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Effect of vitamin D on sleep quality in hemodialysis patients

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ABSTRACT

Introduction: Quality of sleep is among the factors that affect the improvement of life quality. The previous studies showed that 50%-80% of hemodialysis patients experience sleeping disturbances. Additionally, dialysis patients commonly experience vitamin D deficiency.
Objectives: We aimed to determine the impact of vitamin D deficiency therapy on sleep quality of hemodialysis patients.
Patients and Methods: Thirty hemodialysis patients with 25-hydroxy vitamin D deficiency and Pittsburgh Sleep Quality Index (PSQI) ≥5 were enrolled in this clinical trial. Patients were treated with 50000-unit vitamin D per week for 12 weeks. After treatment, the PSQI score was recalculated for each patient.
Results: Nineteen out of 30 patients (63.3%) were men and 11(36.7%) were women, with a mean age of 56.7 ± 14.3 years. The mean of vitamin D level was 18.61 ± 6.32 ng/mL before treatment and 41.14 ± 9.62 ng/mL after the treatment. The mean of PSQI score at the start of study was 9.97 and after treatment with vitamin D3, it was 9.47 ($P > 0.05$).
Conclusion: Treatment of vitamin D deficiency did not have any effect on the sleep quality according to the PSQI score in hemodialysis patients.
Trial Registration: This randomized controlled trial was registered in the Iranian Registry of Clinical Trials (identifier: IRCT20200223046593N1; https://en.irct.ir/trial/46126, ethical code; IR.SBMU.RETECH.REC.1397.1277).

Implication for health policy/practice/research/medical education:
In a study on 30 hemodialysis patients with vitamin D deficiency and poor sleep quality, we found that the treatment of vitamin D deficiency has no effect on sleep quality according to Pittsburgh Sleep Quality Index (PSQI).
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Original

Introduction

Sleep disorder is commonly experienced by hemodialysis (HD) patients. Previous studies showed that about 50%-80% of HD patients suffered from sleep disorders (dyssomnia) (1-3). These disorders consist of insomnia (problems in the start of sleeping and/or repeated waking in the nights) and feeling sleepy during the daytime, restless legs syndrome and/or periodical limb movements and sleep apnea (1,4). Sleep quality significantly contributes to the improvement of life quality (2,5,6). Sleep disorders are associated with impairment in immune functioning (1,7), increased mortality and cardiovascular risk (2,5,6). There is an association between sleep quality of HD patients and the following factors; female gender, older age, caffeine consumption, alcohol consumption, tobacco abuse, concurrent comorbidity, recombinant erythropoietin therapies, years receiving dialysis, dialysis shift, depression, physical performance, greater body mass index (BMI) values, dialysis efficiency, anemia, hypoalbuminemia, parathyroid hormone and serum creatinine (8-10). Deficiency of vitamin D is commonly experienced by patients who undergo dialysis (6,11,12). Several studies reported the relationship of vitamin D deficiency and sleep disorders in non-dialysis (13,14) and dialysis patients (6,15). Also, according to several research works, vitamin D deficiency treatment improves sleep quality in non-dialysis patients(16,17).

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Objectives

The present study aims at determining the effect of vitamin D deficiency treatment on the sleep quality of patients receiving HD.

Patients and Methods

Study population

This clinical trial was conducted at HD center of Loghman Hakim hospital in Tehran, Iran from May 2018 to June 2019. The inclusion criteria were the following; being above 18 years, receiving dialysis for a minimum of three months, HD adequacy (Kt/V>1/2), 25-hydroxy vitamin D (25(OH)D) <30 ng/mL, and Pittsburgh Sleep Quality Index (PSQI) ≥5. Psychiatric disorders (clinical diagnosis and or previous treatment), drug abuse, alcohol consumption, smoking, habits such as having coffee or tea prior to sleep and any hospitalization record during the previous four weeks were considered as the exclusion criteria.

First, the serum level of vitamin D was measured by enzyme-linked immunosorbent assay (ELISA) in the morning venous blood sample. Then, we completed the Pittsburg Sleep Quality questionnaire for patients with vitamin D deficiency. Out of 200 HD patients, only 30 individuals met the inclusion criteria (Figure 1). We employed the PSQI to collect information through self-reports to determine the quality as well as the quantity of sleep during one month before assessment. PSQI consists of 19 individual items, which create seven components of subjective sleep quality, sleep latency, length of sleep, habitual sleep efficiency, sleep disturbance, taking sleep medicine and dysfunctions during the day, which provide one global score between 0-21. Scores of five or higher suggested a poorer sleep. This questionnaire has validity and reliability (18). Because of vitamin D deficiency complications in people receiving HD and its ethical considerations, all patients with vitamin D deficiency were treated. Confounding factors were controlled too. Treatment was performed using 50 000 units of vitamin D 3/week over a 12-week interval. Measurement of the serum 25(OH)D levels as well as PSQI scores was carried out following the treatment. Patients were revisited and excluded if they met exclusion criteria after 12 weeks, although all patients remain in the trial.

Statistical analysis

Data were analyzed by SPSS 24, while data distribution was considered using paired *t* test. Mean ± SD or median

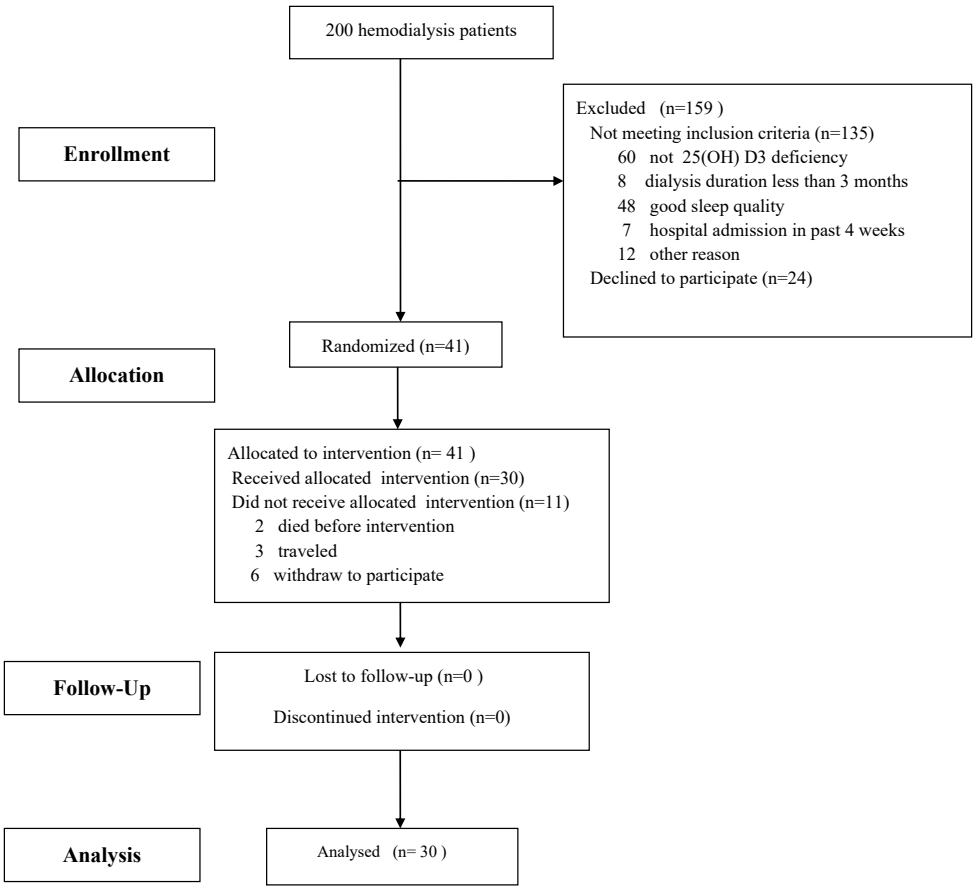

Figure 1. The flow diagram of study.

was used to show the study results regarding normal or non-normal distribution of continuous variables along with numbers or percentages for the nominal variables. *P* value of <0.05 was set as the significance level.

Results

Table 1 presents baseline demographics. Research participants included 19 males and 11 females. The age distribution was between 32 and 85 years, with a mean age of 56.7 ± 14.31 years. Etiologic findings of ESRD indicated diabetes in 12 (40%) and hypertension in 8 (26.7%) patients. The mean of the duration of HD was 42.20 ± 40.28 months. The participants' mean of vitamin D level was 18.61 ± 6.32 ng/mL before treatment and 41.14 ± 9.62 ng/mL after treatment. A mean PSQI score of 9.97 was obtained at week 0 while it was 9.47 (mean difference 0.005) after 12 weeks that did not show statistical significance ($P = 0.473$).

Habitual sleep efficiency significantly changed after treatment ($P = 0.037$), meaning that the number of hours slept/number hours spent in bed increased (Table 2).

Table 1. Demographic features of patients

Parameter	Value
Age (years)	
Mean ± SD	56.70 ± 14.31
Median	56.50
Range (Minimum-Maximum)	53 (32-85)
Gender	
Female	11 (36.7%)
Male	19 (63.3%)
Dialysis duration (months)	
Mean ± SD	42.2 ± 40.28
Median	30.5
Scope (Minimum-Maximum)	165 (3-168)
Etiology of ESRD	
DM	12 (40.0%)
HTN	8 (26.7%)
Other causes	10 (33.3%)

Discussion

Based on our study, PSQI score did not change significantly after the treatment of vitamin D deficiency. Prior literature indicates the relationship of vitamin D deficiency with the quality of sleep in dialysis patients, but no study has been performed on the treatment of vitamin D deficiency in HD patients.

Hon et al and Yavuz et al approved that the levels of 25(OH) D fell down in dialysis patients having sleep disturbances, in comparison with those that do not have sleep disorders (6,15). However, they did not confirm whether the treatment of vitamin D deficiency could affect the quality of sleep. Improvement of sleep quality with vitamin D supplement was reported in some studies. Gominak et al showed sleep improvement with 25(OH) D supplement in individuals who suffer neurologic problems and had evidence of abnormal sleep; however, only a limited range of 25(OH)D blood level of 60-80 ng/mL was maintained (16). This level of vitamin D is not recommended in dialysis patients, therefore we kept vitamin D level between 30-40 ng/mL, according to other studies. In another study, which was conducted on patients with chronic pain, sleep latency, sleep duration and global PSQI score improved with 25(OH)D supplement (17).

Sahakyan reported insomnia improvement with a combination of vitamin D and melatonin in 60-65-year-old women with vitamin D deficiency (19).

The difference of our study is that most studies were carried out on non-HD people. The second reason may be other confounding factors not yet found. The small number of participants may also be the other reason for this difference.

Kidir et al examined the effect of vitamin D on sexual dysfunction in 37 dialysis patients (40.5% HD patients and 59.5% peritoneal dialysis patients). They measured several parameters including sleep disorders and sleep score, and found that vitamin D treatment for 6 months did not affect sleep score (20).

Vitamin D deficiency has many complications in dialysis patients, hence all these patients must be treated.

Table 2. Mean and mean difference of components of PSQI before and after treatment of vitamin D deficiency

Component of PSQI	Mean before intervention	Mean after intervention	Mean difference	95% CI of the difference		*P* value
				Lower	Upper	
Subjective sleep quality	1.40	1.23	0.167	-0.160	0.493	0.305
Sleep latency	1.67	1.80	-0.133	-0.611	0.344	0.573
Sleep duration	1.87	1.73	0.133	-0.173	0.439	0.380
Habitual sleep efficiency	1.90	1.40	0.500	0.320	0.968	0.037[a]
Sleep disturbances	1.37	1.20	0.167	-0.075	0.409	0.169
Use of sleeping medication	0.80	1.10	-0.300	-0.656	0.056	0.095
Daytime dysfunction	0.93	0.97	-0.033	-0.498	0.432	0.884
Global PSQI Score	9.97	9.47	0.500	-0.907	1.907	0.473

Abbreviation: CI, confidence interval; [a] Statistically significant.

Conclusion

Treatment of vitamin D deficiency does not affect the quality of sleep according to PSQI in HD patients. However, habitual sleep efficiency significantly changed after treatment.

Limitations of the study

The subjective nature of the PSQI could lead to limitations on its value in cases where some patients did not cooperate well. Moreover, another limitation was the small sample size of our study.

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Authors' contribution

ZNS; preparation of research design and manuscript drifting. DZ and TA; manuscript reviewing. MN; data collection and statistical analysis. All authors read and signed the final paper.

Conflicts of interest

No conflicts of interest were declared by the researchers.

Ethical issues

The study was conducted based on the Declaration of Helsinki, and the patients filled out informed consent. Moreover, the Ethical Committee of Shahid Beheshti University of Medical Sciences declared the approval of the research (IR.SBMU.RETECH.REC.1397.1277). This work has been extracted from the internal medicine residential thesis of Maryam Namakchian in the School of Medicine, Shahid Beheshti University of Medical Sciences. Besides that, the study protocol was registered in the Iranian registry of clinical trials (identifier: IRCT20200223046593N1; https://en.irct.ir/trial/46126). Moreover, ethical considerations consisting of plagiarism, misconduct, data fabrication, falsification, double publications or submissions, and redundancies were thoroughly considered by the authors.

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