysis patients is 50 - 80 percent worldwide and 70 - 95 percent in Iran (10-14). Sleep disorders cause many problems, including sleep apnea syndrome (SAS), periodic limb movement disorder (PLMD), restless leg syndrome (RLS), and extreme daytime sleepiness (EDS) (10, 12, 15, 16). These problems ultimately lead to disturbances in the quality of sleep (17).

Sajjadi et al. showed that more than 60 percent of hemodialysis patients in Iran suffer from severe fatigue (18). Sleep disorder is a major factor in the feeling of fatigue of these patients (19). A cross-sectional study by Lavidor et al. showed that sleep quality is one of the predictors of fatigue (20). Lethargy and fatigue are common and painful, chronic, and debilitating (21). Jhamb et al. showed that 94 percent of dialysis patients tend to do more dialysis if their energy level increases (22). Thus, helping to relieve fatigue is very important for these patients.

Dinis and Braganca showed that lack of sleep predicts depression or depressive symptoms. However, they acknowledged that sleep disorders and depression have a two-way relationship, so depression also affects sleep (23). In a meta-analysis study, the overall prevalence of depression in hemodialysis patients from 1998 to 2013 was 63 percent in Iran, which was higher than in developed countries (24). Depression can cause irreparable complications such as the risk of alcohol and drug abuse, non-adherence to treatment, lower than expected quality of life, delay in the treatment process, etc., in hemodialysis patients (25, 26).

Thus, in addition to the fact that hemodialysis alone affects various dimensions of the patient's health, sleep disorders also have consequences for these dimensions, including fatigue and depression, causing more damage to their health and causing a further decrease in patients' quality of life (27).

Black et al. showed that increasing sleep quality improves fatigue and depression in older adults with sleep disorders (28). It is believed that helping to solve sleep disorders can probably be effective on other problems of hemodialysis patients, including fatigue and depression.

Sleep disorders in hemodialysis patients are treated through pharmacological and non-pharmacological procedures (29, 30). Drug therapy is these patients' first line of treatment (31). Despite many advances in pharmaceutical methods, they have always been associated with some consequences and side effects (32). As a result, non-pharmacological methods are more beneficial for hemodialysis patients. One of the non-pharmacological methods is the sleep hygiene education program, which involves instructions for health measures and controlling environmental factors that can effectively continue sleep (33). Given that sleep hygiene education is a simple, easy, and accessible method for nurses compared to other non-pharmacological measures, and considering the high prevalence of fatigue and depression and low sleep quality in dialysis patients, the present study aims to examine the effect of sleep hygiene education on sleep quality, fatigue, and depression in hemodialysis patients admitted to hospitals affiliated with Zahedan University of Medical Sciences in 2021.

2. Methods

This quasi-experimental study was conducted on 80 patients undergoing hemodialysis in Khatam Al-Anbia and Ali Ibne Abi Talib hospitals affiliated with Zahedan University of Medical Sciences in 2021. The sample size was estimated as 5 persons based on the mean and standard deviation of sleep quality of hemodialysis patients in a similar studybwith a 95 percent confidence interval and a 95 percent test power based on the following formula (34). Considering the sample size in similar studies and taking into account the possible dropout and ensuring sampling adequacy, the sample size was considered 40 patients in each group (80 persons in total).

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 \left({S_1}^2 + {S_2}^2\right)}{\left(\bar{X}_1 - \bar{X}_2\right)^2} = 4.23$$

Where $Z_{1-\frac{\alpha}{2}} = 1.96$, $Z_{1-\beta} = 1.64$, $\bar{X}_1 = 8.13$, $\bar{X}_2 = 1.4$, $S_1 = 3.53$, and $S_2 = 1.53$.

The participants were selected among eligible patients using convenience sampling and then randomly assigned to two intervention and control groups through permuted block randomization.

The inclusion criteria were having poor sleep quality (a total score of higher than 5), taking sleeping pills, being literate, having a history of at least 6 months of hemodialysis, having an age range between 18 - 65, not smoking/drug use present, having full consciousness and listening ability acceptable for sleep hygiene education, and not having any known mental/psychological disorder. Furthermore, some exclusion criteria were the failure to continue participating in the study, the occurrence of emergency or unforeseen incidents (kidney transplant, severe physical illness during the intervention, etc.), and the occurrence of acute infectious disease during the study.

The instruments used to collect the data were a demographic information form, Pittsburgh sleep quality index (PSQI), Multidimensional Fatigue Inventory (MFI), and Beck Depression Inventory-II (BDI-II). The demographic information form assessed patients' age, gender, education, ethnicity, women's menopause, employment status, underlying diseases, duration of dialysis, number of dialysis sessions, duration of dialysis, daily activity, hemoglobin, sodium, potassium, creatinine, urea nitrogen before and after dialysis, and adequacy of dialysis.

2.1. Pittsburgh Sleep Quality Index

The reliability of the Persian version of the Pittsburgh Sleep Quality Questionnaire was estimated at 0.89 (35). This quantitative instrument has 19 items scored on a 4-point Likert scale from 0 to 3. The total score ranges from 0 to 21. A score higher than 5 means poor sleep quality. The reliability of this tool in the present study was confirmed with Cronbach's alpha of 0.88.

2.2. Multidimensional Fatigue Inventory

The MFI contains 20 items that quantitatively measure fatigue on a 5-point Likert scale (36). Tavakoli et al. assessed the validity and reliability of the inventory for hemodialysis patients, and its reliability index was reported as r = 0.91 (21). The total fatigue score can range from 20 to 100, with higher scores indicating more fatigue. The reliability of this tool in the current study was confirmed with Cronbach's alpha of 0.78.

2.3. Beck Depression Inventory-II

In Iran, Cronbach's alpha for the instrument was reported to be 0.870, and its test-retest reliability was 0.740 (37). This inventory has 21 items scored from 0 to 3, with scores ranging from 0 to 63 and higher scores indicating a higher level of depression (38). The reliability of this tool in the present study was confirmed using Cronbach's alpha of 0.72.

After obtaining permission from the ethics committee and the vice-chancellor for research and technology of the university and making arrangements with hospital managers and officials, patients who met the study's enrollment criteria were selected using convenience sampling, and informed written consent was obtained upon the patient's agreement. The selected patients were assigned to intervention and control groups using permuted block randomization. The patients in both groups completed the questionnaires as the pretest. The patients in the intervention group attended a sleep hygiene training program that lasted 3 sessions based on the educational content detailed in Table 1. Each session took 40 - 60 minutes, according to the patient's tolerance. The instructional content was taught directly (face-to-face) and indirectly (through educational pamphlets). Two months after the intervention, sleep quality, fatigue, and depression were measured again in the patients in both groups. During these two months, each patient's condition was checked through a follow-up procedure at least twice a month. The patients in the control group received only the routine training offered at the hemodialysis unit. At the end of the study, an educational booklet was given to the patients in the control group. The collected data were statistically analyzed with SPSS-25 software. The results of the Shapiro-Wilk test showed the pretest and post-test scores related to sleep quality, depression, and fatigue had a normal distribution. As a result, the data were summarized using descriptive statistics, including frequency, percentage, mean, standard deviation, minimum, and maximum. Besides, the paired *t*-test was used to compare each group's pre-intervention and post-intervention scores. The independent *t*-test was also run to compare the mean scores for the two intervention and control groups. Moreover, the chi-square test was applied to compare the qualitative variables' frequency in the two groups. The covariance (ANCOVA) analysis was used to check the significantly different variables between the two groups in the pre-intervention stage. Data analysis in this study was performed at a significance level of less than 0.05 ($P < 0.05$). Table 1 shows the content of the sleep hygiene education program:

3. Results

An analysis of the participant's demographic characteristics showed that the two groups were not significantly different in terms of gender, education, occupation, ethnicity, underlying diseases, age, duration

Table 1. The Content of the Sleep Hygiene Education Program

Sessions and Content	Duration
1. Introduction the research objectives, sleep physiology and biology, factors improving or deteriorating sleep quality, and characteristics of healthy and unhealthy sleep.	40 - 60 min
2. Types of sleep disorders, providing instructions to reduce the factors deteriorating sleep quality (physical environment, diet, etc.), and self-monitoring of sleep behaviors.	40 - 60 min
3. Teaching behavioral interventions, including relaxation and visualization; behavioral strategies to improve sleep hygiene; summarizing the content of the program; and providing pamphlets to the patients.	40 - 60 min

of dialysis, number of dialysis sessions, daily activity level, creatinine, urea/nitrogen before undergoing hemodialysis ($P > 0.05$). However, the two groups showed significant differences in terms of urea/nitrogen after dialysis and the adequacy of dialysis. The results from the analysis of covariance (ANCOVA) indicated that these variables had no impact on the dependent variables (Table 2).

The results showed that the increase in the mean scores of sleep quality after the intervention compared to before the intervention was significant in both intervention and control groups. Besides, the changes in the fatigue and depression scores after the intervention were significant in both groups (Table 3). However, by controlling the effect of the pre-test on all three variables, the ANCOVA results showed that mean differences in the scores of sleep quality ($P = 0.001$), fatigue ($P = 0.001$), and depression ($P = 0.001$) were still significant between the intervention and control groups two months after the intervention (Table 4).

4. Discussion

Since the patients in this study were randomly allocated into two intervention and control groups using permuted block randomization, it was impossible to match the two groups' pre-intervention scores. Thus, the two groups' pre-intervention scores for sleep quality and fatigue significantly differed. However, by controlling the pretest effects, the analysis of covariance (ANCOVA) indicated that the differences in the post-intervention scores for both variables were significant between the two groups, confirming the positive effect of the sleep hygiene education program on these variables.

The findings from the present study also indicated that sleep quality in the intervention group improved after the implementation of the sleep hygiene education program, but it did not change significantly in the patients in the control group, confirming the positive effect of the sleep hygiene education program on the sleep quality of the patients in the intervention group. Similarly, Soleimani et al. examined the effect of sleep hygiene education on the sleep quality of hemodialysis patients and found that sleep hygiene education improves the sleep quality of hemodialysis patients (39). Moreover, Saeedi et al. examined the impact of sleep hygiene education on hemodialysis patients and showed that sleep hygiene education increased the quality of sleep of these patients. Thus, the authors recommended that nursing teams and doctors reduce the sleep problems of hemodialysis patients by teaching sleep hygiene to them (27). Other studies reported similar findings (40-42).

The findings also showed that the fatigue scores for the patients in the intervention group decreased after the implementation of the training, but the fatigue scores increased in the control group. Moreover, the mean differences were significant in the two groups before and after the intervention, indicating the positive effect of the sleep hygiene education program on the fatigue of patients in the intervention group. Likewise, Borzou et al. examined the effect of sleep hygiene education on the severity of fatigue and sleep quality of hemodialysis patients and found that sleep hygiene education can play a significant role in reducing the fatigue of hemodialysis patients (34). Similar findings were reported in the literature (43-45).

The findings from the present study also confirmed that the sleep hygiene education program improved depression in dialysis patients in the intervention group. The patients in the control group reported a slight increase in their depression scores. In a similar vein, Turgay and Polat examined the effect of sleep hygiene training and progressive relaxation exercise on sleep, quality of life, and depression of hemodialysis patients and found that sleep hygiene training and progressive relaxation exercise were effective in reducing the severity of depression (46). Other studies reported similar findings (47-50).

The data in the present study showed a significant increase in sleep quality, fatigue, and depression scores, confirming that the sleep quality of the hemodialysis patients in the control group worsened, and their levels of fatigue and depression increased. The scores for these variables in the intervention group significantly changed after the intervention, indicating improved sleep quality, fatigue, and depression. Insomnia affects all aspects of the lives of hemodialysis patients over time according to their

Table 2. The Demographic Characteristics of the Patients in the Two Groups [a]

Variables	Intervention Group	Control Group	P-Value
Age	37.05 ± 13.38	42.55 ± 12.42	0.06 [b]
Number of dialysis sessions	2.80 ± 0.46	2.63 ± 0.49	0.10 [b]
Dialysis duration	3.77 ± 0.40	3.78 ± 0.35	0.88 [b]
Dialysis onset duration	4.23 ± 2.75	3.33 ± 2.64	0.14 [b]
Daily activity level	2.20 ± 1.17	2.52 ± 0.89	0.16 [b]
Creatinine	9.07 ± 1.64	9.19 ± 2.92	0.81 [b]
Dialysis adequacy	1.16 ± 0.22	1.04 ± 0.24	0.01 [b]
Pre-dialysis urea/nitrogen	55.53 ± 13.95	62.18 ± 18.74	0.07 [b]
Post-dialysis urea/nitrogen	20.38 ± 6.81	26.87 ± 10.68	0.002 [b]
Education			0.31 [c]
Primary school	13 (32.50)	12 (30)	
Secondary school	12 (30)	6 (15)	
Diploma	10 (25)	13 (32.50)	
Academic education	5 (12.50)	9 (22.50)	
Occupation			0.16 [c]
Unemployed	28 (70)	22 (55)	
Employed	12 (30)	18 (45)	
Underlying diseases			0.82 [c]
Hypertension	20 (50)	17 (42.5)	
Diabetes	5 (12.50)	7 (17.50)	
Hypertension and diabetes	7 (17.50)	7 (17.50)	
Cardiovascular or pulmonary disease	8 (20)	9 (22.50)	
Ethnicity			0.37 [c]
Fars	22 (55)	23 (57.50)	
Baluch	18 (45)	17 (42.50)	
Gender			
Female	21 (52.5)	17 (42.50)	
Male	19 (47.5)	23 (57.50)	

[a] Values are presented as No. (%) or mean ± SD.
[b] Independent samples *t*-test
[c] Chi-square test

sleep physiology (51). It also aggravates the fatigue caused by water and electrolyte disorders and the accumulation of toxins and makes most patients helpless and frustrated, leading to depression and a vicious cycle that generally worsens patients' quality of life (4, 5). In addition, the experience of dialysis is considered an unpleasant experience for all patients, and if it continues, the patient will feel depressed and frustrated, and other problems in their life will further fuel this state (19). Over time, the patient develops chronic fatigue, and due to complications of dialysis and mental preoccupation, etc., their sleep quality worsens severely (52).

The laboratory data in this study were collected from the patient's records registered routinely by the medical and laboratory staff. Moreover, sleep quality, fatigue, and depression are subjective qualities that the patient reports, and the reported score can be affected by various factors beyond the researcher's control as a limitation of the present study.

4.1. Conclusions

The findings from this study showed that sleep hygiene education can increase the sleep quality of hemodialysis patients and reduce their fatigue and depression. One of the significant contributions of the present study was the use of sleep hygiene training as a simple and practical method to improve dialysis complications such as poor sleep quality, fatigue, and depression. Thus, this educational program can be implemented with the help of experienced nurses in hemodialysis treatment centers.

Table 3. The Descriptive Statistics for the Sleep Quality, Depression, and Fatigue Scores in the Two Groups Before and After the Intervention [a]

Variables	Pre-intervention	Post-intervention	Paired Samples *t*-test
Sleep quality			
Intervention	2.18 ± 12.05	10.85 ± 2.00	0.001
Control	10.28 ± 1.85	10.45 ± 1.85	0.003
Independent samples *t*-test	0.001	0.35	
Fatigue			
Intervention	57.98 ± 13.48	52.25 ± 13.23	0.001
Control	48.88 ± 8.97	52.20 ± 8.80	0.001
Independent samples *t*-test	0.001	0.98	
Depression			
Intervention	24.20 ± 6.26	22.28 ± 5.26	0.001
Control	25.18 ± 7.70	25.68 ± 7.54	0.02
Independent samples *t*-test	0.53	0.02	

[a] Values are presented as mean ± SD.

Table 4. ANCOVA Results for the Sleep Quality, Depression, and Fatigue Scores After the Intervention by Controlling the Pre-test Effects

Variables	SS	df	MS	F	Sig	Eta	Power
Source of change (sleep quality)							
Pretest	216.11	1	216.11	303.72	0.001	0.8	1
Dialysis adequacy	0.70	1	0.70	0.99	0.32	0.01	0.16
Urea/nitrogen	0.56	1	0.56	0.78	0.37	0.01	0.14
Group	20.31	1	20.31	28.55	0.001	0.2	1
Error	53.36	75	0.71				
Total	9368	80					
Source of change (fatigue)							
Pretest	7954.56	1	7954.56	475.52	0.001	0.8	1
Dialysis adequacy	28.66	1	28.66	1.71	0.19	0.02	0.25
Urea/nitrogen	32.37	1	32.37	1.93	0.16	0.02	0.27
Group	998.13	1	998.13	59.66	0.001	0.4	1
Error	1254.59	75	16.72				
Total	228056	80					
Source of change (depression)							
Pretest	3027.12	1	3027.12	1040.86	0.001	0.9	1
Dialysis adequacy	0.82	1	0.82	0.28	0.59	0.04	0.08
Urea/nitrogen	0.33	1	0.33	0.11	0.73	0.02	0.06
Group	118.58	1	118.58	40.77	0.001	0.3	1
Error	218.12	75	2.90				
Total	49520	80					

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Footnotes

Authors' Contribution: Faeze Ebrahimi: Study design, data collection, and drafting of the manuscript. Saeed Sookht saraei: Collaboration in study design. Ali Navidian: Study design, data analysis, and interpretation.

Conflict of Interests: There was no conflict of interest in this study.

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