Original Article

Dietary and Sleep Quality Association in Hemodialysis Patients

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Abstract

Background: Poor sleep quality is a common issue among patients with end-stage renal disease (ESRD) who undergo dialysis. Nutritional habits are associated with sleep hygiene in patients undergoing dialysis. The objective of this study was to examine the potential correlation between nutritional status and sleep quality in individuals receiving hemodialysis treatment.

Materials and Methods: This cross-sectional study included 160 hemodialysis patients. A food frequency questionnaire (FFQ) was used to measure food intake in participants. The Persian-validated version of the Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep quality. Patients were classified as poor or good sleepers with a PSQI score of <5 and >5, respectively.

Results: Eighty-four percent of hemodialysis patients had bad sleep hygiene. There was a significant association between sleep quality and educational status and age ($P < 0.001$). Poor sleepers were older (61.65 years versus 51.12) and less educated (31.1% versus 4%). However, there was no significant difference in the intake of micro- and macronutrients between poor and good sleepers ($P > 0.05$).

Conclusion: The results of this study suggest that sleep quality has no significant relationship with nutrient intake in hemodialysis patients. Demographic factors, such as age and educational status, have played a more effective role than nutritional factors in patients' sleep quality.

Keywords: Hemodialysis, nutrients, sleep quality

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Introduction

The prevalence of sleep disorders that affect sleep hygiene in end-stage renal disease (ESRD) patients undergoing dialysis is significantly higher than that in the healthy population. It has been seen that almost 80% of dialysis patients have sleep disorders.[1,2] The most commonly reported sleep disorders in this population are insomnia, sleep apnea, restless legs syndrome, and diurnal sleep disorders.[2] The association between sleep hygiene and both life quality and mortality has been established among patients undergoing hemodialysis.[3,4]

Therefore, identifying factors related to poor sleep hygiene is crucial for improving the overall health of hemodialysis patients. Although many factors, such as age, gender, and comorbidities, can affect sleep hygiene,[5,6] nutritional status has been considered a crucial determinant of sleep hygiene according to previous research.[7] Some observational studies have shown that nutritional status affects sleep hygiene in the general population.[8] It has been suggested that adherence to a Mediterranean diet, representing a healthy dietary pattern, results in improved sleep hygiene in older adults.[9] However, an association between unhealthy eating patterns and poor sleep hygiene has been suggested.[10] In a study conducted on over 3000 middle-aged female Japanese workers, a significant correlation was observed between their sleep hygiene practices and the amount of vegetable and confectionary consumed.[11]

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A highly significant difference between the intake of energy, carbohydrates, folic acid, and vitamin B12 has been reported in a study among Indians.[12] These results were confirmed in a large-scale study assessing the association between diet and various sleep hygiene.[13]

We hypothesized that dietary habits in hemodialysis patients are correlated with sleep hygiene. As far as we know, there has been no previous research conducted on the link between dietary and sleep hygiene among patients with ESRD undergoing hemodialysis treatment. Therefore, our objective was to evaluate the link between macronutrient and micronutrient consumption and sleep hygiene in hemodialysis patients residing in Isfahan province. The findings from this study may aid healthcare professionals in developing nutritional interventions for hemodialysis patients as a means of enhancing their sleep hygiene and quality of life.

Materials and Methods

Patient selection and study design

This cross-sectional study was conducted on 160 hemodialysis patients who were referred to the hemodialysis units of Khorshid and Zahraye Marzieh Hospitals, both associated with Isfahan University of Medical Sciences (IUMS) in Isfahan, Iran.

All adult ESRD patients treated with hemodialysis ≥6 months were included. Patients with cognitive limitations or psychological disorders that prevented them from fully completing the study questionnaires were excluded. Before commencing the research, written consent was procured from all participants and the study methodology (ethical code: 1397.250) received approval from the ethics committee at IUMS.

Data collection

A researcher-made checklist was used to collect socio-demographic (age, gender, cigarette smoking, marital, educational, and occupation status) and clinical data (cause of ESRD, disease duration, urea reduction ratio, and Kt/V).

Trained dietitians using a semi-quantitative 168-item food frequency questionnaire (FFQ) representing foods commonly used during the past year did the dietary assessment. Data on the validity and reproducibility of the questionnaire have been reported previously.[14] Patients were requested by the researchers to report their consumption of each food item on a daily, weekly, and monthly basis throughout the last year. The average intake of micronutrients and macronutrients was analyzed using Nutritionist software intravenous (IV).

A Persian-validated version of the Pittsburgh Sleep Quality Index (PSQI) was used to collect data on sleep hygiene. The validity and reliability of this questionnaire had been confirmed in the previous study.[15] The self-reported questionnaire contains 19 questions divided into seven category scores including time to fall asleep, sleep hygiene, sleep duration, sleep disorders, sleep efficiency, use of sleeping pills, and daytime dysfunction. Sleep hygiene was assessed using the PSQI score, which ranged from 0 to 21. A lower score indicated better sleep hygiene. The cutoff score was determined to be 5.[15]

Statistical analysis

The study presented quantitative continuous data as mean ± standard deviation (SD) and median (minimum–maximum). Normally and nonnormally distributed continuous variables were compared between two groups (good and poor sleep hygiene) using an independent-samples *t*-test and Mann–Whitney U-test, respectively. We presented the categorical variables as frequency (percentage) and compared them between the two groups using the Chi-square test. We employed analysis of covariance (ANCOVA) to compare data on the intake of macro- and micronutrients between groups while adjusting for possible confounders such as energy intake. Statistical Package for the Social Sciences (SPSS) statistical software version 23 (SPSS Inc., Chicago, IL, USA) facilitated all statistical analyses.

Results

The basic attributes of hemodialysis patients are summarized in Table 1. The mean age was 66.01 ± 13.52 years, and the majority were male (66.3%), nonsmokers (85.6%), and unemployed (75.6%). The combination of diabetes and hypertension was the primary cause of ESRD in our patients (29.4%). The majority of the patient were poor sleepers (84%).

Our results indicated that there was a significant association between sleep hygiene and educational status and age ($P < 0.001$). Poor sleepers were older (61.65 years versus 51.12) and less educated (31.1% versus 4%).

Dietary intake of macro- and micronutrients in hemodialysis patients according to their sleep hygiene levels is shown in Tables 2 and 3, respectively. The intake of energy and macronutrients was higher in good sleepers (1935.29 Kcal/day) compared with poor sleepers (1640.56 Kcal/day); however, the difference was not significantly different ($P > 0.05$). Based on our study findings, there is no statistically significant link in terms of micronutrient intake and sleep hygiene ($P > 0.05$).

Discussion

Many hemodialysis patients suffer from improper sleep hygiene, which results in negative impacts on their health. Poor sleep hygiene is often linked to sleep-related complaints and can increase the risk of morbidity and mortality.[16] To address these issues, it is crucial to identify potential risk factors and develop interventions aimed at improving sleep hygiene for this patient population.

In the current study, poor sleep hygiene was found in over 84% of hemodialysis patients. Older patients with lower educational

Table 1: Relationship between demographic characteristics and sleep quality in hemodialysis patients

	Sleep quality		Total	*P*
	Poor	Good		
Age*(years)	61.65±13.02	51.12±12.90	60.01±13.52	<0.001
Gender				
Male	64.4	76	66.3	0.26
Female	35.6	24	33.7	
Education status				
Uneducated	31.1	4	26.9	<0.001
Under diploma	47.4	36	45.6	
Diploma	15.6	40	19.4	
University	5.9	20	8.1	
Occupation status				
Employed	25.2	20	24.4	0.58
Unemployed	74.8	80	75.6	
Cigarette smoking				
Yes	13.3	20	14.4	0.38
No	86.7	80	85.6	
Cause of ESRD				
Hypertension	22.2	28	23.1	0.15
Diabetes mellitus	21.5	20	21.3	
Hypertension–diabetes	31.1	20	29.4	
Unknown	25.2	32	26.2	
Disease duration (years)	6.47±6.28	5.84±4.43	6.37±6.02	0.63
Kt/V	1.52±0.29	1.53±0.26	1.52±28	0.92
Urea reduction ratio	71.44±9.07	72.28±8.01	71.58±8.90	0.67

Values in the table are mean±SD for continuous variables and percentage for categorical variables, *P* values were obtained from an independent-samples *t*-test for continuous variables and a Chi-square test for categorical ones. $P<0.05$ is considered significant

Table 2: Comparing dietary macrodiet between hemodialysis patients with good and poor sleep hygiene

Macronutrients	Sleep quality		Total	*P**
	Good (*n*=25)	Poor (*n*=135)		
Energy (kcal/day)	1935.27±861.74	1640.55±689.52	1686.60±724.08	0.31
	1846.97 (4146.61-822.94)	1482.98 (4096.68-801.67)	1504.50 (4146.61-801.67)	
Carbohydrate (gr/day)	290.93±146.37	246.46±120.46	253.40±125.40	0.77
	245.17 (668.01-23.07)	220.14 (811.75-99.78)	223.53 (811.75-96.43)	
Fiber (gr/day)	23.31±10.88	19.75±14.02	20.31±13.61	0.72
	0.27 (1.62-0.06)	0.18 (13.19-0.02)	0.19 (13.19-0.02)	
Protein (gr/day)	67.66±25.78	59.15±25.02	60.48±25.25	0.99
	68.30 (118.93-20.46)	54.17 (135.80-21.01)	55.37 (135.80-20.46)	
Fat (gr/day)	59.96±31.96	50.33±26.77	51.84±27.76	0.81
	48.50 (139.54-23.07)	45.05 (188.41-14.99)	45.08 (188.41-14.99)	
Saturated fatty acids (gr/day)	20.30±11.51	17.64±11.02	18.06±11.11	0.92
	18.95 (48.77-7.50)	14.90 (93.99-4.57)	14.98 (93.99-4.57)	
Monounsaturated fatty acids (gr/day)	20.83±12.07	17.59±10.48	18.10±10.77	0.80
	16.49 (53.67-7.29)	14.98 (80.00-2.51)	15.08 (80.00-2.51)	
Polyunsaturated fatty acids (gr/day)	10.88±5.53	9.46±5.62	9.69±5.61	0.65
	10.47 (46.39-4.53)	8.39 (40.90-1.70)	8.51 (40.90-1.70)	
Cholesterol (gr/day)	203.67±128.16	192.85±119.71	194.54±120.71	0.66
	201.26 (644.31-60.33)	161.20 (642.06-40.92)	163.33 (644.31-40.92)	

Data are represented as mean±SD and median (maximum–minimum). $P<0.05$ has been considered significant. *P* values were obtained from an independent-samples *t*-test

levels were more likely to be poor sleepers compared with good sleepers. There is a wealth of evidence on the link between socioeconomic status and sleep hygiene,[17-19] which suggests that people with lower socioeconomic status have a higher incidence of sleep complaints. However, studies on the association between socioeconomic status and sleep hygiene

Table 3: Comparing dietary microdiet between hemodialysis patients with good and poor sleep quality

Micronutrients (gr/day)	Sleep quality		Total	*P**
	Good (*n*=25)	Poor (*n*=135)		
Vitamin A	363.18±231.38	361.51±418.18	361.77±394.28	0.48
	273.31 (862.27-81.06)	249.18 (3618.79-38.40)	250.89 (3618.79-38.40)	
Vitamin D	0.62±0.69	0.81±1.01	0.78±0.97	0.07
	0.33 (3.11-0.05)	0.42 (6.42-0)	0.41 (6.42-0)	
Vitamin E	8.97±4.97	8.41±6.77	8.50±6.51	0.55
	8.38 (21.47-2.70)	6.72 (60.65-0.80)	6.96 (60.65-0.80)	
Vitamin K	87.41±76.53	82.26±76.34	83.06±76.15	0.68
	56.69 (299.45-17.92)	58.76 (509.94-3.91)	58.09 (509.94-3.91)	
Vitamin C	95.33±112.67	74.89±79.75	78.09±85.62	0.87
	58.43 (573.52-9.50)	59.93 (578.96-7.14)	53.10 (578.96-7.14)	
Vitamin B_1	1.57±0.72	1.33±0.54	1.36±0.57	0.71
	1.34 (3.11-0.50)	1.21 (3.16-0.38)	1.23 (3.16-0.38)	
Vitamin B_2	1.33±0.55	1.20±0.57	1.22±0.57	0.51
	1.30 (2.42-0.35)	1.06 (3.05-0.12)	1.09 (3.05-0.12)	
Vitamin B_3	20.04±8.32	17.15±9.09	17.60±9.01	0.92
	19.45 (37.34-6.15)	15.20 (74.92-6.25)	15.51 (74.92-6.15)	
Vitamin B_5	4.18±1.59	3.83±1.54	3.89±1.55	0.20
	3.75 (7.38-1.80)	3.51 (10.62-0.85)	3.62 (10.62-0.85)	
Vitamin B_6	1.59±0.61	1.39±0.58	1.42±0.60	0.94
	1.47 (2.94-0.54)	1.28 (3.15-0.44)	1.32 (3.15-0.44)	
Vitamin B_7	20.01±10.97	17.65±8.64	18.02±9.04	0.88
	16.24 (42.78-7.63)	16.40 (50.11-2.65)	16.32 (50.11-2.65)	
Vitamin B_9	322.14±177.30	339.08±138.91	347.37±146.22	0.88
	360.53 (771.33-150.70)	309.53 (773.00-134.60)	313.48 (773.00-134.60)	
Vitamin B_{12}	3.36±2.38	3.15±1.83	3.18±1.92	0.60
	2.68 (11.71-0.77)	2.88 (9.11-0.42)	2.83 (11.71-0.42)	
Sodium	4061.43±3518.42	3772.85±4394.67	3817.94±4260.10	0.88
	3605.65 (19273.21-749.41)	2916.81 (43177.62-472.31)	2985.00 (43177.62-72.31)	
Potassium	2556.00±1189.55	2277.08±1235.01	2320.66±1228.55	0.38
	373.31 (862.27-81.06)	249.18 (3618.79-38.40)	250.89 (3618.79-38.40)	
Magnesium	295.39±138.11	248.54±106.78	255.86±113.04	1.00
	274.71 (702.12-100.35)	220.49 (675.36-68.31)	227.24 (702.12-68.31)	
Phosphorus	1142.66±429.75	1026.84±413.97	1044.93	0.54
	1092.51 (2105.28-380.93)	947.34 (2405.86-223.45)	972.88 (2405.86-223.45)	
Iron	12.39±6.86	10.08±4.67	10.44±5.12	0.59
	10.21 (34.20-3.85)	8.95 (29.16-4.03)	9.29 (34.20-3.85)	
Calcium	726.37±290.25	672.26±351.33	680.71±342.24	0.48
	673.53 (1284.35-250.87)	613.75 (2103.07-82.27)	622.70 (2103.07-82.27)	
Selenium	85.05±42.40	71.67±31.55	73.76±3.67	0.62
	75.37 (180.59-31.88)	64.23 (172.71-15.71)	67.05 (180.59-15.71)	
Manganese	4.83±3.05	4.11±1.10	4.22±2.20	0.83
	3.76 (15.19-1.36)	3.61 (11.55-1.19)	3.62 (15.19-1.19)	
Zinc	9.46±4.24	8.21±3.33	8.41±3.51	0.89
	8.48 (20.83-3.37)	7.45 (18.36-1.94)	7.60 (20.33-1.94)	
Copper	1.18±0.58	1.00±0.53	1.03±0.54	0.66
	0.93 (2.56-0.36)	0.86 (4.07-0.29)	0.88 (4.07-0.29)	
Fluoride	1760.11±1773.62	1562.12±1158.09	1593.06±1268.99	0.91
	1017.39 (8600.06-289.32)	1255.60 (5875.34-40.33)	1194.76 (8600.06-40.33)	
Chromium	0.08±0.09	0.06±0.06	0.06±0.07	0.26
	0.06 (0.34-0)	0.04 (0.39-0)	0.04 (0.39-0)	

Data are represented as mean±SD and median (maximum–minimum). $P<0.05$ has been considered significant. **P*-values were obtained from an independent-samples *t*-test

in hemodialysis patients have yielded inconsistent results. Our findings are consistent with those of a study by Eslami *et al*.,[20] which identified education as one of the predictors of sleep hygiene in hemodialysis patients. Conversely, a study

on Iranian hemodialysis patients did not find any significant association between educational status and sleep hygiene.[21]

The investigation carried out by Ho *et al*.[22] in Malaysia explored the link between diet and sleep hygiene among patients undergoing hemodialysis. The findings indicated a correlation between consuming an evening meal on dialysis days and abstaining from dinner on non-dialysis days with compromised sleep hygiene. Multiple studies on the overall populace have indicated that nutritional habits can disrupt slumber; however, the majority of these inquiries concentrated on the correlation between diet and duration of sleep on. Furthermore, studies investigating the correlation between sleep hygiene and dietary patterns have employed diverse methodologies and reporting conventions. We did not observe any correlation between energy intake and dietary patterns with sleep hygiene among patients undergoing hemodialysis. Earlier investigations have similarly indicated that there is no link between dietary energy intake and sleep hygiene within the general population.[23,24] In contrast, the results of a study by Stelmach-Mardas *et al*.[25] showed that energy restriction affects sleep. In contrast to our findings, the results of a study by Grander *et al*. showed that the intake of specific nutrients is correlated with sleep hygiene.[13] Research has additionally demonstrated a link between macronutrient intake and sleep indices. Lindseth *et al*.[26] interventional study, for instance, found that a high-protein diet results in fewer wake episodes when compared to a control diet. They also observed that sleep latency was longer in the control diet as compared to the high-carbohydrate diet. Studies have reported that a high-carbohydrate diet can influence both deep slow-wave sleep and rapid eye movement (REM) sleep.[27,28] It is assumed that the intake of dietary supplements and nutritional education in hemodialysis patients improves their nutritional status. Further research is warranted to determine the factors that influence sleep hygiene among patients undergoing hemodialysis.

The study was limited by a small sample size; therefore, it is necessary to conduct large-scale studies to further examine how diets and sleep hygiene are associated with hemodialysis. Additionally, it is critical to understand the effect of socioeconomic factors and how they interrelate with other determinants of sleep hygiene in hemodialysis patients.

Conclusion

Our results demonstrate that the dietary habits of hemodialysis patients had no significant association with sleep hygiene. Demographic factors have played a more effective role than nutritional factors in patients' sleep hygiene. Poor sleepers were older and less educated.

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Conflicts of interest

There are no conflicts of interest.

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