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Comparative Efficacy of Benson Relaxation and Structured Breathing Exercises on Sleep Quality in Patients Undergoing Hemodialysis: A Randomized Controlled Trial

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ABSTRACT

Background: Sleep problems are common in chronic kidney disease, especially end stage renal disease (ESRD), affecting daily life and increasing health risks.

Objective: To compare the impact of Benson relaxation technique and breathing exercise on sleep quality in hemodialysis patients

Patients and Methods: This randomized controlled trial included 102 hemodialysis patients of both sexes with ESRD. The patient's' ages varied between 55 and 65 years, and their BMI was 25 to 29.9 kg/m^2. They were randomly subdivided into 3 groups (A, B, and C). All groups received their prescribed medical treatment and hemodialysis; in addition, Group A (n=34) practiced the Benson relaxation technique, while Group B (n=34) performed diaphragmatic breathing exercises, and Group C (n=34) received no additional intervention. The study was prolonged for 8 weeks, with 3 sessions each week. The assessment of sleep quality involved the measurement of Pittsburg Sleeping Quality Index (PSQI).

Results: There was a significant change in PSQI index in the 3 groups after the intervention (P<0.05). Consequently, post-hoc tests exhibited a significant difference between groups A and C, groups B and C, as well as groups A and B (P<0.05). Furthermore, there was a significant alteration in the scores of PSQI within every group.

Conclusion: 8 weeks of training with Benson relaxation technique had a more significant effect on sleep quality than breathing exercise or medications only.

Keywords: Benson relaxation technique**,** Diaphragmatic Breathing Exercise, sleep quality, Hemodialysis, Chronic kidney disease.

INTRODUCTION

A major public health concern, chronic kidney disease (CKD) is characterized by abnormalities of kidney structure or function that have been present for more than three months and have particular health consequences [1].

The simple diagnostic criteria for CKD include: either morphological changes in the kidneys or corresponding changes in laboratory or imaging studies, and a reduction in the glomerular filtration rate (GFR) of less than 60 ml/min/1.73m^2 for a period of three months or longer, irrespective of whether other symptoms of kidney damage are present or not [2].

People with CKD, especially those with ESRD, frequently have sleep problems. Eighty percent of ESRD patients on dialysis have been shown to have sleep issues, with daytime drowsiness being the most often reported symptom. Lack of sleep and poor sleep quality lower general QoL and can cause a number of additional problems, such as weakened immunity and an increased risk of CVD. Fatigue, excessive daytime drowsiness, decreased health-related QoL, increased morbidity, and increased mortality are all consequences of sleep disruptions [3].

Hemodialysis may induce sleep disturbances. In addition to lowering sleep quality, sleep problems can affect the immune system. Poor quality sleep lowers QoL, which can lead to early mortality and adverse effects on the immune system, which can result in CVD, the primary cause of death for kidney disease patients [4]. The Pittsburgh Sleep Quality Index (PSQI) is a self-reported questionnaire that assesses sleep quality according to seven distinct sleep disorder categories [5].

One of the most popular relaxation techniques is Benson's technique, which was discovered by Herbert Benson. It is easy to master and results in complete muscular relaxation. One of the most advanced methods for relaxing muscles is the BR technique, which reduces sympathetic and parasympathetic stimulation and regulates the hypothalamus. The mindfulness practices included in this relaxation approach can help with a variety of psychological and physical ailments, including pain, stress, anxiety, sadness, mood, and self-esteem [6].

Incorporating relaxation methods into nursing treatments has shown considerable advantages for those receiving hemodialysis, including improved physical and psychological well-being and lower stress levels. Muscle tension, physiological strain, cardiovascular and respiratory parameters, and stress-induced muscle spasms are all reduced by suppressing sympathetic

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nervous system activity, modulating catecholamine secretion, and regulating hypothalamic function [7].

Research has shown that the Benson Relaxation Technique (BRT) is an effective strategy for decreasing sleep disruptions in older persons, hemodialysis patients, and pregnant women with hypertension [8].

A relaxing technique called diaphragmatic breathing causes people to breathe more deeply and slowly. The diaphragm muscle is used by the person to pump oxygen into their lungs with each breath. Usually, autonomic arousal or anxiety causes rapid, shallow breathing. By altering breathing patterns to a more relaxed pattern, diaphragmatic breathing helps those who are anxious or have trouble sleeping [9].

As a type of relaxation treatment, breathing exercises have been demonstrated to improve the quality of sleep by causing a noticeable increase in body temperature that is followed by a compensatory decrease a few hours later. This ensuing drop in body temperature, which lasts for two to four hours after exercise, makes it easier to go asleep and stay asleep. Furthermore, breathing techniques enhance sleep by acting as a moderate physical stressor, which causes the brain to compensate by increasing the amount of deep sleep [10].

Therefore, it is possible to hypothesize that different relaxation techniques such as Benson's relaxation technique or diaphragmatic breathing could improve sleep quality on hemodialysis patients. Therefore, this investigation aimed to compare the impact of Benson's relaxation technique and diaphragmatic breathing on sleep quality on hemodialysis patients.

MATERIAL AND METHODS

Sample Size

The sample size was computed using G*power version 3.1.9.7. A previous power analysis was conducted using an α-error probability of 0.05 and a power (1-β error probability) of 0.95. The minimal sample size was determined to be 102 patients. The patients were randomly placed into three groups with equal numbers. Randomization to receive Benson relaxation technique or breathing exercise or only medication and hemodialysis sessions was performed by closed envelope. After seeing the envelope, a blinded researcher divided the patients into groups **(Figure 1).**

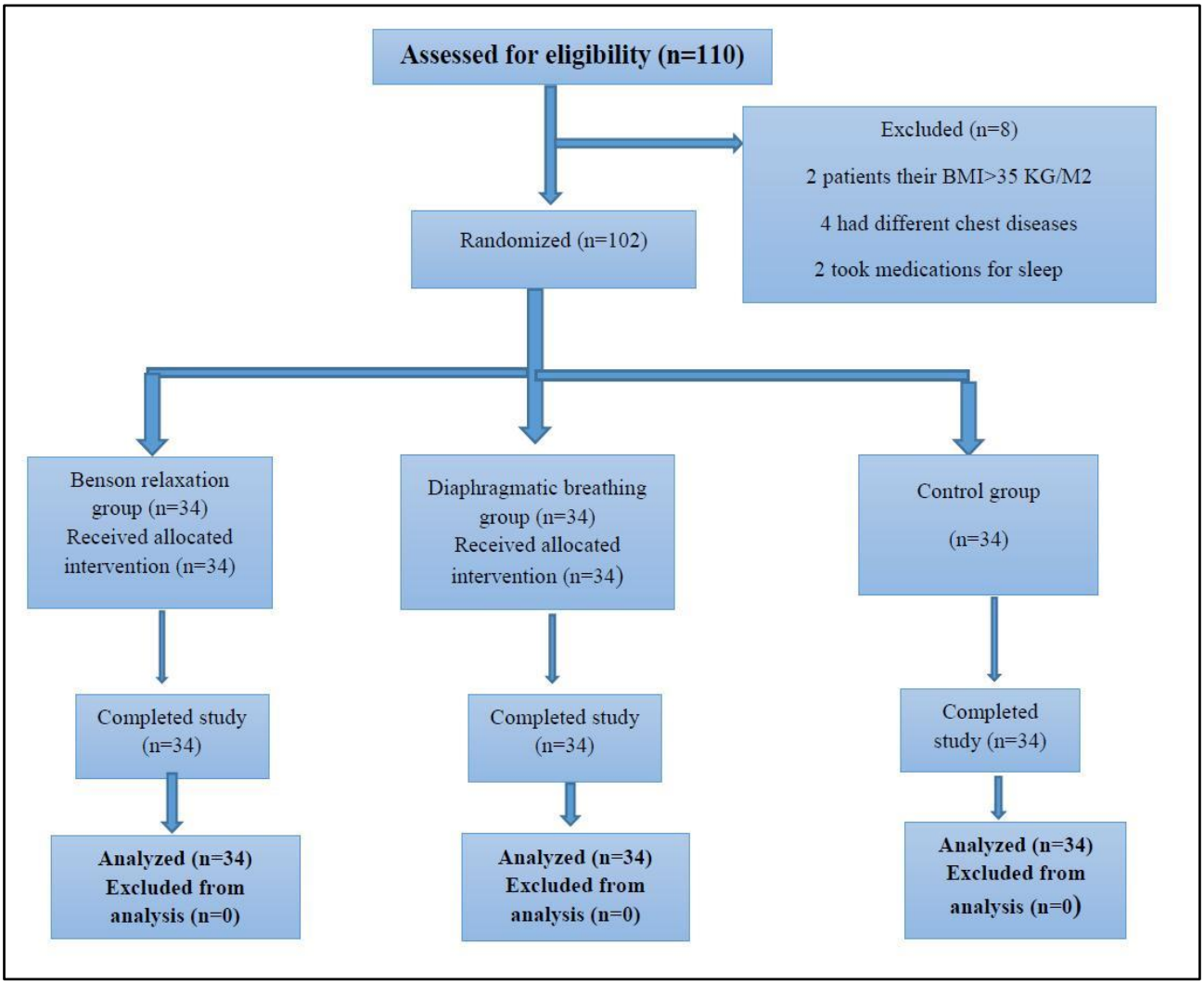

Figure (1): Sample size.

Participants

The study was planned as a prospective, parallel randomized controlled experiment. This investigation was carried out in the hemodialysis unit of Tala Central Hospital. 102 hemodialysis patients of both sexes with ESRD (aged 55 to 65) agreed to participate and were randomly assigned to three groups (A, B, and C). Group A: Benson relaxation method; Group B: diaphragmatic breathing exercise; and Group C: control. The inclusion criteria included patients who had been on hemodialysis for at least one year, with two to three sessions per week lasting 3-4 hours each, and who had been diagnosed with end stage renal failure (stage 5 CKD) and had been on maintenance regular HD for more than three months. They were receiving HD through an uncomplicated arm arteriovenous (AV) fistula. Their BMI was 25-29.9 kg/m² and under medical supervision. Exclusion criteria were as follows: Patients undergoing pharmacological or non-pharmacological sleep medications. Patients with resting systolic blood pressure more than 200 mmHg and/or diastolic blood pressure greater than 120 mmHg. Patients with mental health problems and cognitive impairment owing to the inability to educate them how to develop relaxation techniques and breathing exercises. Patients suffering from unstable angina, uncontrolled cardiac arrhythmia, decompensated heart failure, acute pericarditis, or myocarditis.

Procedures: At the start of the study, all participants had a physical evaluation by a competent physiotherapist to evaluate their eligibility to participate. Each participant's height (cm) and weight (kg) were recorded, and BMI was calculated.

Interventions

Benson relaxation technique for Group (A): The processes of doing the BRT were explained to all patients on their initial appointment prior to beginning the program. Each patient received BRT training for 20 minutes during the third hour of their hemodialysis session, three times a week for eight weeks. The steps of Benson's relaxation technique were as follows: patients were encouraged to sit comfortably and close their eyes. They then engaged in progressive relaxation of all muscle groups, beginning with the feet and gradually going upward to the face, achieving full physical relaxation. Breathing was done via the nose, paying close attention to the sound of breathing. For 20 minutes, patients silently repeated the word 'one' while exhaling. When other ideas occurred, they were recognized without judgment with the phrase "oh, well," and the focus was gently transferred to the repetition [11].

Diaphragmatic breathing exercise for Group (B): In the first visit before starting the program, the steps of doing the exercise were explained to all the patients. The patients in this group were received diaphragmatic breathing exercise for 30 minutes for each session, 6 sets, 5 repetitions in each set, for 8 successive weeks, 3 times per week. Patients were positioned in a semi-Fowler's posture with the head and back fully supported, ensuring relaxation of the abdominal wall. From functional residual capacity to total lung capacity, they were told to breathe deeply and slowly through their noses while holding their breath for at least three seconds. Relaxation was emphasized to allow the patient to perceive abdominal expansion during inspiration. Exhalation was performed through the mouth. Patients positioned a hand on the rectus abdominis, just below the anterior costal border, to feel the movement of the abdomen during inspiration and expiration in order to improve proprioceptive awareness. The exercise was repeated (with rest as needed) until satisfactory movement was achieved [12].

The Control group for Group (C): Patients in this group were kept on medical treatment and hemodialysis alone.

Outcome measures

The Pittsburg Sleeping Quality Index (PSQI):

It was used to determine the patient's sleep quality. All patients were requested to take the Arabic version of the PSQI before and after 8 weeks of training, as well as a personal interview, following which the therapist determined their overall score. The PSQI allows to evaluate the quality and disruptions of sleep. The questionnaire consists of 19 self-assessed questions that are classified into seven components: 1) sleep quality; 2) sleep latency; 3) sleep length; 4) sleep efficiency; 5) sleep disorders; 6) sleep medication usage; and 7) daytime drowsiness. Each component is assigned a score from 0 to 3. The total of the scores from these seven components yields a score ranging from 0 to 21. It defines good sleep quality as PSQI < 5 and poor sleep quality as PSQI >5 [13].

Ethical approval:

This study was approved by Cairo University's Faculty of Physical Therapy's Research Ethics Committee (No.: P.T.REC/012/005188, date: 2.04.2024). Each patient was given a thorough explanation of the study's goals and procedures prior to filling out the informed consent form. Throughout its implementation, the study complied with the Helsinki Declaration.

Statistical analysis: For all statistical studies, SPSS software version 22 was used. ANOVA was used to compare the attributes of the groups, such as age, height, weight, and BMI. Chi^2 test was used to compare the three groups based on sex. Additionally, MANOVA was conducted to compare the PSQI of the three groups. Nonetheless, pairwise comparisons were carried out to find the significant differences within the groups, and multiple comparisons were carried out to find the differences between each group and each other group. The Kolmogorov-Smirnov test was used to check for data normality. Additionally, the homogeneity of the data was tested using Levene's test. For every statistical test, the significance threshold was set at $P < 0.05$.

RESULTS

Typically, 102 participants were enrolled in this study and distributed randomly in 3 groups (34 patients per group). Demographic data analysis was conducted and indicated that there was no significant difference between the three groups regarding their age, weight, height, BMI, and sex distribution as the P-values were more than 0.05 **(Table 1).**

Table (1): Comparison of characteristics between groups A, B, and C.

	Group A (Benson relaxation) n=34		**Group B (Diaphragmatic) n=34**		**Group C (Control) n=34**		**F-value**	**P-value**
	Mean ± SD		**Mean ± SD**		**Mean ± SD**			
Age (years)	59.5±3.1		60.2±3.3		60.1±3.2		0.456	0.633
Weight (Kg)	74.5±6.8		77.7±8.1		77.8±8.3		2.061	0.133
Height (cm)	165±6.8		167.8±7.6		168±7.7		1.586	0.210
BMI (kg/m^2)	27.3±1.4		27.7±1.2		27.9±1.3		1.251	0.291
	Male	Female	Male	Female	Male	Female	X^2	
Sex distribution	20(58.8%)	14(41.2%)	21(61.8)%	13(38.2%)	21(61.8%)	13(38.2%)	0.082	0.960

*: significant.

The study indicated that no statistical variations related to the PSQI were detected between the three groups before treatment but there was a significant difference after intervention. Consequently, post-hoc tests exhibited a significant difference between groups A and C, groups B and C, as well as groups A and B (P<0.05). Furthermore, there was a significant alteration in the scores of PSQI within every group. The percentage of the reduction for group A was 65.5%, which was higher than group B (43.1%), however, group C showed a significant increase with percentage of change of 16.8% **(Table 2).**

Table (2): Comparison between groups regarding PSQI.

PSQI	**Group A (Benson relaxation) n=34**	**Group B (Diaphragmatic) n=34**	**Group C (Control) n=34**	**Comparison between group**	
	Mean ± SD	**Mean ± SD**	**Mean ± SD**	**F-value**	**P-value**
Before Intervention	16.88±1.18	17.38±1.34	16.71±1.62	2.152	0.122
After Intervention	5.82±1.17	9.88±1.15	19.15±1.08	123.8	P<0.05*
percentage of change	65.5%	43.1%	16.8%		
Comparison within group	P<0.05*	P<0.05*	P<0.05*		
Post-intervention Multiple Comparisons					
			Mean difference	**P-value**	
Group (A) vs. Group (B)			-4.06	P<0.05*	
Group (A) vs. Group (C)			-13.3	P<0.05*	
Group (B) vs. Group (C)			-9.26	P<0.05*	

*: significant.

DISCUSSION

The results of this study demonstrated that the Benson relaxation technique and diaphragmatic breathing exercise had a valuable and significant effect on sleep quality in patients undergoing hemodialysis, but Benson relaxation technique had more significant differences than diaphragmatic breathing exercise and medication only.

Many factors contribute to the development of sleep disturbance symptoms in people with severe chronic kidney disease. These issues include physiological alterations linked to impaired kidney function, dialysis-induced sleep disruptions, inadequate sleep hygiene, and potential side effects from medications [14].

The current study revealed that the implementation of a relaxation technique led to a significant reduction in sleep disturbances among hemodialysis patients. This was reflected in the decrease of the PSQI score from 16.88±1.18 before the intervention to 5.82±1.17 after the intervention, with a statistically significant difference ($P < 0.05$). These findings are in line with prior studies that demonstrated the effectiveness of progressive muscle relaxation in enhancing sleep quality by inducing deep muscular relaxation and reducing mental tension and found statistically significant difference between pre and post training program among the patients regarding their PSQI level. PSQI score before intervention was 12.3±2.6, which decreased to 7.1±2.2 after PMR intervention with a remarkable statistically significant difference (P-value <0.001). Such interventions have been associated with improvements in psychological outcomes and better sleep patterns in patients with chronic conditions [15].

Previous study has shown that BRT reduces a person's stress responses by activating the parasympathetic nervous system. By decreasing the activity of the sympathetic nervous system, it lowers the amount of oxygen that the body uses. A feeling of relaxation is the outcome of the ensuing muscular relaxation. Attaining this state triggers the parasympathetic nervous system, which soothes the participants and helps them get rid of typical symptoms including sadness, anxiety, stress, pain, and sleep difficulties [16].

The current study's findings corroborate those of **Sayed and Younis** [10] who discovered that relaxation techniques greatly enhanced hemodialysis patients' overall sleep quality and its dimensions. They also discovered that all of the patients in the study reported having poor sleep quality one month prior to intervention. However, a month after using relaxation techniques, the majority of the patients in the study experienced a considerably higher overall quality of sleep ($P <0.05$). Their research reaffirmed how crucial it is to include relaxation training in standard medical care in order to improve patient wellbeing.

The result of diaphragmatic breathing exercise corroborated those of **Krismiadi *et al.*** [17] who conducted a study on hemodialysis patients and found a noteworthy enhancement in the quality of sleep in the intervention group following the implementation of deep breathing relaxation ($P=0.000<0.05$), suggesting its efficacy. In order to calm the body, they discovered that breath relaxation treatment alters breathing patterns, which can trigger parasympathetic neurons to limit the sympathetic central system's ability to regulate heart rate. In order to relieve tension and create a pleasant, relaxed body, deep breathing relaxation stimulates many senses, which in turn promotes the best possible sleep patterns.

CONCLUSION

Hemodialysis patients can greatly enhance their quality of sleep by using the Benson relaxation technique and diaphragmatic breathing. But according to our research, the Benson relaxation technique outperformed the diaphragmatic breathing exercise in terms of effectiveness.

So, this research may make attention on the importance of relaxation techniques and breathing training in dialysis unit and give hope to patients to make their daily activities better.

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