

Sleep Quality in Iranian Hemodialysis Patients: A Systematic Review and Meta-analysis

Abstract

Background: Hemodialysis is a major therapeutic method for many chronic kidney disease patients that causes complications. One of these complications tends to be sleep disorders. This study was performed through systematic review and meta-analysis to determine the prevalence of low sleep quality in hemodialysis patients in Iran. **Materials and Methods:** Journal papers written in English and Persian searched from January 2000 to July 2018 were selected. The search keywords included (Prevalence OR Epidemiology) AND (hemodialysis OR hemodialysate OR 'intermittent chronic haemodialysis' OR 'intermittent chronic hemodialysis' OR 'intermittent haemodialysis' OR 'intermittent hemodialysis' OR 'kidney dialysis' OR 'renal dialysis') AND ('sleep problem' OR 'sleep disturbance' OR 'sleep disorder' OR 'sleep quality' OR 'chronobiology disorders' OR dysomnia). To determine the pooled prevalence, the stochastic DerSimonian-Laird model was used, computing the effect size with its 95 per cent confidence interval. The main international electronic databases were Embase, PubMed/MEDLINE, ISI/Web of Science (WOS), Scopus, Psych INFO, and Iranian databases such as MagIran, SID and Irandoc. The data were analysed using the Stata (version 13.0). **Results:** After searching through the databases and other resources, 21 articles (7 in Persian and 14 in English language) were included. The overall prevalence of low sleep quality in dialysis patients was 75.30 per cent (95 per cent confidence interval, 70.08–82.50). The heterogeneity study showed moderate heterogeneity among studies ($I^2 = 50.30$ per cent, $p < 0.05$). **Conclusions:** The results of this study showed that the prevalence of low sleep quality in hemodialysis patients has become a common problem. Thus, patients' sleep quality need to be evaluated periodically.

Keywords: Chronic, renal dialysis, renal insufficiency, sleep quality

Introduction

Change of lifestyle has nowadays given rise to chronic diseases to be one of the major health problems afflicting people throughout the world. One of these highly growing diseases is Chronic Kidney Disease (CKD) that generally leads to poor quality of life, premature death and hence, substantial financial burden on the health system.^[1,2] There are about 32,000 Iranians with kidney (or renal) failure. A total of 49 per cent of these patients had kidney transplants, 48 per cent are undergoing hemodialysis and 3 per cent peritoneal dialysis.^[3] Among the treatments mentioned above, hemodialysis is the dominant therapeutic method in many patients^[4] causing complications for the patient one of which is sleep disorders.^[5]

Hemodialysis has the benefits of sleep-inducing effects for patients, such

as mobility restriction, interleukin-1 production, increased body temperature, and osmotic imbalance in the brain that leads to reduced consciousness.^[6] However, it also brings about a number of disadvantages such as sleep apnea syndrome, restless leg syndrome, sleep disturbances, and excessive anxiety during the day.^[7,8] Various studies to date, have reported sleep disorders in hemodialysis patients.^[9-13] Low sleep quality in these patients leads to poor quality of life and premature death.^[14] Furthermore, it has negative impacts on the immune response and can cause the development of cardiovascular diseases as the primary cause of death in all patients with renal disease. After a while, these sleep disturbances may lead to 'day-night reversal', that is, insomnia at night and sleepiness during the day, headache, depression and declined functional capacity. Moreover, it has recently been demonstrated

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that poor-quality sleep, caused by periodic limb movements and their related arousals, is an important predictor of mortality in patients with end-stage renal disease. Various factors in patients with kidney failure can cause sleep disturbances and poor sleep quality, such as levels of blood urea and creatinine, parathyroid hormone, blood pressure, and so on.^[15,16] Therefore, early diagnosis and taking timely action to improve the quality of sleep in these patients are necessary.^[17,18]

Epidemiological studies of sleep quality in hemodialysis patient play an important role in determining the general health of the patient as well as assisting policy making and future planning of service delivery. Given the diversity of studies conducted, review studies are appropriate options for extracting, combining and integrating data from a large spectrum of studies. Considering the differences in studies in the prevalence of low sleep quality in hemodialysis patients, a systematic review has not been done to integrate the results of studies in this field. Therefore, this study was carried out through systematic review and meta-analysis to determine the prevalence of low sleep quality in hemodialysis patients in Iran.

Materials and Methods

This systematic review and meta-analysis has been performed according to the ‘Preferred Reporting Items for Systematic Reviews and Meta-Analyses’ (PRISMA) guidelines. PRISMA is an evidence-based minimum set of items for reporting in systematic reviews and meta-analyses. It primarily focuses on the reporting of reviews evaluating randomised trials; however, it can also be employed as a basis for reporting systematic reviews of other types of research.^[19] The two authors independently searched different scholarly databases, namely, Embase, PubMed/MEDLINE, ISI/Web of Science (WOS), Scopus, Psych INFO, and Iranian databases such as MagIran, SID and Irandoc from inception to 1 July 2018. In addition, the grey literature (via Google Scholar) was mined. Studies written in English or Persian language were searched. Our search strategy was as follows: (Prevalence OR Epidemiology) AND (hemorenodialysis OR hemodialysate OR ‘intermittent chronic haemodialysis’ OR ‘intermittent chronic hemodialysis’ OR ‘intermittent haemodialysis’ OR ‘intermittent hemodialysis’ OR ‘kidney dialysis’ OR ‘renal dialysis’) AND (‘sleep problem’ OR ‘sleep disturbance’ OR ‘sleep disorder’ OR ‘sleep quality’ OR ‘chronobiology disorders’ OR dyssomnia) AND (Iran). Medical subject headings and wild-card options were used where appropriate. This search strategy was adopted and planned in cooperation with an information specialist. The articles were screened by title and abstract content for inclusion by Masood Taheri Mirghaed and Hassan Gorji. The references of the included articles were hand searched for other eligible articles. Following this comprehensive process, the included articles were distributed for review among all the

authors according to their expertise and experience. Studies published between 2000 and 2018 addressing research about the quality of sleep in patients with adult CKD were selected. The search time was 15 August 2018.

To be included in our study, the studies needed to involve at least 30 patients to ensure greater homogeneity. In addition, only articles written in Persian and English were considered. Scientific studies (with a control group), clinical studies and surveys that reported the prevalence of poor sleep quality in dialysis patients were also included. The patients under the studies were undergoing dialysis treatments. The exclusion criteria were studies that the participant patients were under the age of 18 (since separate sleep problems for younger patients might be present), studies that access to summaries only, and reviews and papers whose results had previously been published. Two independent investigators evaluated the studies based on their title and abstract according to inclusion and exclusion criteria. Finally, studies eligible to be entered into the meta-analysis were selected. There was a disagreement between the two researchers; hence, help was sought from a third person as a referee and the dispute was resolved with exchange of views.

The variables including the first author, year of publication, language of study, place of study, sample size, mean age of participants, mean dialysis duration and the prevalence of poor sleep quality, were extracted from the studies and entered into the Microsoft Excel software (version 2010, Microsoft Corp, Redmond, WA, USA). The Newcastle Ottawa Scale (NOS) was used to assess the quality of the studies included. Based on the risk scores, studies were classified into three categories: high risk (score in the range 1–3), moderate risk (score in the range 4–6) and low risk (score in the range 7–9).^[20]

The prevalence of poor sleep quality in dialysis patients in Iran was investigated based on the DerSimonian Laird random model.^[21] The procedure suggested by DerSimonian and Laird is the simplest and most commonly used method for fitting the random effects model for meta-analysis.^[22] The results were reported with 95 per cent confidence intervals. The I^2 was used to assess heterogeneity among studies. In addition, a meta-regression was planned by including the variables defined *a priori* to further explore sources of heterogeneity based on year of publication, sample size, mean age and mean duration of dialysis. *p* value less than 0.05 was considered significant. In this study, the data were analysed using the Stata (version 13.0, StataCorp LP, College Station, TX, USA).

Ethical consideration

The study was approved by the Ethics Committee of Iran University of Medical Sciences with the ethical code IR.IUMS.REC 1396. Furthermore, the authors commit themselves to avoiding plagiarism in the entire article, not deliberately manipulating the data or analyses, refraining

from data making or fabrication, and considering honesty, objectivity, integrity and carefulness.

Results

After searching for databases and other resources, a total of 571 articles were found (PubMed = 29, Embase = 57,

ISI = 24, Scopus = 78, Psych INFO = 3, and Iranian databases Magran = 186, SID = 167 and Irandoc = 10). This number, however, dropped to 251 articles after removing duplicates. Of these, 197 articles were removed based on exclusion criteria. After reviewing the full text of the articles, 33 other articles were excluded from the study. Finally, 21 articles (7 Persian and 14 English papers) were included [Figure 1].^[23-43] The time course of included articles was from 2008 to 2018. One study was conducted at the national level, and 20 others were conducted on provincial level. In this study, low sleep quality was evaluated in 9,342 dialysis patients with an average sample size of 445 in each study. The highest number of sample belonged to Eeinollahi *et al.*'s study with a total of 6,878 patients and the lowest number was related to Sadeghi *et al.*'s study with 43 patients. The mean age of patients was 57.09 years and the mean duration of dialysis was 41.57 months [Table 1].

The overall prevalence of low sleep quality in dialysis patients was 75.30 per cent (95 per cent confidence interval, 70.08–82.50). The heterogeneity study showed moderate heterogeneity among studies ($I^2 = 50.30$ per cent, $p < 0.05$). The overall prevalence of low sleep quality is shown in Figure 2. According to this figure, the highest reported prevalence belonged to Otaghi *et al.*^[36] with 94.60 per cent and the lowest amount related to Einollahi *et al.*^[26] with 60.60 per cent. Investigating the quality of studies using STROBE checklist showed that nine of studies had high quality, eight had moderate quality and four had low quality. The prevalence of low sleep quality in dialysis patients

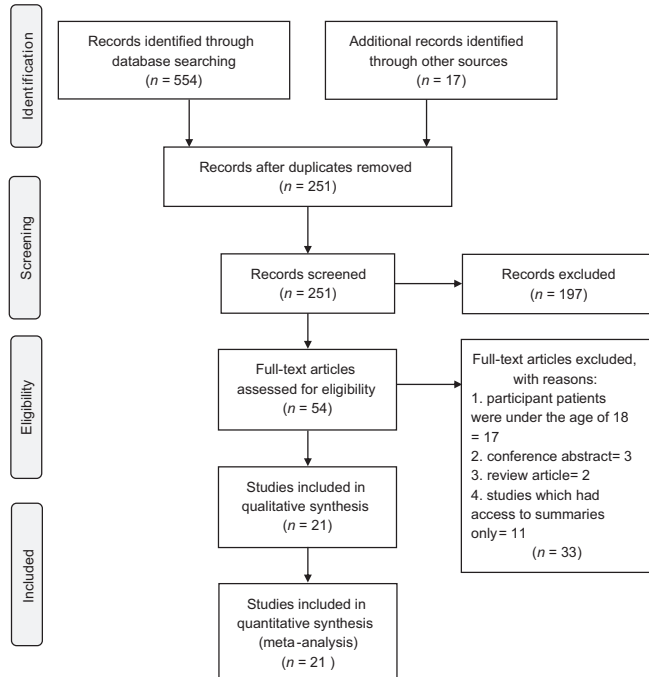


Figure 1: Selection of studies for meta-analysis

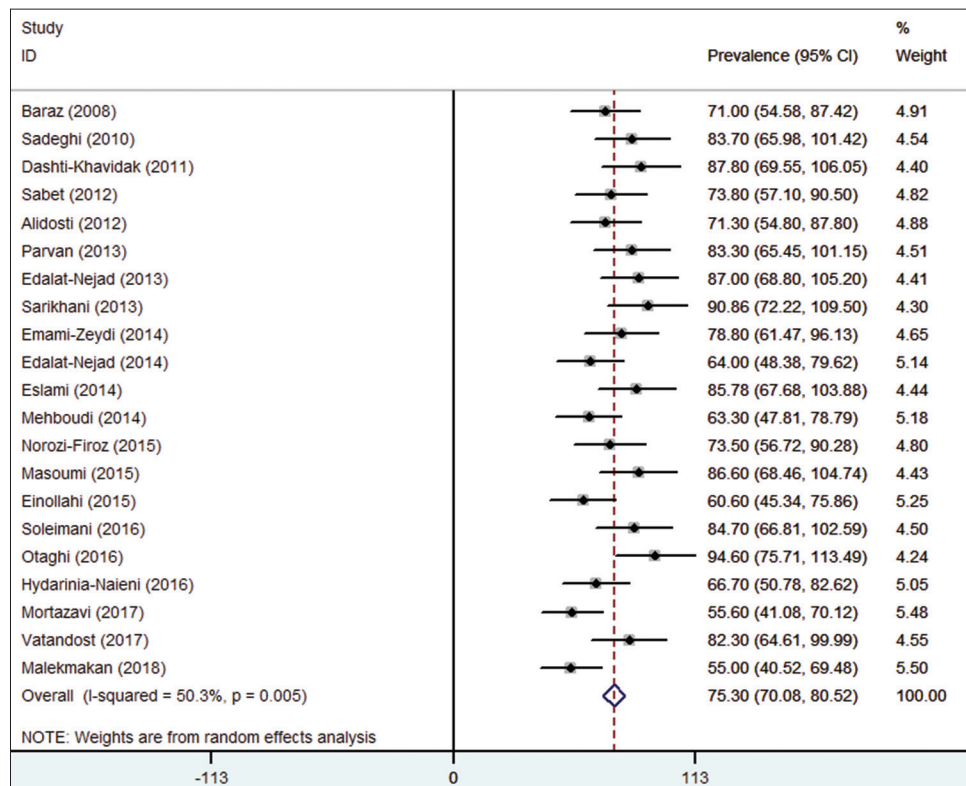


Figure 2: The overall prevalence of low sleep quality in hemodialysis patients in Iran based on the random-effects model

Table 1: Characteristics of included studies

First author	Year of publication	Type of study	Place of study	Prevalence of poor sleep quality	Sample size	Quality of study
Sabet	2012	Cross-sectional	Fasa	73.80	61	low
Dashti-Khavidak	2011	Cross-sectional	Tehran	87.80	80	moderate
Norozi-Firoz	2015	Descriptive-correlative	Mazandaran	73.50	310	high
Parvan	2013	Descriptive-correlative	Tabriz	83.30	245	high
Masoumi	2015	Cross-sectional	Isfahan	86.60	90	moderate
Einollahi	2015	Cross-sectional	Iran	60.60	6878	high
Edalat-Nejad	2013	Cross-sectional	Arak	87	115	moderate
Emami-Zeydi	2014	Cross-sectional	Sari	78.80	132	high
Edalat-Nejad	2014	Cross-sectional	Arak	64	138	high
Malekmakan	2018	Cross-sectional	Shiraz	55	144	moderate
Mortazavi	2017	Cross-sectional	Isfahan	55.60	81	low
Alidosti	2012	Cross-sectional	Shahreکرد	71.30	171	high
Sadeghi	2010	Quasi-experimental	Isfahan	83.70	43	high
Eslami	2014	Descriptive-correlative	Isfahan	85.78	190	high
Soleimani	2016	Randomized controlled clinical trial	Khoy	84.70	60	moderate
Otaghi	2016	Quasi-experimental	Ilam	94.60	56	moderate
Sarikhani	2013	Cross-sectional	Shiraz	90.86	197	high
Mehboudi	2014	Cross-sectional	Borazjan	63.30	74	low
Hydarinia-Naieni	2016	Cross-sectional	Semnan	66.70	90	moderate
Baraz	2008	Cross-sectional	Tehran	71	85	low
Vatandost	2017	Descriptive-correlative	Sanandaj	82.30	102	moderate

Table 2: The results of subgroup analysis

Subgroup	Prevalence, %	<i>I</i> ² , %	95% confidence interval	<i>p</i>
Sample size				
≤100	74.83	55	69.51-80.15	0.018
>100	73.86	50.30	68.80-78.93	0.79
Language of article				
English	76.72	49.73	72.16-81.28	0.018
Persian	69.95	47.25	63.73-76.11	0.078
Year of publication				
2008-2011	80.18	1.10	70.13-90.23	0.364
2012-2015	75.40	37.93	70.28-80.51	0.097
2016-2018	70.53	68.70	64.34-76.72	0.004
Quality of study				
High	77.07	35	71.01-83.12	0.149
Intermediate	72.70	63.06	67.44-77.95	0.003
Low	72.84	35	63.22-82.45	0.149
Mean age, y ¹				
51-55	70.39	67	64.94-75.84	0.002
56-60	73.61	0.01	67.27-79.94	0.589
>60	83.01	45.70	72.76-93.25	0.158
Mean duration of dialysis, mo ²				
≤39	71.70	49.12	65.87-77.54	0.056
39-62	67.23	45.36	60.06-74.39	0.12
>62	87.20	0.08	74.33-99.3	0.927

1=Year, 2=Months

was also assessed based on the quality of the studies. The results showed that the highest prevalence was related to high-quality studies (77.07 per cent) and the lowest rate was related to studies with average quality (72.70 per cent).^[44]

The results of the subgroup analyses based on sample size, year of publication, article language, study quality, mean age of patients, and mean dialysis duration were shown in Table 2. The studies with a sample size of over 100, studies

Table 3: The results of meta-regression

Factor	Standard Error	Co-efficient	CI	<i>p</i>
Sample Size	0.001	-0.002	-0.005--0.001	0.205
Year of publication	1.06	-1.44	-3.66-0.787	0.192
Mean age	0.77	1.23	-0.393-2.857	0.128
Mean duration of dialysis	0.19	0.14	-0.255-0.544	0.449

with English language, studies conducted between 2008 and 2011 and high-quality studies reported the highest prevalence of low sleep quality. In addition, the highest prevalence of sleep disorder was reported in patients with an average age of over 60 years and duration of dialysis over 62 months.

Meta-regression was carried out based on sample size, year of publication, mean age of patients and mean duration of dialysis in order to find the source of heterogeneity. The results of this analysis are shown in Table 3. The results of the study showed that with increasing the sample size, the prevalence of low sleep quality increases; however, this trend did not show to be statistically significant. The prevalence of low sleep quality has declined from 2008 to 2018. However, this did not prove to be statistically significant either. This rate also increases with the patients' age, although not statistically significant. Finally, the prevalence of low sleep quality has also increased with the increased duration of dialysis. This trend has also not been significant.

Discussion

Low sleep quality and its causes in hemodialysis patients have attracted the attention of many researchers in recent years.^[41] Evidence synthesis in the present study showed that the prevalence of low sleep quality in hemodialysis patients in Iran is 75.30 per cent (95 per cent confidence interval, 70.08–82.50). The results of this study are consistent with other studies conducted around the world. However, they tend to be closer to studies carried out in Asian countries like Pakistan (72.60 per cent).^[45] This rate is also higher than the rate of countries such as Norway (53.30 per cent), Taiwan (57.10 per cent) and China (69.10 per cent)^[46-48] and lower than of Egypt (79.50 per cent).^[49] Results have shown that low sleep quality is a common problem in patients undergoing hemodialysis. In this study, the prevalence of poor sleep quality in dialysis patients in Iran was higher than in developed countries, and it is more similar to countries of the same economic, social and cultural background. It can be concluded that as the development rate of the country increases, the rate of poor sleep quality is reduced. In this study, the prevalence domain of low sleep quality in hemodialysis patients was 55 per cent to 90 per cent. The difference in study design can be a reason for this diversity. Based on this study and other similar studies^[26] in this area, it can be concluded that one of the problems of hemodialysis patients is low

sleep quality and sleep disorder. Therefore, fundamental measures should be taken to improve the quality of sleep in these patients.

The results of this study also indicated that many dialysis patients suffer from low sleep quality. This will affect different aspects of QOL especially burden of kidney disease, physical health and mental health dimensions.^[27] There is an inverse relationship between age and sleep quality in patients with dialysis. Therefore, as the age increases, the quality of sleep decreases. Findings from other studies also confirm our results.^[47,50-52] Furthermore, it seems that aging has noticeable physical and mental impact on the patient. As the risk of diseases and disabilities increases with age, considering supportive factors and enabling older people to improve their quality of life can be important preventive measures. Moreover, curative policies should be developed to protect the health of the elderly.^[53] The results of the study also indicated an inverse relationship between the mean duration of dialysis and the quality of sleep. Therefore, by increasing the average duration of dialysis, the quality of sleep decreases. The results of Menon *et al.*'s and Tel *et al.*'s studies are consistent with our findings in this regard.^[10,54] Low sleep quality tends to be a common factor in all reviewed studies that negatively affects individual and occupational life. Patients' sleep quality will not increase by increasing the efficiency of the dialysis process^[55] and other factors such as improving nutrition, the status of dialysis filters, and so on should be considered.^[55] One of the advantages of this study was the average heterogeneity between studies, as well as conducting meta-regression to find a source of heterogeneity. In addition, a large number of studies for meta-analysis were another advantage of this study. The study has some limitations as well including: 1) the lack of information on the prevalence of sleep quality in hemodialysis patients by gender, 2) poor quality of 14.50 per cent of the studies, and 3) undetermined mean dialysis duration in 29 per cent of studies.

Conclusion

The results of this study showed that sleep quality in hemodialysis patients is very low as a common health problem. Thus, patients' sleep quality needs to be evaluated periodically. In addition, patients can use medical interventions and sleep hygiene to improve the quality of sleep. These interventions include improving room ventilation, proper lighting, comfortable bed and room temperature. Moreover, there is pressing need for new researches to identify new methods and therapeutic techniques to improve sleep quality in these patients.

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Conflicts of interest

Nothing to declare.

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