

Sama Vritti Pranayama breathing exercise on sleep disturbance and fatigue among hemodialysis patients: A quasi-experimental study

Fariba Heydarian (MSc)¹
Sepideh Mohammadi (PhD)^{2*}
Abbas Shamsalinia (PhD)²
Afsaneh Arzani (PhD)³

1. Student Research Committee, Health Research Institute, Babol University of Medical Sciences, Babol, Iran

2. Health Research Institute, Nursing Care Research Center, Babol University of Medical Sciences, Babol, Iran

3. Non-Communicable Pediatric Diseases Research Center, Health Research Institute, Associate Professor of Nursing department, Nursing and Midwifery School, Babol University of Medical Sciences, Babol, Iran

* Correspondence:

Sepideh Mohammadi, Health Research Institute, Nursing Care Research Center, Babol University of Medical Sciences, Babol, Iran

E-mail:

sepidmohamadi@yahoo.com

Tel: +989111279208

Received: 1 Jan 2025

Revised: 11 May 2025

Accepted: 28 Jun 2025

Published: 10 March 2026

Abstract

Background: Poor sleep quality and fatigue are common complications in hemodialysis patients. Although Sama Vritti pranayama breathing exercise as a yogic breathing is prescribed to improve sleep quality, its efficacy in this group of patients is not well established. The present study was conducted to examine the effects of Sama Vritti Pranayama applied to hemodialysis patients on sleep disturbance and fatigue.

Methods: The pre-test/post-test quasi-experimental design was conducted in 60 hemodialysis patients. Data were collected from May to October 2023. A Sama Vritti pranayama breathing exercise was given to the experimental group (n= 30) twice a day for two months. Control group (n=30) received only routine hospital care. Sleep disturbance and fatigue were assessed by the Insomnia Severity Index (ISI) and Fatigue Assessment Scale (FAS), at baseline and after 2-month intervention.

Results: The two groups were homogeneous in terms of demographic characteristics, insomnia severity (P=0.54) and fatigue score (P=0.74) at baseline. Following a 2-month intervention, insomnia severity (P=0.02) and fatigue score (P=0.00) were significantly better in the experimental group compared with the control group.

Conclusion: A 2-month Sama Vritti pranayama breathing exercise can effectively reduce insomnia severity and minimize fatigue score of hemodialysis patients. Therefore, this breathing exercise as a feasible practice should be recommended for hemodialysis patients to manage sleep disturbance and fatigue.

Keywords: Breathing exercise, Insomnia, Sleep disorders, Fatigue, Hemodialysis.

Citation:

Heydarian F, Mohammadi S, Shamsalinia A, Arzani A. Sama Vritti Pranayama breathing exercise on sleep disturbance and fatigue among hemodialysis patients: A quasi-experimental study. Caspian J Intern Med 2026; 17(2): 457-463.

According to the latest published evidence, chronic kidney disease (CKD) has emerged as one of the major causes of mortality worldwide and an increasing condition that affects more than 800 million people worldwide (1). CKD in Iran is associated with an alarming rise in mortality and morbidity (2). The result of a study in Iran indicates a higher than the global average prevalence of CKD in this country (3). Hemodialysis is the commonest form of kidney replacement therapy. Although renal function is partially replaced through hemodialysis, patients undergoing hemodialysis endure many complications such as sleep disorders and fatigue. The result of a systematic review indicated a high prevalence of sleep disorders among patients undergoing hemodialysis (4). Statistics showed that approximately 80% of patients undergoing hemodialysis suffered from various types of sleep disorders (5). The most frequently reported sleep abnormalities in hemodialysis patients are insomnia, excessive daytime sleepiness, restless leg syndrome and sleep-disordered breathing (6). Some physical complications such as muscle cramps, gastrointestinal diseases, hypertension and body fluids or electrolytes imbalances as well as, psychological factors such as depression and anxiety may contribute to the insomnia in hemodialysis patients (4,7).



Patients under hemodialysis endure a high level of fatigue that is one of the most frequently experienced symptoms with more than 80% of patients reporting a feeling tired and lack of energy (4, 7). Fatigue negatively affects their quality of life and daily distress. In an effort to decrease sleep disorders and fatigue in hemodialysis patients, various pharmacological and non-pharmacological methods have been tried (8). Pharmacological methods are frequently used to decrease sleep disorder symptoms but have wide complications in this group of patients. Some of the alternative and safe non-pharmacological interventions to promote the quality of sleep are meditation, yoga, deep breathing, music therapy and many others (9). Pranayama breath technique is an ancient Indian type of breathing that originates from yogic practices. Pranayama breath technique involves controlling breath in different lengths and styles (10).

Sama Vritti is a form of pranayama that involves controlling the natural breathing process ratio (10, 11). This breathing technique uses a set length of equal inhalations, exhalations and breath retentions. Sama means “equal”, and vritti means “mental fluctuations”, so Sama Vritti pranayama translates as “equal mental fluctuation breathing”(12). The key aim of this technique was to reduce anxiety and enhance relaxation. The results of the studies indicated that Sama Vritti has a very calming effect on the nervous system and can help increase oxygen to the brain, slow down the heart rate, as well as reduce stress and anxiety (11). Results of a study showed that the Sama Vritti pranayama is very helpful in lowering sleep disorders, anxiety and blood pressure among patients with hypertension (13). According to the result of a systematic review, Pranayama has a beneficial effect on physiological and psychological symptoms among patients with respiratory and cardiovascular disease. The mentioned that in light of this knowledge, the beneficial consequences of Sama Vritti pranayama are controversial and further high-quality study are needed to provide decisive evidence (14). The result of a systematic review highlighted Pranayama's preventive and therapeutic potential for conditions ranging from psychosomatic disorders to chronic obstructive pulmonary disease. Although evidence supports its integration into daily routines for comprehensive health benefits, further studies are recommended to elucidate the mechanisms behind these effects and to develop standardized guidelines for incorporating Pranayama into modern healthcare practices (10). Furthermore, most studies conducted to date have focused on other subgroups of pranayama breathing exercises, while research on sama vritti breathing particularly in patients has been limited and

has produced contradictory results (15). To the best of our knowledge, the effects of Sama vritti pranayama on sleep disturbance and fatigue among patients undergoing hemodialysis have not been studied yet. This research study is significant in that it focused on an intervention method that has not yet been applied to patients in Iran and this breathing technique as a non-pharmacological and noninvasive “tool” may be used beneficially in the future to improve sleep quality and reduce fatigue in hemodialysis patients.

Methods

Study design: This study was a pre-test/post-test quasi-experimental with two groups (control and experimental) without blinding design. The research hypothesis for the present study was that statistically significant changes would be observed in the insomnia severity and fatigue of hemodialysis patients after the use of Sama Vritti pranayama breathing exercise.

Setting and participants: The current study was conducted from May to September 2023 on 60 patients undergoing hemodialysis in a hospital affiliated with Babol University of Medical Sciences, Iran. Eligibility criteria for participation in this study were as follows: willingness to take part in the current study, receiving hemodialysis 3 times a week, no use of sleep medications, obtaining a score higher than 7 on the Insomnia Severity Index (ISI), being able to carry out the Sama Vritti pranayama breathing exercise, no history of substance addiction, no history of chronic pulmonary disease and psychiatric disorders based on the patient's medical record, no history of doing yoga and breathing exercise in the last 3 months, and under hemodialysis for at least 6 months. Exclusion criteria for subjects were: missing more than 3 days of the Sama Vritti pranayama breathing exercise and presence of any health issue (such as an acute respiratory disease) that was a barrier to doing Sama Vritti pranayama breathing exercise and unwillingness to continue with the current study.

Sampling: On the basis of data (mean standard deviation of sleep quality) collected in our pilot study on 22 hemodialysis patients (11 patients in each group), a total of 54 subjects was obtained with a confidence interval of 95% and a power of 80%. The final sample size, with considering 10% possibility of samples' drop out, was determined as 60 patients (30=experimental group, 30=control group). The schedule of patients who undergo hemodialysis three days a week in our target hospital was as follows: one group of patients visited on Sunday, Tuesday and Thursday and the other group visited on Saturday, Monday and Wednesday.

So, to minimize information bias and contact between the study subjects of the two groups, days of the week were randomly assigned to the control (Sunday, Tuesday and Thursday) and experimental (Saturday, Monday and Wednesday) arms by flipping a coin. Then, participants who

met the inclusion criteria were enrolled in the study using convenience sampling. All subjects included in the two control and experimental groups were present until the end of the study, and there was no sample dropout. The flowchart of the study design is shown in figure1.

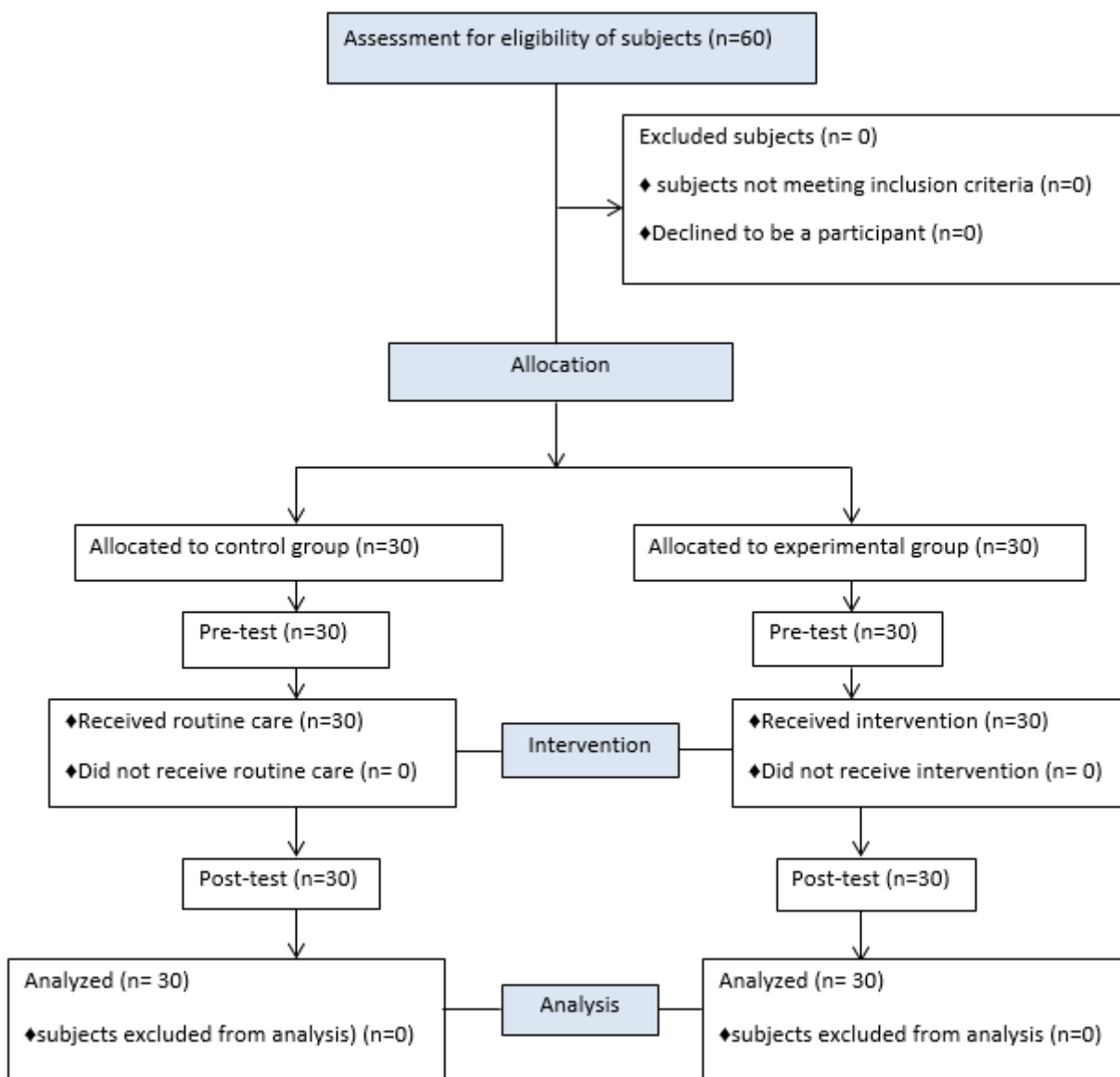


Figure 1. Flow chart of the study design

Procedure: The experimental group, in addition to routine hospital care, received the Sama Vritti pranayama breathing exercise. Following eligible subjects signed informed consent, the Sama Vritti pranayama breathing exercise in the experimental group was conducted by a trained investigator (first author) according to a standardized procedure. The breathing exercise program in the experimental group had 4 stages, including “teaching how to perform Sama Vritti pranayama breathing exercises”,

“checking the accuracy of breathing by the participants”, “giving an educational brochure”, and “follow-up”. In the first stage, the experimental group were instructed in how to do breathing exercise and were asked to do the following 5 steps: first step; sit quietly and calm your minds, second step; close your eyes and breathe in through your nose, slowly count to 4 counts, third step; hold your breath and slowly count to 4 counts, fourth step; slowly exhale to 4 counts, fifth step; hold the exhalation for another 4 counts

then continue these steps for 5 minutes. In the second stage, they were asked to perform the breathing exercise several times until the researcher was sure that the breathing exercise was performed correctly. They were asked to do this breathing exercise twice a day (once in the morning and once at night during their free time) for two months. These stages were performed individually for each participant and lasts around 30 to 40 minutes. Also, they were given an educational brochure with pictures of Sama Vritti pranayama breathing exercises steps. In the fourth stage, the investigator sent a short message to the cell phone of the experimental group every morning and evening to remind them to do the breathing exercise. A daily checklist, divided into morning and evening sections, was provided to the intervention group for a duration of two months. Participants were instructed to mark 'yes' each time they successfully completed the breathing technique. The control group received routine hospital care and no breathing exercise training was given to them. Pre-test and post-test were taken from both groups at the beginning and then two months after the start of the study.

Outcome measures

Insomnia severity: The Insomnia severity in subjects was measured using the Insomnia Severity Index (ISI). ISI is a self-rated questionnaire and one of the most widely used sleep disorder questionnaires. The ISI comprised 7 items that measure different aspects of both daytime and nighttime insomnia, such as the severity of sleep problems, sleep maintenance, sleep dissatisfaction, the distresses caused by insomnia, and its impact on daily functioning. This scale asks the subjects to rate the items on a 5-point Likert scale, from 0 (none) to 4 (very severe). Each item score from 0 to 4, and the total score ranges from 0 to 28. The total score of ISI is interpreted as follows: no clinically significant insomnia (0–7); mild or sub-threshold insomnia (8–14); clinical insomnia of moderate severity (15–21); and severe clinical insomnia (22–28).

Fatigue: The fatigue of subjects was measured using the Fatigue Assessment Scale (FAS). FAS is quick and easy to complete for patients, and not time-consuming. This scale is a 10-item self-report scale evaluating symptoms of chronic fatigue. Five questions reflect physical fatigue and 5 questions (questions 3 and 6-9) about mental fatigue. The total score ranges from 10 to 50, with a higher score indicating more severe fatigue.

Data analysis:

The collected data was analyzed through the SPSS Version 22.0 (SPSS Inc., Chicago, IL, USA). Descriptive sample statistics included means, standard deviations, and frequencies. Descriptive statistics such as frequencies, percentage mean and standard deviation were used to describe the baseline characteristics of the subjects. Differences between the two groups were analyzed using independent sample t-tests and the chi-square test. A significance level of 5% was used.

Ethical approval: Ethics approval was granted by the Ethics Committee of Babol University of Medical Sciences (Ethical Code: IR.MUBABOL.REC.1400.130). Study subjects were assured that their participation was voluntary, and we respected their decision not to take part. Also, they were assured that their data would be kept confidential and anonymized. A written consent was obtained after an explanation about the aim of the study.

Results

In both study groups, more than 50% of the study participants were males. The educational level of more than half of the samples in the intervention group and control group was primary school. At baseline, there was no difference in terms of demographic characteristics, duration of dialysis, dialysis adequacy (Kt/V), and phosphorus and calcium level in both groups. The demographic characteristics of the subjects are presented in table 1.

Table 1. Baseline demographic and clinical characteristics of the subjects in experimental and control group

Characteristics, total (n=60)	Control group	Experimental group	Statistic test and P-value
Age, (years) (Mean±SD)	71.23±6.87	72.00±7.50	t = 0.41, P= 0.68
Gender, n (%)			
Male	17 (56.7)	18 (60)	χ ² = 0.069 df=1 P= 0.79
Female	13 (43.3)	12 (40)	
Educational level, n (%)			
Primary	13 (43.3)	15 (50)	χ ² = 0.96 df=3 P= 0.809
Secondary	5 (16.7)	6 (20)	
High school and diploma	4 (13.3)	2 (6.7)	
Higher	8 (26.7)	7 (23.3)	

Characteristics, total (n=60)	Control group	Experimental group	Statistic test and P-value
Duration of dialysis n (%)			
1-2 years	10 (33.3)	12 (40)	x ² = 1.13 df=2 P= 0.568
3-5 years	15 (50)	11 (36.7)	
Above 5 years	5 (16.7)	7 (23.3)	
Kt/V or Dialysis adequacy			
≥1.2	21 (70)	18 (60)	x ² = 0.65 df=1 P= 0.417
≤1.2	9 (30)	12 (40)	
Phosphorus level	5.00±0.75	5.17±0.66	t = -0.91, P= 0.36
Calcium level	9.2±0.44	8.90±0.49	t = -0.93, P= 0.35

Insomnia severity in the experimental and control groups was homogeneous before the study and showed no statistically significant difference (P=0.54). However, after the two months' intervention, insomnia severity was statistically significant lower in the intervention group than

in the control group (P=0.02) (table 2). There was no significant difference in the fatigue score at baseline between two groups (P=0.74). The experimental group showed significant improvements in fatigue score after intervention (P=0.00) (table 2).

Table 2. Comparison of outcomes between the control and experimental groups at baseline and at after the intervention

Variables	Control group	Experimental group	Test	P-value*
Insomnia severity at baseline- N (%)				
- mild or sub-threshold insomnia	6 (20)	8 (26.7)	x ² =1.20	0.54
- clinical insomnia of moderate severity	21 (70)	17 (56.6)		
- severe clinical insomnia	3 (10)	5 (16.7)		
Insomnia severity after intervention N (%)				
- mild or sub-threshold insomnia	6 (20)	16 (53.3)	x ² =7.17	0.02**
- clinical insomnia of moderate severity	19 (63.3)	11 (36.7)		
- severe clinical insomnia	5 (16.7)	3 (10)		
Fatigue at baseline(Mean±SD)	29.80±8.69	29.16±6.51	t=0.32	0.74
Fatigue after intervention (Mean±SD)	32.60±8.30	23.90±6.80	t=4.43	0.00**

SD, standard deviation. **A statistically significant difference

Discussion

In the present study, our data showed that the Sama Vritti Pranayama breathing exercise significantly affects sleep disturbance and fatigue in hemodialysis patients. After the two months' intervention, insomnia severity was statistically significant lower in the intervention group than in the control group (P=0.02). Also, the experimental group showed significant improvements in fatigue score after intervention (P=0.00). The present study used the Insomnia Severity Index (ISI) to assess sleep disturbance in hemodialysis patients and, according to the results, more than 50% of the subjects in the control and experimental groups were at a clinical insomnia of moderate severity before the intervention, which indicates the poor quality of

sleep of these people. Consistent with our results, the results of a study in Iran represented that 59.6% of hemodialysis patients suffer from poor sleep quality. The current study, in line with Abd El Khalik et al., (14) examined the influence of breathing exercise on sleep disturbance among hospitalized patients, and they found breathing exercise had significant effect on improving sleeping quality and reducing the occurrence of delirium among the intervention group than the control group. Similar effects have been found in previous study. The findings of a study (2020) showed that Bhamari pranayama breathing intervention helped to improve the quality of sleep and general wellbeing of COVID-19 patients during the treatment period. They indicated that Pranayama breathing helps to balance the

autonomic nervous system by increasing parasympathetic output and reducing the sympathetic tone, which can contribute to a reduction of bad moods and negative emotions in patients (15). In another study done by Vialatte et al. they found that Pranayama breathing exercise has a significant effect on brain activity and makes a feeling of 'blissfulness'(16). In a systematic review study titled 'Effects of Bhramari pranayama on health' in 2018, it concluded that Pranayama breathing balances the autonomic nervous system through enhanced activation of the parasympathetic system, reduces blood pressure and heart rate and can be practiced for mental relaxation (17). Also, all of the above studies mentioned that study participants felt that Pranayama breathing sessions were feasible, easy to practice and able to follow the exercises. Thus, according to the results of the above studies, the effectiveness of this intervention in improvements the quality of sleep can be justified. In contrast to the present study, Hassani et al. found that yogic breathing exercises did not yield a positive effect on sleep delay, sleep disorders and mental quality in patients with chronic heart failure (18). This study differs from the present study in terms of the breathing exercise protocol and the intervention duration. While their study implemented breathing exercises only twice a week, our intervention involved twice-daily sessions over two months. Thus, the limited training frequency in their study likely contributed to the lack of significant positive effects. The present study also showed that there was a reduction in the level of fatigue experienced by the hemodialysis patients who practiced Pranayama than the patients in the control group. Consistent with our results, Ilter et al. in 2023 conducted a study to examine the effects of Pranayama applied to hemodialysis patients on fatigue. The patients in the pranayama group applied the interventions 15 to 20 minutes every day, once a day, for a total of 3 months and, it was found that pranayama reduced the fatigue severity in hemodialysis patients (19). Also, our findings are in agreement with previous study that tested the effectiveness of Pranayama techniques in reducing cancer-related fatigue among breast cancer patients undergoing radiation therapy. It was found that pranayama techniques (5 days a week for 6 weeks) resulted in statistically significant improvements in level of fatigue (20). These studies concluded from their study that variables such as fatigue require a long and continuous stimulus for significant changes. In our study, the duration of the intervention was two months, and the continuous implementation of the intervention by the participants was checked by the researcher, so it can be one of the reasons for the effectiveness of our intervention. In another study by

Gündođdu and Koçařlı in 2022, investigating the effect of pranayama and deep breathing exercises on cancer-related fatigue and insomnia during radiotherapy. In this study, patients performed Pranayama for ten minutes after each radiotherapy session for 25 days. The results of the study represented that Pranayama and deep breathing exercises are effective in reducing fatigue and insomnia in patients receiving radiotherapy due to breast cancer. They concluded since sleep disorders and poor sleep quality are associated with an increase in daily fatigue, therefore, any intervention that leads to the improvement of sleep quality can also have a positive effect on reducing fatigue (21). In agreement with this study, the study by Pastier et al. also confirmed that improvement in sleep quality among adults can affect mental energy and fatigue (22). In the current study, it seems that improving the quality of sleep has a positive effect on reducing fatigue. This study supported the hypothesis that the Sama Vritti pranayama breathing exercise could minimize sleep disturbance and fatigue levels of hemodialysis patients. This type of breathing exercise is feasible and easy to practice. Therefore, teaching Sama Vritti pranayama breathing exercise to hemodialysis patients as a safe way to improve sleep quality and reduce fatigue may play an important role in minimizing some complications in these patients. As the present study was a single-site study, results should not be generalized. A multiple-site with a large sample size study would be required for a definitive study. Also, patient follow-up in the present study was conducted by short messages to the cell phone only and there were no home visits. Since there were no home visits in our study, it is suggested to use home visits in other studies to improve the quality of the study.

Acknowledgments

This study is the result of a master's thesis at Babol University of Medical Sciences. The authors would like to thank all study participants patients as well as to all individuals involved in approving and conducting the work. Likewise, to Mr. Seyyed Javad Hosseini for his guidance as a psychiatric nurse in this study.

Funding: The financial support of the current study was provided by Babol University of Medical Sciences.

Ethics approval: IR.MUBABOL.REC.1400.130.

Conflict of interests: The authors declare no conflict of interest.

Authors' contribution: All listed authors in the present study are in agreement with the content of the manuscript and meet the authorship criteria. Sepideh Mohammadi,

Abbas Shamsalinia and Fariba Heydarian designed the study; Sepideh Mohammadi, Fariba Heydarian and Afsaneh Arzani, collected and supervised collection of the data; Sepideh Mohammadi and Abbas Shamsalinia analyzed the data; Sepideh Mohammadi, Afsaneh Arzani and Fariba Heydarian prepared and revised the manuscript.

References

1. Kovesdy CP. Epidemiology of chronic kidney disease: an update 2022. *KI Supplements* 2022; 12: 7-11.
2. Dehghani A, Alishavandi S, Nourimajalan N, Fallahzadeh H, Rahmanian V. Prevalence of chronic kidney diseases and its determinants among Iranian adults: results of the first phase of Shahedieh cohort study. *BMC Nephrol* 2022; 23: 203.
3. Moazzeni SS, Arani RH, Hasheminia M, et al. High incidence of chronic kidney disease among Iranian diabetic adults: using CKD-EPI and MDRD equations for estimated glomerular filtration rate. *Diabetes Metab J* 2021; 45: 684-97.
4. Fonseca NT, Urbano JJ, Nacif SR, et al. A systematic review of sleep disorders in patients with chronic kidney disease undergoing hemodialysis. *J Phys Ther* 2016; 28: 2164-70.
5. Wang X, Gu J, Liu J, Hong H. Clinical evidence for acupressure with the improvement of sleep disorders in hemodialysis patients: A systematic review and meta-analysis. *Complement Ther Clin Pract* 2020; 39: 101151.
6. Pojatić Đ, Pezerović D, Mihaljević D, Degmečić D. Factors associated with sleep disorders in patients on chronic hemodialysis treatment. *Southeastern Eur Med J* 2020; 4: 74-86.
7. Kir S, Kirhan İ, Dilek M. Prevalence of sleep disorders and related factors in individuals undergoing hemodialysis. *Cogn Behav Neurol* 2021; 34: 161-9.
8. Tsirigotis S, Polikandrioti M, Alikari V, et al. Factors associated with fatigue in patients undergoing hemodialysis. *Cureus* 2022; 14: e22994.
9. Edley R. Can non-pharmacological interventions improve sleep quality for haemodialysis patients? *J Kidney Care* 2020; 5: 6-12.
10. Chetry D, Chhetri A, Rajak DK, Rathore V, Gupta A. Exploring the health benefits of bhramari pranayama (humming bee breathing): A comprehensive literature review. *Indian J Physiol Pharmacol* 2024; 68: 71-85.
11. Noventi I, Soleha U, Hasina SN, Wijayanti L. The effectiveness of mindfulness based stress reduction and sama vritti pranayama on reducing blood pressure, improving sleep quality and reducing stress levels in the elderly with hypertension. *Bali Med J* 2022; 11: 302-5.
12. Epe J, Stark R, Ott U. Different effects of four yogic breathing techniques on mindfulness, stress, and well-being. *OBM Integr Comp Med* 2021; 6: 1-21.
13. Jayawardena R, Ranasinghe P, Ranawaka H, et al. Exploring the therapeutic benefits of pranayama (yogic breathing): a systematic review. *Int J Yoga* 2020; 13: 99-110.
14. Abd El Khalik EF, Abd Elbaky MM, Ahmed NA, Moursy SHT. The effectiveness of using breathing exercise on sleep quality among hospitalized patients. *Am J Nurs* 2020; 9: 272-80.
15. Jagadeesan T, Archana R, Kannan R, et al. Effect of Bhramari Pranayama intervention on stress, anxiety, depression and sleep quality among COVID 19 patients in home isolation. *J Ayurveda Integr Med* 2022; 13:100596.
16. Vialatte FB, Bakardjian H, Prasad R, Cichocki A. EEG paroxysmal gamma waves during Bhramari Pranayama: a yoga breathing technique. *Conscious Cogn* 2009; 18: 977-88.
17. Kuppusamy M, Kamaldeen D, Pitani R, Amaldas J, Shanmugam P. Effects of Bhramari Pranayama on health—a systematic review. *J Tradit Med Complement* 2018; 8: 11-6.
18. Hasani Sadi S, Vaezi A. Study of the effect of yoga exercises on anxiety and sleep quality of patients with chronic heart failure in Kerman city in 2015. *Daneshvar Medicine* 2015; 24: 35-45.
19. İltter SM, Ovayolu Ö. The Effect of pranayama applied to hemodialysis patients on fatigue: A randomized controlled trial. *Holist Nurs Pract* 2023; 37: 318-29.
20. Chakrabarty J, Vidyasagar M, Fernandes D, et al. Effectiveness of pranayama on cancer-related fatigue in breast cancer patients undergoing radiation therapy: A randomized controlled trial. *Int J Yoga* 2015; 8: 47-53.
21. Gündođdu F, Koçaşlı S. The effects of pranayama or deep breathing exercises on fatigue and sleep quality in women receiving radiation for breast cancer. *Oncol Nurs Forum* 2023; 50: 509-20.
22. Pastier N, Jansen E, Boolani A. Sleep quality in relation to trait energy and fatigue: An exploratory study of healthy young adults. *Sleep Sci* 2022; 15: 375-9.