Int J Epidemiol Health Sci 2021;2: e21
doi: http//doi.org/10.51757/IJEHS.2.10.2021.245581

Original Article

Breathing exercise and respiratory parameters in chronic kidney disease patients with hemodialysis

Aliakbari, F. [1,*] , Safei, F. [2], Deriss, F. [3] , Salehitali, S. [1]

[1] Community-Oriented Nursing Midwifery Research Center, School of Nursing and Midwifery , Shahrekord University of Medical Sciences, Shahrekord, Iran
[2] Critical Care Nursing Unit, Imam Ali Hospital, Shahrekord University of Medical Sciences, Shahrekord, Iran
[3] Department of Epidemiology and Biostatistics, School of Health, Shahrekord University of Medical Sciences, Shahrekord, Iran

***. Corresponding author:** F. Aliakbari, Community-Oriented Nursing Midwifery Research Center, School of Nursing and Midwifery , Shahrekord University of Medical Sciences, Shahrekord, Iran. E-mail: aliakbarifa@gmail.com.

Cite this article: Aliakbari, F.; Safei, F.; Derris, F.; Salehitali, S. Breathing exercise and respiratory parameters in chronic kidney disease patients with hemodialysis. Int J Epidemiol Health Sci 2021;2: e21. Doi:10.51757/IJEHS.2.10.2021.245581.

Abstract

Introduction: Patients with chronic renal disease are at risk for dyspnea, which can have a negative impact on their quality of life. The current study aims to investigate the influence of breathing exercise on respiratory parameters in hemodialysis patients due to a lack of agreement on the efficacy of breathing exercise in the respiratory status of hemodialysis patients.

Method: Participants were randomly assigned to one of two groups in this single-blind clinical investigation (intervention and control). Under the supervision of a nurse, the intervention group practiced breathing interventions (deep and slow breathing) for eight sessions over the course of a month. Data was collected using two questionnaires (demographic and respiratory parameter checklist).

Results: There was a significant change (P=0.000) between the pre- and post-scores of the respiratory score in the intervention and control groups.

Conclusion: Because breathing intervention is beneficial in lowering dyspnea and improving respiratory parameters, nurses should consider using it as an appropriate therapy for these patients due to its simplicity and low cost.

Keywords: Hemodialysis, Deep breathing, Physiological parameters, Chronic kidney disease, End-stage of renal disease

Introduction

Chronic Kidney Disease (CKD) is a disease with a poor prognosis that causes the loss of renal function and progresses to the end stages of renal disease (ESRD) (1,2). Continuous hypertension, fatigue, dizziness, limb edema, shortness of breath, tachycardia, pericarditis, pericardial effusion, seizure, and restless leg syndrome are all symptoms of this condition (1,3). The patient's physiological and psychological function are both reduced as a result of this disease (2). In America, there were 125480 ESRD patients registered in 2107, with a standardized rate of 340.7 per million (2). The frequencies of these patients are increasing in Iran as well. At the end of 2014, there were roughly 53000 individuals with advanced renal failure, with 25934 of them on dialysis (4, 5). Because of the long-term chronicity of the disease, patients may require and suffer from life-long dialysis, dietary restrictions, a heavy financial burden of treatment, as well as dialysis blockage, pain in the fistula, fatigue, and changes in vision, all of which can lead to psychiatric disorders (4, 6, 7). Anxiety (46.72 percent) is the second most frequent psychological condition in dialysis patients, following depression (55.9%). (8). Furthermore, some research reveal that patients are more anxious during dialysis sessions (8).

Anxiety can raise a person's vulnerability, aggravate the disease, and shorten the length of treatment. Continued worry in dialysis patients raises mortality, increases the risk of suicide by aggravating symptoms, lowers quality of life, and hinders recovery (9-12). The majority of patients' seemingly unreasonable behaviors, such as inactivity, may be attributed to anxiousness in these patients, in which they dispute the personnel and doctors (13). Many studies have shown, however, that prompt diagnosis and treatment of these people can significantly enhance their quality of life and sleep, as well as reduce inappropriate behavior (6, 9-11). Anxiety raises heart rate, blood pressure, and respiration rate by activating the sympathetic nervous system and producing adrenaline and norepinephrine, whereas hemodialysis affects vital indicators such hypotension, respiratory failure, and tachycardia. As a result, anxiety-controlling therapies can also enhance these patients' physiological markers (3, 14, 15). The pharmacological technique cannot be utilized due to low renal function because of the numerous difficulties of anxiolytic medications and their unfavorable effects on hemodialysis (2, 12, 13). To manage anxiety in these people, non-drug approaches such as music, relaxation techniques, regular exercise, hypnosis, Quran, hope therapy, and yoga have been used in recent years (16,17). Nurses are one of the long-standing groups in contact with these individuals. They are in charge of the physical and mental well-being of patients (14). Nurses play a critical role in encouraging happy emotions in patients by developing and designing techniques to deal with negative emotions (14). One of these strategies is to create safe, non-prescriptive interventions like deep breathing, which is a low-cost relaxing technique that may be practiced with minimal instruction (2). These breathing exercises regulate respiratory rate and respiratory count by opening alveoli and relaxing muscles, resulting in a decrease in respiratory rate and respiratory count while promoting relaxation and regular breathing (5). Deep breathing has been shown to increase parasympathetic system activity, reduce anxiety, and improve vital signs in athletes, according to research.

Deep breathing, according to other studies, maintains a balance between the sympathetic and vagal systems and, as a result, improves heart rate. Deep breathing also helps individuals with advanced heart illness, as well as improving fatigue, sleep, and overall quality of life (14, 15). The traditional approach to treating psychiatric diseases including anxiety and depression relies on drug therapy. These medications irritate dialysis patients due to their diminished renal function and consequences. Techniques like as serenity and deep breathing can be applied, and they are also inexpensive (2). Because rapid changes in heart rate, blood pressure, and arrhythmias can lead to sudden death in hemodialysis patients, it's best to keep an eye on them throughout dialysis (15). The high incidence of anxiety has a negative impact on patients' quality of life and therapy, particularly in terms of physiological indicators (respiratory rate). Respiratory exercises can be utilized as a non-pharmacological, low-cost, simple, inexpensive, and low-level option to regulate anxiety and avoid dangerous chemical therapies in these patients (16, 17). It's yet unclear whether respiratory training provided by a nurse can assist these patients experience less dyspnea during dialysis. As a result, the purpose of this study was to see how breathing exercise affected hemodialysis patients' respiratory indices.

Method

This was a single-blind clinical trial that was registered with the Iran Clinical Trial Center under the code IRCT2017100736611N1. ESRD patients who completed two to four-hour sessions in a hemodialysis unit connected with Shahrekord University of Medical Sciences provided the study sample.

Patients must be 18 years old, have been on hemodialysis for at least three months with two to three sessions per week, have no non-hearing impairment or mental disorders confirmed by psychiatrists, and have no underlying respiratory illness that makes performing respiratory exercises and participating in the study difficult (2). Patients who were hospitalized or who did not have a regular dialysis referral for any reason during the study period were excluded (2).

A total of 100 eligible male and female patients were chosen at random and divided into two groups based on dialysis day. Six days of the week were randomly

divided into two groups of three days for the experimental and control groups using a lottery (both for three days a week). Before defining the days in each group, it is vital to emphasize that hemodialysis occurs two or three times every week. They were divided into two groups of 50, one control and the other experimental, after acquiring written agreement. Demographic questionnaires and a respiratory indicators checklist, which included breathing rate and VO2max, were used to collect data. Age, sex, education level, marital status, occupation, duration of chronic renal illness, hospitalization history, and drug intake were all included in the demographic data. The patient's chest movements per minute were used to determine his breathing rate. An assessment that was blind to the type of intervention was used to collect data. The level of respiratory parameters in the control and test groups were measured and recorded 10 minutes before the intervention and 10 minutes after the intervention, respectively (2).

In the intervention group, these activities were completed in three phases, with the nurse providing direction in three different methods at each stage:

A) For patients, ten minutes of breathing exercises under the direct direction of a nurse.

B) The audio device played instructions for 10 minutes at the start of the respiratory program (abdominal proper breathing, breathing speed, body situation, and methods of abdominal muscle contraction during the bellows and exhalation), and then the music played while the patients did calm and deep breathing with the nurse.

C) At this point, the patients conducted 30 minutes of breathing exercises under indirect supervision (18). The nurse supervised all three stages during the first session, and during subsequent sessions, the breathing exercises were performed with the nurse's indirect assistance. Of course, the nurse had to ensure that the patient had learnt the exercises and that he or she had not dozed off throughout the training session. The control group received standard medical treatment. The data was encoded and entered into SPSS software version 21 once it was collected. Descriptive statistics (frequency, percentage, mean, standard deviation) and inferential statistics were used to examine the data (independent t-test, Chi-square test, repeated values). P less than 0.05 was deemed to be the significant level.

Results

Five patients in the intervention group refused to participate, and five persons in the control group did not match the research's inclusion requirements, therefore 50 people in each group were enrolled in the

main trial. The intervention and control groups had similar mean ages of 64.94 11.76 years and 60.12 15.63 years, respectively. There were 34 (68 percent) males in the control group and 35 (70 percent) guys in the test group. Other socioeconomic characteristics

such as gender, age, locality, marital status, education level, job, and so on had no significant link with hospitalization history (P >0.05). (Table 1).

The mean and standard deviation of respiratory rate and VO2max were measured in each session. Table 2 shows the outcomes of the variables investigated. There was a significant difference in the mean of the difference between the respiratory rate scores before and after the intervention (F=418.584, df=1, P-value=0.000). There was a significant statistical difference in the mean VO2max score before and after intervention (F=2.538, df=6.305, P-value=0.018).

The mean respiratory rate before and after intervention was substantially greater in the first session than in the others, but there was no statistically significant difference between the remaining sessions. In both the experimental and control groups, the mean difference before and after the respiratory rate in the research sessions was statistically significant. The experimental group's respiratory rate was substantially different from the control group before and after the intervention in all sessions (F = 2.423, df = 6.305, P-value = 0.023).

Table 1. Demographic characteristics and physiological indices of the studied samples in the control and test groups

Variables		Test group N(%)	Control group N(%)	P-value
Sex	Female	15(30)	16(32)	0.829
	Male	35(70)	34(68)	
Address	City	28(56)	30(60)	0.685
	Village	22(44)	20(40)	
marital status	Single	1(2)	4(8)	0.169
	Married	49(98)	46(92)	
Level of Education	Illiterate	30(60)	26(52)	0.672
	Under the diploma	11(22)	16(32)	
	diploma	7(14)	7(14)	
	Higher than diploma	2(4)	1(2)	
Job	housewife	15(30)	17(34)	0.835
	Free	9(18)	10(20)	
	Retired	26(52)	23(46)	
History of hospitalization	Yes	44(88)	46(92)	0.505
	No	6(12)	4(8)	
Age (Mean ± SD)		64.94±11.76	60.12±15.63	0.085

Table 2. The mean and standard deviation of the pre- and post- anxiety scales in each session

Group Session		VO2max	Breath per minute (Mean±SD)
First	intervention group	17.4 (7.2)	24.2 ±1.11
	Control group	17.1 (5.2)	24.04±0.51
	P-value	0.97	0.90
Second	intervention group	20.4(8.7)	20.76±1.84
	Control group	17.2(5.7)	23.06±1.43
	P-value	0.03	0.04
Third	intervention group	20.9 (8.4)	19.65±1.25
	Control group	17.1(5.4)	23.12±1.43
	P-value	0.02	0.02
Fourth	intervention group	20.9 (8.4)	18.49±1.06
	Control group	17.1 (5.4)	23.22±0.63
	P-value	0.02	0.04
Fifth	intervention group	21.4 (8.4)	18.62±1.23
	Control group	17.0 (5.4)	23.11±0.43
	P-value	0.03	0.02
Sixth	intervention group	20.9 (8.4)	17.67±1.17
	Control group	17.2 (5.4)	23.00±0.70
	P-value	0.02	0.03
Seventh	intervention group	21.2(8.4)	17.64±1.35
	Control group	17.1(5.4)	23.02±0.68
	P-value	0.01	0.03
Eighth	intervention group	21.5(8.2)	17.71±1.06
	Control group	17.4(5.3)	23.00±0.76
	P-value	0.01	0.02
Total	intervention group	20.4(8.3)	18.76±1.84
	Control group	17.2(8.4)	20.54±1.43
	P-value	0.000	0.018

Discussion

Dyspnea and the number of breaths per minute decreased during dialysis, whereas VO2 max increased dramatically, according to the study's findings. Both intradialytic cycling and pedometer programming enhanced aspects of physical function, according to Bohm and colleagues. In hemodialysis programs, neither intervention had a substantial effect on aerobic capacity (19).

An intra-dialytic training program increased sub-maximal aerobic metabolism and endurance exercise capacity, according to a study by Reboredo and colleagues (20). Zoonmer and colleagues also discovered that parasympathetic stimulation lowers the respiratory rate, heart rate, and pain in patients with chronic pain (21). Bilo and colleagues discovered that slow, deep breathing lowers systolic blood pressure as well (22).

Because the mechanism of these respiratory workouts is the expansion of the alveoli as a result of an increase in the parasympathetic system's activity and the sympathetic system's and tone-vagal system's balance, it appears that they diminish positional anxiety and physiological parameters (systolic and diastolic blood pressure, and respiratory rate). As a result, the findings revealed that following a respiratory intervention, the mean of situational anxiety fell dramatically. Bennett et al. discovered that yoga and deep breathing training, which is one of the phases of yoga, can help hemodialysis patients feel less depressed and enhance their quality of life (23). Aerobic exercise was another treatment option for these patients.

Afshar and colleagues found that moderate-intensity aerobic exercise during the first two hours of dialysis enhanced dialysis patients' quality of life and sleep (24). Stanly Rat et al. found that complete breathing method enhances health-related quality of life and lowers heart rate variations, anxiety, exhaustion, insomnia, and pain in hemodialysis patients in a review research (25). As a result, the findings of this study are similar with our findings, indicating that deep and calm breathing reduces respiratory rate in hemodialysis patients. Kiani and colleagues found that Benson's relaxation approach did not improve total anxiety symptoms in hemodialysis patients in their study (26).

In their study "Exercise-Based Interventions in Hemodialysis Patients: A Systematic Review with a Meta-Analysis of Randomized Controlled Trials," Bogataj and colleagues found that overall exercise programs for dialysis patients have significant positive effects on 6-minute walk test performance, oxygen consumption, and inflammation. However, there were no statistically significant differences between this sort of exercise and aerobic or resistance training alone (27).

So, while contradictory studies on non-pharmacological treatments have shown that non-pharmacological methods are not always effective in dialysis patients, the relaxation method used in this study is simple to learn, requires no special equipment or costs, and can be followed by all patients in the sleep mode. As a result, patients can learn these activities quickly, either during dialysis or by boosting their index and reaping the benefits. We will prevent these patients from experiencing different economic and psychological expenses, as well as costs to themselves and their family, by intervening physiologically. These patients will be able to practice these breathing exercises without the assistance of a professional and qualified individual, which will cost them money. By teaching this strategy, the treatment team and patients can take an effective step toward reducing anxiety and improving physiological indices in these individuals.

The limitations of this study are that, first, cultural, social, psychological, family and educational differences in dialysis patients can be evaluated in determining of the severity of anxiety symptoms in patients not under researcher’s control; second, the likelihood of a sample loss due to a chronic illness was high; third, because of the patient’s age, the complications of dialysis have led to interruptions in breathing exercises which were not controlled by the researcher. Researchers recommend conducting a similar study with a larger sample size and more sessions. Due to the loudness of dialysis and packed devices, it is preferable to utilize the Hennessy Fei instead of the sound system when instructing these patients. It is best to employ digital monitoring to obtain blood pressure, heart rate, and respiration for the researcher's convenience, and these workouts will eventually continue during dialysis sessions.

Conclusion

The findings of this study revealed that during dialysis, deep and silent breathing lowered respiratory rate and dyspnea enhanced VO2max. These exercises can be a useful tool for improving physical and mental health in these people, and they come at no cost to them. These breathing exercises are also simple to conduct because these patients are unable to participate in out-of-home sporting activities due to their physical limitations. These exercises also don't require any equipment or space, and the patient can do them while lying down. Nurses can play an important role in hemodialysis by providing health care, regulating symptoms, reducing anxiety, and, as a result, enhancing the physiological indices of patients undergoing hemodialysis. The findings of this study can be used to develop a strategy for reducing anxiety severity and promoting hemodynamic improvement in these patients. However, it appears that a study with such a large number of samples and a long intervention period could aid in the generalization of the findings.

Application of Research Findings in clinical practices

Because it reduces anxiety and improves vital signs, this non-pharmacological method can enhance treatment responsiveness and provide better dialysis care for these patients. It's also regarded as a straightforward treatment option with few drawbacks. The dialysis ward nurse pays close attention to the patient, and the patient benefits as a result.

Acknowledgement

The Shahrekord University of Medical Sciences' Research and Technology Deputy funded this study.

Conflict of interest

There is no conflict of interest.

References

1. Hinkle, J.L., Cheever, K.H. Brunner & Suddarth's textbook of medical-surgical nursing (12th edition). Lippincott Williams & Wilkins, Philadelphia, USA. 2010.
2. Saran, R., Robinson, B., Abbott, K.C., Bragg-Gresham, J., Chen, X., Gipson, D., et al. US Renal Data System 2019 Annual Data Report: Epidemiology of Kidney Disease in the United States. Am J Kidney Dis 2020;75(1 Supl. 1):A6–A7.
3. Shahgholian, N., Jazi, S.K., Karimian, J., Valiani, M. The effects of two methods of reflexology and stretching exercises on the severity of restless leg syndrome among hemodialysis patients. Iran J Nurs Midwifery Res 2016;21(3):219-24.
4. Hmwe, N.T.T., Subramanian, P., Tan, L.P., Chong, W.K. The effects of acupressure on depression, anxiety and stress in patients with hemodialysis: A randomized controlled trial. Int J Nurs Stud 2015;52(2):509-18.
5. Tayebi, A., Dehkordi, A.K., Ebadi, A., Sahraei, H., Einollahi, B. Effects of aromatherapy with lavender on sleep quality of hemodialysis patients: a clinical trial. Evidence-based care J 2015; 5(15):65-74.
6. Rahimipour, M., Shahgholian, N., Yazdani, M. Effect of hope therapy on depression, anxiety, and stress among the patients undergoing hemodialysis. Iran J Nurse Midwif Res 2015;20(6):694-9.
7. Janiszewska, J., Lichodziejewska-Niemierko, M., Golebiewska, J., Majkowicz, M., Rutkowski, B. Determinants of anxiety in patients with advanced somatic disease: Differences and similarities between patients undergoing renal replacement therapies and patients suffering from cancer. Int Urol Nephrol 2013;45(5):1379-87.
8. Turkistani, I., Nuqali, A., Badawi, M., Taibah, O., Alserihy, O., Morad, M., Kalantan, E. The prevalence of anxiety and depression among end-stage renal disease patients on hemodialysis in Saudi Arabia. Ren fail 2014;36(10):1510-5.
9. Feroze, U., Martin, D., Reina-Patton, A., Kalantar-Zadeh, K., Kopple, J.D. Mental health, depression, and anxiety in patients on maintenance dialysis. Iran J Kidney Dis 2010;4(3):173-80.
10. Preljevic, V.T., Osthus, T.B., Os, I., Sandvik, L., Opjordsmoen, S., Nordhus, I.H., Dammen, T. Anxiety and depressive disorders in dialysis patients: association to health-related quality of life and mortality. Gen Hosp Psychiatry 2013;35(6):619-24.
11. Macaron, G., Fahed, M., Matar, D., Bou-Khalil, R., Kazour, F., Nehme-Chlela, D., Richa, S. Anxiety, depression and suicidal ideation in Lebanese patients undergoing hemodialysis. Community Ment Health J 2014;50(2):235-8.
12. Vasilopoulou, C., Bourtsi, E., Giaple, S., Koutelekos, I., Theofilou, P., Polikandrioti, M. The impact of anxiety and depression on the quality of life of hemodialysis patients. Glob J Health Sci 2016;8(1):45-55.
13. Cohen, S.D., Cukor, D., Kimmel, P.L. Anxiety in Patients Treated with Hemodialysis. Clin J Am Soc Nephrol 2016;11(12):2250-2255.
14. Lovink, M.H., Kars, M.C., Man-van Ginkel, J.M., Schoonhoven, L. Patients' experiences of safety during haemodialysis treatment–a qualitative study. J Adv Nurs 2015;71(10):2374-83.
15. Charytan, D.M., Foley, R., McCullough, P.A., Rogers, J.D., Zimetbaum, P., Herzog, C.A., Tumlin, J.A. Arrhythmia and sudden death in hemodialysis patients: protocol and baseline characteristics of the Monitoring in Dialysis Study. Clin J Am Soc Nephrol 2016;11(4):721-34.
16. Hmwe, N.T., Subramanian, P., Tan, L.P., Chong, W.K. The effects of acupressure on depression, anxiety and stress in patients with hemodialysis: a randomized controlled trial. Int J Nurs Stud 2015;52(2):509-18.

17. Ferrario, M., Moissl, U., Garzotto, F., Cruz, D.N., Clementi, A., Brendolan, A., et al. Effects of fluid overload on heart rate variability in chronic kidney disease patients on hemodialysis. BMC Nephrol 2014;15:26.
18. Salehi, B., Salehi, M., Nsirnia, K., Soltani, P., Adalatnaghad, M., Kalantari, N., et al. The effects of selected relaxing music on anxiety and depression during hemodialysis: A randomized crossover controlled clinical trial study. Art Psychotherapy 2016;48:76-80.
19. Bohm, C., Stewart, K., Onyskie-Marcus, J., Esliger, D., Kriellaars, D., Rigatto, C. Effects of intradialytic cycling compared with pedometry on physical function in chronic outpatient hemodialysis: a prospective randomized trial, Nephrol Dial Transplant 2014;29(10):1947–55.
20. Reboredo, M.M., Neder, J.A., Pinheiro, B.V., Henrique, D.M., Lovici, J.C., Paula, R.B. Intra-dialytic training accelerates oxygen uptake kinetics in hemodialysis patients, Eur J Prev Cardiol 2015;22(7): 912–919.
21. Zunhammer, M., Eichhammer, P., Busch, V. Do cardiorespiratory variables predict the antinociceptive effects of deep and slow breathing? Pain Med 2013;14(6):843-54.
22. Bilo, G., Revera, M., Bussotti, M., Bonacina, D., Styczkiewicz, K., Caldara, G., et al. Effects of slow deep breathing at high altitude on oxygen saturation, pulmonary and systemic hemodynamics. PloS one 2012;7(11):e49074.
23. Bennett, P.N., Parsons, T., Ben-Moshe, R., Neal, M., Weinberg, M.K., Gilbert, K., et al. Intradialytic Laughter Yoga therapy for haemodialysis patients: a pre-post intervention feasibility study. BMC Complement Altern Med 2015;15(1):176.
24. Afshar, R., Emany, A., Saremi, A., Shavandi, N., Sanavi, S. Effects of intradialytic aerobic training on sleep quality in hemodialysis patients. Iran J Kidney Dis 2011;5(2):119-23.
25. Stanley, R., Leither, T.W., Sindelir, C. Benefits of a holistic breathing technique in patients on hemodialysis. Nephrol Nurs J 2011;38(2):149-52.
26. Kiani, F., Zadeh, M., Shahrakipour, M. The effect of Benson’s relaxation method on hemodialysis patients' anxiety. Biomed Res-Tokyo 2017; 28(3):1075-1080.
27. Bogataj, Š., Pajek, M., Pajek, J., Ponikvar, J.B., Paravlic, A.H. Exercise-Based Interventions in Hemodialysis Patients: A Systematic Review with a Meta-Analysis of Randomized Controlled Trials. J Clin Med 2020;9(1):43.

