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A systematic review and meta-analysis of sleep hygiene implementation and its effect on sleep quality and fatigue in patients undergoing hemodialysis

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ABSTRACT

Introduction: The prevalence of patients undergoing hemodialysis who experience sleep disturbances and fatigue is high. Pharmacologic management has consequences and adverse effects, therefore, integrative intervention is important to be investigated. Sleep hygiene is one such integrative intervention that improves comfort including enhancing sleep quality and reducing fatigue. However, none have synthesized the effect of sleep hygiene intervention, particularly in the hemodialysis setting. This systematic review aims to synthesize the effectiveness of sleep hygiene in improving sleep quality and fatigue in patients undergoing hemodialysis.

Methods: This is a systematic review and meta-analysis of randomized controlled trials and quasi-experimental studies. Relevant studies were gathered by searching five databases from 2008-2023 using several keywords, such as sleep hygiene, sleep quality and fatigue. Quality assessment was conducted using relevant tools from the Joanna Briggs Institutes (JBI). Following that, synthesis of research findings was conducted using Review Manager version 5.4.

Results: Seven studies of 3,633 screened were included, with one high-quality study (88%) and six studies of moderate quality (61-76%). The review indicated a significant difference in sleep quality (MD = -2.36; 95% CI = -4.28, -0.44; p=0.016). However, there was no significant difference in fatigue (SMD = -0.08; 95% CI = -0.40, 0.24; p=0.61).

Conclusions: The evidence supports that sleep hygiene is effective in enhancing sleep quality. This systematic review contributes evidence to support the inclusion of sleep hygiene into holistic nursing to assist patients in improving sleep quality and reducing fatigue.

Keywords: fatigue, hemodialysis, sleep hygiene, sleep quality

Introduction

Chronic kidney disease (CKD) is considered one of the major public health issues worldwide, and its incidence continues to rise (Kovesdy, 2022). This disease affects more than 800 million people (Kovesdy, 2022). The global prevalence of CKD stands at 13.4% (11.7-15.1%), with patients requiring kidney replacement therapy for end-stage CKD estimated to be between 4.9-7.1 million (Lv and Zhang, 2019).

Patients suffering from chronic kidney disease experience a loss of more than 90% of their kidney function, disrupting the body's balance in maintaining fluid and electrolyte equilibrium. This condition necessitates kidney replacement therapy for individuals with CKD. Hemodialysis is the most widely used kidney replacement therapy, and its numbers continue to increase annually (Himmelfarb et al., 2020). Hemodialysis involves filtering metabolic waste using a

membrane that functions as an artificial kidney, commonly known as a dialyzer. Most patients require 12 to 15 hours weekly for hemodialysis, divided into two or three sessions lasting 3 to 6 hours each (Majlessi et al., 2022).

Patients undergoing hemodialysis frequently encounter various issues, including chronic fatigue, anxiety, depression, and a decline in sleep quality, all of which impact their well-being, health, and their quality of life (Al Naamani et al., 2021). It is estimated that approximately 8%-36% of patients with early-stage CKD and 50%-75% of patients with end-stage CKD requiring hemodialysis experience insomnia, reduced sleep quality, and chronic fatigue (Tan et al., 2022). These physical discomforts are the concern to holistic nursing.

Understanding the holistic processes that lead to a patient's well-being is important. Pharmacological and non-pharmacological therapies can manage sleep disturbances and fatigue in hemodialysis patients. Pharmacological therapy involves drugs such as melatonin supplementation and benzodiazepines or non-benzodiazepine receptor agonists, which appear to be effective in improving sleep quality and reducing patient fatigue (Asghar et al., 2020; Cukor et al., 2021; Fatemeh et al., 2022). However, these pharmaceuticals come with several consequences and adverse effects such as drug dependence, renal clearance issues, and a higher risk of death (Asghar et al., 2020). Therefore, non-pharmacological therapies are an alternative and may be more beneficial for patients with CKD (Li et al., 2021). Non-pharmacological therapies include foot reflexology, back massage, acupressure, and sleep hygiene. Although there are several non-pharmacological therapies for improving sleep quality and reducing fatigue in patients undergoing hemodialysis, sleep hygiene might be the primary choice due to its simplicity and ease of application compared to other non-pharmacological interventions (Ebrahimi et al., 2023).

Sleep hygiene is an integrative intervention suitable for hemodialysis patients (Natale, 2018). Sleep hygiene has been used to address sleep disorders in the dialysis context since 2008 (Chen et al., 2008). Sleep hygiene can be conducted as a stand-alone intervention or as part of Cognitive Behavior Therapy (CBT). When it is part of CBT, sleep hygiene encompasses a set of behavioral programs that address behavior patterns, environmental improvements, and other sleep factors tailored as therapy to enhance sleep quality and reduce fatigue (Haynes et al., 2018; Herscher et al., 2021). According to recent research by Ebrahimi et al. (2023), implementing sleep hygiene significantly enhances sleep quality, reduces fatigue levels, and decreases the risk of depression in hemodialysis patients (Ebrahimi et al., 2023). Despite this, the full implementation of sleep hygiene practices has not been maximized in holistic nursing practice.

The provision of holistic communication and a therapeutic environment is one of the core values of holistic nursing (Mariano, 2019). Sleep hygiene can be considered as an intervention that aligns with these values. Sleep hygiene comprises a modification of internal and external environments, including physical, emotional, environmental, and spiritual components. Providing sleep hygiene education could enhance holistic nursing practice to serve patients in their physical environment of healing.

Sleep hygiene has been tested in various settings (Irish et al., 2015). We note an existing systematic review that examined the potential effectiveness of sleep hygiene in patients with insomnia in general practice (Chung et al., 2018). However, available evidence of the effectiveness of sleep hygiene hemodialysis setting is still limited. Available review focus on the effectiveness of non-pharmacological therapies to improve patient's sleep quality (Natale, 2018). Further literature reveals no reviews on the effectiveness of sleep hygiene in the hemodialysis setting. Therefore, a systematic review that aims to synthesize the effectiveness of sleep hygiene on patient's sleep quality and fatigue is required.

Materials and Methods

Review design

This is a systematic review and meta-analysis. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines were followed in preparing this review (Page et al., 2021). This study has been registered with the International Prospective Register of Systematic Reviews (PROSPERO) with the registration number CRD42023486804 on 7 December 2023.

Search Strategy

The literature search was conducted from November to December 2023 across five databases: Scopus, Google Scholar, ProQuest. PubMed, and ScienceDirect. The search began after the publication of a study on sleep hygiene in dialysis patients in 2008 (Chen et al., 2008).

Several keywords were used in the search process: (Sleep Hygiene) OR (Cognitive Behavioral Therapy) AND (sleep quality) AND (fatigue) AND (Hemodialysis), with

language and year filters applied. We employed the term' cognitive behavioral therapy' because sleep hygiene is a part of it (Natale, 2018). The complete list of terms used in the search is detailed in Table 1.

Inclusion and exclusion criteria

The PICO framework was adopted for literature selection (Richardson et al., 1995): 1) Population: patients aged >18 years undergoing maintenance hemodialysis, 2) Intervention: sleep hygiene, 3) Comparison: standard care or usual care for hemodialysis patient or routine training offered at the hemodialysis unit, 4) Outcome: sleep quality and fatigue. These characteristics specified studies were seeking to obtain.

Beyond the PICO framework, additional inclusion criteria included: (i) being an empirical study that is either a randomized controlled trial, studies with pre-post intervention analyses and control groups, or quasi-experimental studies, (ii) studies published between 2008 when a study on sleep hygiene in patients undergoing dialysis was published until 2023, and (iii) studies reported in the English language.

Exclusion criteria included systematic or narrative reviews, protocols, meta-analyses, and concept analyses. Two reviewers independently and simultaneously conducted the filtering process, which involved screening titles, abstracts, and full texts.

Study selection and data extraction.

In the initial search process, all identified studies from various databases were exported to Rayyan, a free, semi-automated web-based program used to check for duplicate articles and to preliminary screen titles and abstracts (Ouzzani et al., 2016).

Two reviewers independently screened in blinded mode. Titles and abstracts were filtered based on inclusion criteria. The initial screening results were reviewed after deactivating the blinded mode. Discrepancies between the two reviewers were resolved through discussion.

In the next step, full-text articles were retrieved from the included studies after the initial screening. We obtained restricted access articles by contacting study authors through ResearchGate and requesting permission to access full-text articles. Then, we read all included articles to determine their relevance. The relevance of the article is adjusted to the inclusion and exclusion criteria that we set. Differences of opinion were resolved through deliberation until a consensus was reached. Data extraction was conducted using Microsoft Excel (Version 365). We extracted data that encompassed authors, year and country, study design, participants, disease type, intervention, control group, measurement instrument, and outcomes.

Table 1. Literature Search

Database	Search statement	Result
Google Scholar	**Technique 1: Without Limiters** Effectiveness OR Influence AND Sleep Hygiene OR Cognitive Behavioral Therapy AND Sleep Quality AND Fatigue AND Hemodialysis	5,950
	Technique 2: With Limiters: Year of publication Effectiveness OR Influence AND Sleep Hygiene OR Cognitive Behavioral Therapy AND Sleep Quality AND Fatigue AND Hemodialysis **Filters:** from 2008-2023.	426
PubMed	**Technique 1: Using MESH without Limiters** ((((Sleep Hygiene) OR (Cognitive Behavioral Therapy)) AND (sleep quality)) AND (fatigue)) AND (Hemodialysis)	11
	Technique 2: Using MESH with Limiters: text availability, article type, year of publication, and language. ((((Sleep Hygiene) OR (Cognitive Behavioral Therapy)) AND (sleep quality)) AND (fatigue)) AND (Hemodialysis) **Filters:** Full text, Randomized controlled trial, from 2008-2023, English language.	5
ProQuest	**Technique 1: Without Limiters** Sleep Hygiene OR cognitive behavioral therapy AND sleep quality AND fatigue AND Hemodialysis	111,265
	Technique 2: With Limiters: text availability, source type, year of publication, subject, document type, and language. Sleep Hygiene OR sunnah of sleep OR cognitive behavioral therapy AND sleep quality AND fatigue AND Hemodialysis **Filters:** Full text, scholarly journal, from 2008-2023, sleep and patients, article, English language.	528
Science Direct	**Technique 1: Without Limiters** "Sleep Hygiene" OR "cognitive behavioral therapy" AND "sleep quality" AND fatigue AND Hemodialysis	8,165
	Technique 2: With Limiters: Year of publication, article type, language "Sleep Hygiene" OR "cognitive behavioral therapy" AND "sleep quality" AND fatigue AND Hemodialysis **Filters:** from 2008-2023, research articles, English language.	2,670
Scopus	**Technique 1: Without Limiters** "Sleep Hygiene" AND "Cognitive Behavioral Therapy" AND hemodialysis	8
	Technique 2: With Limiters: Year of publication, document type, and Language. "Sleep Hygiene" OR "Cognitive Behavioral Therapy" AND hemodialysis **Filters:** from 2008-2023, articles, English language.	4
	TOTAL	3,633

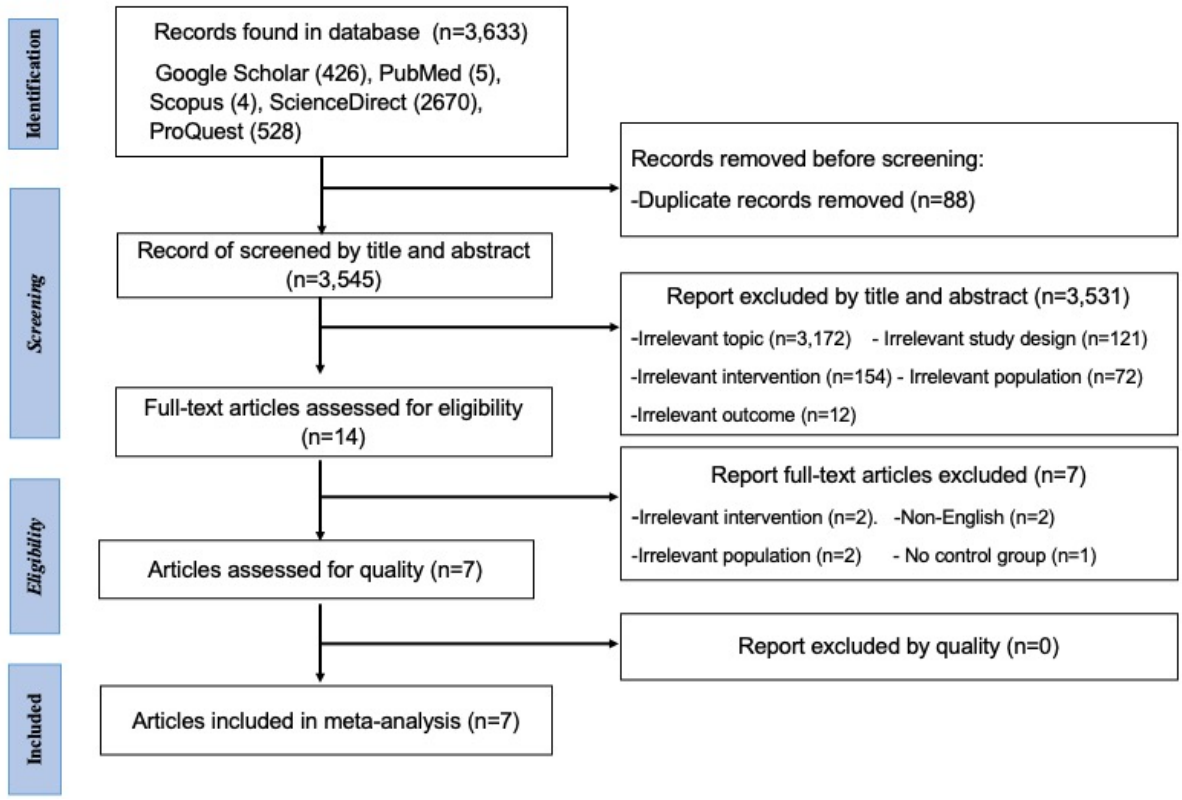

Figure 1. PRISMA flowchart

Appraisal of risk of bias

Critical appraisal was conducted using the Joanna Briggs Institute (JBI) Appraisal Tools, tailored to the study designs, including randomized controlled trials (13 questions) and quasi-experimental studies (9 questions). The appraisal was independently performed by two reviewers. Articles were categorized based on quality, with overall scores calculated as the percentage of "yes" responses from the critical appraisal tools. Scores above 80% are considered high quality, 60%–80% are moderate, and less than 60% are considered low quality (Munn et al., 2020). Any discrepancies in the assessment process were resolved through discussion. We only included high and medium-quality studies in this review.

Data synthesis and analysis

The statistical software Review Manager version 5.4 was utilized to perform a meta-analysis following Cochrane recommendations (Higgins et al., 2023). The analysis involved inputting study data, including the mean post-intervention values, standard deviations, and sample sizes for each group. A random-effects model was employed, utilizing Standard Mean Difference (SMD) and Mean Difference (MD) to report continuous

Table 3a. Assessment of methodological quality of included studies (randomized controlled trial)

	Chen et al., (2011)	Hou et al., (2014)	Muz et al., (2021)	Saeedi et al., (2014)	Shareh et al., (2022)	Soleimani et al., (2016)
Q1	N	Y	Y	Y	Y	Y
Q2	N	N	Y	N	N	N
Q3	Y	Y	N	Y	N	N
Q4	N	N	Y	N	N	N
Q5	N	N	N	N	N	N
Q6	Y	N	N	N	N	N
Q7	N	Y	Y	Y	Y	Y
Q8	Y	Y	Y	N	Y	Y
Q9	Y	Y	Y	Y	Y	Y
Q10	Y	Y	Y	Y	Y	Y
Q11	Y	Y	Y	Y	Y	Y
Q12	Y	Y	Y	Y	Y	Y
Q13	Y	Y	Y	Y	Y	Y
	61%	69%	76%	61%	61%	61%
	M	**M**	**M**	**M**	**M**	**M**

Q1. true randomization used for participant's assignment Q2. Concealment of allocation to treatment groups, Q3. Similar baseline of treatment groups, Q4. Blinding of participants to treatment assignment, Q5. Blind of those delivering treatment assignment, Q6. Blind of outcomes assessors, Q7. Identical treatment of groups, Q8. Adequate description and analysis of follow up, Q9. Participants was analyzed in the groups to which they were randomized, Q10. Similar outcomes measured in treatment group, Q11. Reliable outcomes measurement, Q12. Appropriate statistical analysis, Q13. deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?

Table 3b. Assessment of methodological quality of included studies (Quasi-experiment)

	Ebrahimi et al., (2023)
Q1	Y
Q2	Y
Q3	Y
Q4	Y
Q5	Y
Q6	N
Q7	Y
Q8	Y
Q9	Y
Persentage	**88%**
Category	**H**

Q1. The clarity of cause and effect in the study, Q2. Similar comparison of included participants, Q3. Similar treatment to the participants, Q4. Availability of control group, Q5. Multiple measurements of the outcome both pre and post the intervention/exposure, Q6. Adequate description and analysis of follow up, Q7. Similar outcome measurement of participant, Q8. Reliable outcome measurement, Q9. appropriate statistical analysis used.

Notes: The quality assessment outcomes were determined using the Joanna Briggs Institute Critical Appraisal Checklist. Responses marked as "Y" indicate "yes," while "N" denotes "no." Total score > 80% is categorized high quality, between 60% and 80% denote moderate quality, and < 60% indicates low quality. The category marked as "H" signifies "High," and "M" refers to "Medium".

data within a 95% confidence interval. MD was used when all data were scaled consistently across collected studies, while SMD was used when inputted data were measured using different tools (Higgins et al., 2023). Heterogeneity was calculated using the Higgins I^2 statistic: low (<25%), moderate (25-75%), and high (>75%) (Crombie & Davies, 2009). A fixed-effect model was applied if heterogeneity was low (I^2<50%), whereas a random-effects model was used for high heterogeneity was high (I^2>50%) (Higgins et al., 2023). Effect sizes with *p*-value<0.05 were considered statistically significant in this systematic review (Higgins et al., 2023).

In this review, sleep quality was analyzed using the Random-Effects model with MD, as variable being scaled with the same measurement tool, yielding an I^2=94%. Conversely, for the fatigue variable, the fixed-effects model with SMD was employed as this variable was scaled with differing measurement tools, resulting in an I^2 value of 0%.

Results

Study Selection

Figure 1 presents the PRISMA flowchart for study selection. A comprehensive search across five electronic databases identified 3,633 studies. Eighty-eight were removed due to duplication. After eliminating duplicates, the remaining 3,545 articles underwent screening based on title and abstract, with 3,531 excluded as did not meet the eligibility criteria. A total of 14 full-text articles were collected and being reviewed. Seven of 14 articles were excluded due to these reasons: two were non-English articles, two encompassed irrelevant interventions, two involved irrelevant participants, and one lacked a control group. The remaining seven articles underwent quality assessment. Ultimately, seven articles of moderate to high quality were included in the review.

Characteristics of the included studies

Table 2 provides the characteristics of the included studies. The studies included in this review were published between 2011 to 2023. The seven included studies were conducted across four countries: Iran (n=4), China (n=1), Taiwan (n=1), and Turkey (n=1). Six were RCTs (n=6) and one quasi-experimental (n=1), encompassing 611 participants, with n=307 in the intervention group and n=304 in the control group.

All included studies examined sleep hygiene interventions derived from CBT for Insomnia (CBT-i) (Haynes et al., 2018; Jang et al., 2013; Morin, 2004). Therefore, three studies referred to sleep hygiene as a component of CBT, three labelled it a sleep hygiene training program, and one termed it sleeps health education. Sleep hygiene was administered by trained

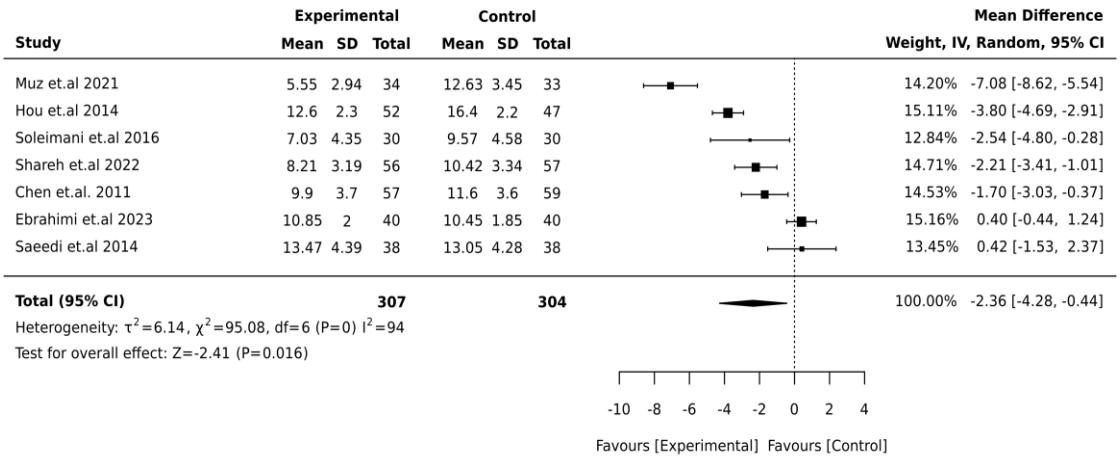

Figure 2. Synthesis of sleep hygiene on sleep quality

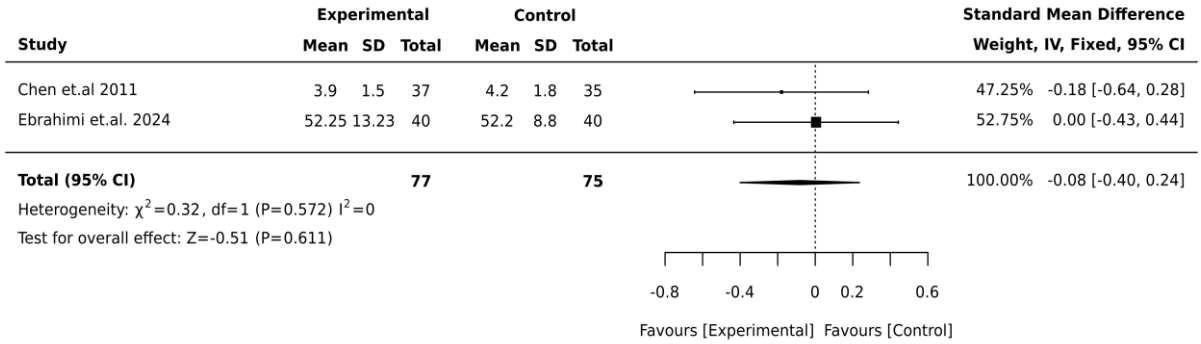

Figure 3. Synthesis of sleep hygiene on fatigue

healthcare professionals such as nurses. The delivery of sleep hygiene occurred in multiple sessions, including one session (n=2), two sessions (n=1), three sessions (n=2), six sessions (n=1), and nine sessions (n=1). On average, sleep hygiene was provided for durations of 30 minutes (n=3), 20 minutes (n=2), 40-60 minutes (n=1), and 90 minutes (n=1). Sleep hygiene was administered to the intervention group, while the control group obtained usual care (n=3) or standard care (n=2) and routine training for hemodialysis units (n=2).

In this systematic review, we aimed to synthesize the effects of sleep hygiene on patient's sleep quality and level of fatigue. All seven studies employed the PSQI to evaluate individual's sleep quality (Chen et al., 2011; Ebrahimi et al., 2023; Hou et al., 2014; Muz et al., 2021; Saeedi et al., 2014; Shareh et al., 2022; Soleimani et al., 2016). Two instruments were utilized to measure fatigue: the Multidimensional Fatigue Inventory (MFI) (Ebrahimi et al., 2023) and the Fatigue Severity Scale (FSS) (Chen et al., 2011)

Risk of bias of methodology

Each study's quality and risk of bias were evaluated. The critical assessment was categorized into two types based on the study designs: 6 RCTs and 1 quasi-experimental study. The assessment was conducted using the JBI critical assessment tool, with the quality scores of the seven included studies ranging from >60% to a maximum scale of 100%. One study was categorized as high quality, with an overall score of 88%, and six studies were categorized as moderate quality, with overall scores ranging between 61% and 76%. Table 3a and 3b displays the quality assessment of the seven included studies.

Effectiveness of interventions

Sleep Quality

Seven studies evaluated the effects of sleep hygiene on sleep quality were further synthesized (Chen et al., 2011; Ebrahimi et al., 2023; Hou et al., 2014; Muz et al., 2021; Saeedi et al., 2014; Shareh et al., 2022; Soleimani et al., 2016). These studies included 611 participants and assessed sleep quality using the 9-item PSQI. The meta-analysis (Figure 2) showed a significant improvement in sleep quality in the intervention group compared to the control group (MD = -2.36; 95% CI = -4.28, -0.44; p = 0.016).

Fatigue

Two out of seven studies, involving 152 participants, assessed the effectiveness of sleep hygiene on fatigue (Chen et al., 2011; Ebrahimi et al., 2023). The meta-analysis results (Figure 3) found no significant changes in fatigue compared to the control group, as measured by the MFI and FSS (SMD = -0.08; 95% CI = -0.40, 0.24; p = 0.61).

Discussions

Summary and interpretation of findings

This systematic review aimed to identify and synthesize the effectiveness of sleep hygiene interventions on sleep quality and fatigue levels among hemodialysis patients. The analysis and synthesis were performed on six RCTs and one quasi-experimental study. From these various findings, we consolidated results from different study designs into a meta-analysis. Such integration allows for generalizability and yields more accurate results (Nestoriuc et al., 2008; Parker et al., 2013). The meta-analysis aimed to evaluate the impact of sleep hygiene interventions on fatigue and sleep quality among hemodialysis patients. The analysis focused on immediate post-intervention measurement outcomes.

The meta-analysis revealed patients' sleep quality improved significantly following the intervention. The seven included studies demonstrated positive outcomes in enhancing sleep quality post-intervention (Chen et al., 2011; Ebrahimi et al., 2023; Hou et al., 2014; Muz et al., 2021; Saeedi et al., 2014; Shareh et al., 2022; Soleimani et al., 2016). The sleep hygiene interventions

incorporated training, behavioral strategies related to sleep hygiene, behavioral strategies to enhance sleep hygiene, sleep restriction, and sleep-related behavioral modifications, aiming to support better sleep quality improvements in patients. These findings align with studies conducted on chemotherapy patients, which also reported improvements in the intervention groups following sleep hygiene interventions (Bean et al., 2020; Elmetwaly et al., 2019; Zengin and Aylaz, 2019). Previous study demonstrates positive effect of sleep hygiene for patients with heart disease (Redeker et al., 2022). These five studies included indicate that sleep hygiene enhances sleep quality over time in patients with chronic diseases. Herscher et al, (2021) also proves that sleep hygiene interventions are proven to be effective in enhancing sleep quality for hospitalized patients (Herscher et al., 2021). Additionally, a previous systematic review indicated that while sleep hygiene aids in improving sleep quality (Chung et al., 2018).

Our review shows that fatigue levels exhibited no significant changes in patients' post-intervention. Two studies reported negative outcomes in reducing fatigue levels following sleep hygiene interventions among hemodialysis patients (Chen et al., 2011; Ebrahimi et al., 2023). Despite slight differences, these studies indicated no improvement in the mean post-test scores in the intervention groups after receiving sleep hygiene. These findings differ from several studies involving cancer patients undergoing chemotherapy, which showed higher mean post-test score changes between groups after sleep hygiene interventions (Bean et al., 2020; Zengin and Aylaz, 2019). These differing findings might be attributed to several reasons.

The first reason for these differing outcomes might be attributed to the relatively shorter duration of sleep hygiene intervention compared to studies involving chemotherapy patients. We believe an extended intervention duration could yield a more optimal effect, resulting in more significant changes in post-test mean values. The second reason for differing outcomes might be physiological factors, specifically the severity levels of the two diseases. Conversely, hemodialysis is typically employed end-stage renal disease (ESRD) (Kalantar-Zadeh et al., 2021). Therefore, patients undergoing hemodialysis tend to experience more physiological challenges than those undergoing chemotherapy, potentially exacerbating their fatigue. For instance, individuals with chronic kidney failure have elevated levels of urea and creatinine. Increased urea levels inhibit the production of erythropoietin hormone, leading to a decreased red blood cell count. Reduced red blood cell production or count decrease the blood's capacity to circulate oxygen to patient's body tissues, resulting in chronic fatigue (Gregg et al., 2021).

The third reason behind these differing findings could be the use of different measurement tools to evaluate the intervention. Our meta-analysis results indicate that different measurement scales contribute to non-significant effect sizes. Hence, further studies are recommended to employ standardized measurement tools to assess the impact of sleep hygiene on fatigue in patients undergoing hemodialysis.

This systematic review has several limitations. The primary constraint this study is the limited number of studies available for meta-analysis, which the scarcity of RCTs or quasi-experimental studies investigating the effectiveness of sleep hygiene despite employing specific keywords in the search across databases. This limitation results in a lack of comprehensive exploration regarding the impact of sleep hygiene on patients undergoing hemodialysis. Secondly, our critical assessment of the methodology in our systematic review reveals that among the seven included studies, only one was of high quality, with the remaining six being of moderate quality. Therefore, future studies particularly in RCTs should be improved by considering blinding techniques, notably double-blind and triple-blind methodologies, to enhance quality and minimize biases to a greater extent. Thirdly, our review is confined to patients undergoing hemodialysis and does not represent individuals with other chronic diseases. Consequently, it remains necessary to ascertain the suitability and efficacy of sleep hygiene for various chronic conditions.

This systematic review and meta-analysis provide valuable insights into the effectiveness of sleep hygiene interventions on sleep quality and fatigue levels in hemodialysis patients. The findings indicate that implementing sleep hygiene interventions enhances sleep quality in these patients. These outcomes underscore the significance of integrating sleep hygiene into clinical practice as a routine aspect of nursing care for individuals undergoing hemodialysis. Including diverse research designs and varying quality levels in the study enables a comprehensive understanding of sleep hygiene interventions.

Despite variations in measurement tools, administration methods, intervention durations, and outcomes, the review provide valuable evidence for healthcare professionals to evaluate specific outcomes of sleep hygiene interventions that could significantly impact the quality of life for hemodialysis patients. Thus,

healthcare providers should prioritize healthcare professional training, especially for hemodialysis unit nurses, who predominantly dedicate their time to patient care during hemodialysis sessions (Hill et al., 2023). This approach could enhance the capacity of healthcare providers, thereby improving the visibility and accessibility of sleep hygiene interventions for patients.

Future research on sleep hygiene for hemodialysis patients requires attention to some key points. Subsequent studies should utilize the standardized measurement tools in assessing the impact of sleep hygiene, especially on sleep quality and fatigue. Additionally, future research should contemplate the duration of intervention delivery to attain more optimal and significant outcomes. Furthermore, prioritizing enhancements and improvements in the quality of experimental research, notably RCTs, which are the gold standard in clinical trials, should be a focus. It could involve considering blinding techniques, especially double-blind and triple-blind methodologies, to minimize biases to a greater extent (Webber and Prouse, 2018).

Conclusion

This review demonstrates the effectiveness of sleep hygiene in improving sleep quality among hemodialysis patients. However, meta-analysis indicates no significant decrease in the fatigue levels of patients. Therefore, we argue that the differing findings in the effectiveness of sleep hygiene may stem from variations in the duration of intervention, physiological factors, and differences in measurement tools across all included studies. Healthcare providers should consider sleep hygiene interventions as standalone interventions or as part of CBT that can assist patients in enhancing sleep quality and reducing fatigue.

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Table 2. Characteristics of the included studies.

Author (year), country	Design	Participant		Intervention		Control group	Measurement Tools*	Outcome
		Number, TOTAL E/C	Mean age, total, E/C	Method	Duration			
Ebrahimi et al., (2023) Iran	Quasi-Experimental	80 participants (40/40)	37,05/42,55	The intervention group received both direct (face-to-face) and indirect (via instructional booklets) sleep hygiene education. • Explain the study's aims, sleep physiology and biology, factors that increase or degrade sleep quality, and characteristics of good and bad sleep. • Various types of sleep problems and recommendations to manage • Teaching relaxation and meditation methods	3 sessions and each session took 40 - 60 minutes.	The routine training offered at the hemodialysis unit.	PSQI is used to measure sleep quality, MFI is used to assess fatigue.	There was a statistically significant difference between the two groups in terms of total quality of sleep (p = 0.001) and fatigue (p=0.001).
Chen et al., (2011) Taiwan	RCT	72 participants (37/35)	E/C= 57/59	CBT programs video assisted during HD sessions, as well as group discussions and education. Sleep hygiene includes sleep restriction, stimulus control and relaxation training.	CBT treatment sessions are 30 minutes long for three weeks and sleep hygiene education during 6-week period.	standard care routine hemodialysis unit.	PSQI to measure sleep quality, FSS to measure fatigue.	• PSQI scores in the intervention group reduced significantly • FSS scores did not reduced significantly between group
Hou et al., (2014) China	RCT	99 participants (52/47)	E/C= 54,5/52,4	Sleep-related modifications to behavior and progressive muscular relaxation were part of the cognitive behavioral therapy.	±20-min interval of training for 3 months.	Usual treatment for hemodialysis patients.	PSQI to evaluate sleep quality.	After treatment, the overall scores and scores for each category were lower between group (P<0.01).
Muz et al., (2021) Turkish	RCT	67 participants (34/33)	E/C= 59,41/60,60	During the training session, all participants get sleep hygiene training recommendations. After the training is completed, the patient were asked every week about sleep issues and changes due education.	Once a week for 3 weeks, each session for 20 minutes.	Standard care for hemodialysis patients.	PSQI is used to measure sleep quality	After intermediate and final follow-up, the intervention group's PSQI became significantly more than the control group (p<0.05).
Saeedi et al., (2014) Iran	RCT	76 participants (38/38)	E/C= 52,27/57,87	The direct sleep hygiene training program consists: • Session 1: Introduction, explanation on objectives of the study and sleep physiology • Session 2: Exploring successful sleep factors as well as various forms of sleep difficulties.	6 sessions weekly for half an hour.	Standard care not specified	PSQI is used to measure sleep quality.	There were no significant differences in global mean scores or sleep quality component scores between the two groups.

Author (year), country	Design	Participant		Intervention		Control group	Measurement Tools*	Outcome
		Number, TOTAL E/C	Mean age, total, E/C	Method	Duration			
				• The session 3: A review of the guidelines for sleep hygiene education. • The sessions 4 and 5: Behavioral Intervention Training. • The session 6: Review sessions, feedback evaluations, and the delivery of an educational brochure.				
Shareh et al., (2022) Iran	RCT	113 participants (56/57)	E/C= 43,7/46,4	CBGT-I that consist of:. • The session 1: Overview of the CBGT-I program. • The session 2: Psychoeducation. • The session 3: Breathing exercises, guided imagery, and self-soothing techniques. • The session 4: Progressive muscle relaxation, body scanning practice, and autogenic training. • The session 5: Programming pleasurable activities, controlling stimuli, and recovering the bedroom. • The session 6: Recognizing and explaining problematic automatic thinking. • The session 7 and 8: Cognitive reorganization • The session 9: Sleep limitation.	Nine sessions with 90-minute were conducted each week.	Usual treatment for hemodialysis patiets but not specific.	PSQI to assess sleep quality.	There was a significant improvement of sleep quality between groups (p<0.001).
Soleimani et al., (2016) Iran	RCT	60 participants (30/30)	The mean age is not specifically explained	The protocol for sleep health education: • The first parts explored the sleep process and its importance, as well as its influence on daily activities and the importance of the sleep environment. • The second section focused on sleep-related health behaviors.	For one hour with each part lasting 30 minutes	Usual treatment not specified	PSQI	Mean of PSQI scores changed significantly between groups (p=0.034).