Effect of Muscle Stretching and Range of Motion Exercises on Sleep Quality and Anxiety among Hemodialysis Patients

[1]Saada Elsayed Rady [2]Shimaa Gomah Yousef [3]Samah Ramadan Ibrahim Elrefaey [4]Monira Samir Abdelhady.

[1, 2] Medical-Surgical Nursing, Faculty of Nursing, Damanhour University, Egypt

[3] Psychiatric and Mental Health Nursing, Faculty of Nursing, Benha University, Egypt

[4] Medical-Surgical Nursing, Faculty of Nursing, Fayoum University, Egypt

Abstract

Background: Sleep disturbance and anxiety are more common observed in hemodialysis patients than in healthy people and affect patients' clinical outcomes. **Aim:** determine the effect of muscle stretching and range of motion exercises on sleep quality and anxiety among hemodialysis patients. **Design:** A quasi experimental research design (pre-posttest control group) was employed. **Setting:** The study was accomplished at the hemodialysis unit at El Fayoum General Hospital. The unit worked three shifts per day /week expect Friday**. Subjects:** specific eligibility criteria were applied to purposively select a sample of 60 adult patients/both genders on maintenance hemodialysis. They further were partitioned into two groups 30 patients in each (study and control groups). **Tools:** three tools were handled: A structured interview questionnaire, The Pittsburgh Sleep Quality Index (PSQI) Scale and Spielberger State-Trait Anxiety Inventory scale/STAI: **Results:** a statistically significant difference was observed between the study and control groups in favor of the former concerning the Global Pittsburgh Sleep Quality Index(PSQI) score and anxiety level after 6 weeks of intervention in which more than half (60.0%) in the study group have no difficulty comparing to more than three quarters (76.7%) in the control group had somewhat difficulty with P = 0 .00. Also 70.0% in the study group had mild anxiety while, in the control group 53.3% had moderate anxiety. **Conclusion:** The study concluded that; muscle stretching and range of motion exercises have significant positive effect on sleep quality and anxiety level among patients on maintenance hemodialysis. **Recommendation:** The developed booklet with its simple instructions and illustrations should be utilized in hemodialysis unit as a teaching aid for hemodialysis patients. Intradialytic exercise programs should be incorporated into routine clinical practice.

Keywords: hemodialysis, sleep quality, anxiety, range of motion and muscle stretching exercises

Introduction

End Stage Renal Disease (ESRD) is considered one of the most common chronic diseases and its incidence and prevalence are on the rise. The prevalence of patients with ESRD is rapidly growing, especially among patients with chronic diseases particularly diabetes mellitus and hypertension. Consequently, more than two million people are expected to be treated by dialysis for renal failure by 2030 (**United State Renal Data System, 2014).** End Stage Renal Disease is an irreversible decrease in kidney function for which renal replacement therapy is required to maintain life. As a result of the increased incidence of ESRD, longer life expectancy of Hemodialysis (HD) patients and inability to meet the need for kidney transplantation, most of dialysis patients

experience symptoms which interfere with their ability to function according to their normal capacity and impede their quality of life. Therefore, symptoms management is an important component in enhancing dialysis patients' quality of life (**Vajihe et al., 2016)**

Dialysis is associated with deterioration of physical function, muscle function, psychological status and poor sleep quality **(Leal et al., 2011).** The high prevalence of potential sleep disorders as sleep apnea, restless legs syndrome and periodic limb movement disorders is one major factor which contributes to poor sleep quality in HD patients. Around 50-80% of people undergoing HD experience major sleep problems that further complicate their overall health status. These problems are; difficulty in falling asleep, daytime sleepiness, delayed sleep onset, frequent arousals and trembling (**Sullivan and Carthy, 2014)**.

Evidence shows that conducting dialysis session during early morning or late afternoon can increase the risk for sleep disturbances. Restless leg syndrome in which HD patients are unable to rest, have low quality of sleep and insomnia, depression and constant emotional stress is another issue for developing poor sleep quality (**Kuany, 2016)**. Impairment of sleep initiation, maintenance and adequacy among HD patients, were found to be associated with significant reduction in their vitality. All these sleep problems directly contribute to poor quality of life in HD patients which further deteriorates their health status. Also sleep disturbance alters innate functional cellular immune response and brings inflammatory disorders such as autoimmune disease, infection and cardiovascular diseases (**Irwin, Carrillo and Olmstead 2013).**

Hemodialysis patients are also challenged by many psychosocial problems as anxiety, loneliness, lack of social support and depression. Anxiety is frequently detected among HD patients and the average anxiety rate among HD patients ranged from approximately 12% to 52% **(Murtagh, Addington-Hall & Higginson2010**). Anxiety also can decrease the quality of life among HD patients by accelerating poor social interaction, hampering their emotional well-being and productivity, interferes with the ability to concentrate, take decisions and participate effectively in self-care. However, screening for anxiety among HD patients has received little attention (**Cukor, Ver Halen, & Fruchter, 2013)**.

Several complaints may be considered as manifestations of the anxiety disorder: palpitations, indigestion, shortness of breath, tremors, numbness/tingling, nervousness, and excessive sweating **(Cukor, Ver Halen, & Fruchter, 2013)**. So, it is of prime for the nurse to exclude certain medical conditions such as cardiovascular, neurologic, and pulmonary disorders prior to linking these symptoms to anxiety disorder. There are scarce studies that evaluated the management of anxiety disorders among HD patients. Lifestyle adjustments and psychotherapeutic interventions like cognitive-behavioral psychotherapies and pharmacologic agents were common management strategies that may alleviate anxiety. **(Reinhold and Rickels, 2015).** Lifestyle changes such as regular physical activity, sleep hygiene and quitting smoking and caffeine use, should be reviewed with HD patients suffering from anxiety disorders. These simple strategies may alleviate anxiety symptoms without the need for extra rigorous interventions with avoidance of the side effects of drugs (**Stein and Sareen, 2015**). A collaborative multidisciplinary team of health care workers of nephrologists, social health

professionals, dialysis nurses is of paramount importance to aid HD patients with anxiety in managing the challenging demands of the fixed schedule of dialysis sessions and adapting to the social context of the dialysis unit (**Cohen et al., 2011)**.

In general HD patients have diminished physical activity so exercises programs should be the main focuses of the nurse in routinely care for those patients. Exercises are planned structured physical activity with repetitive body movement for sustaining or enhancing fitness and health (**Smart and Steele, 2014)**. Exercises during hemodialysis (intradialytic exercises) improve toxins and urea removal through increasing blood flow to the exercised muscle and efflux these wastes into the vascular compartment for successive elimination at the dialyzer where they can be removed. Furthermore, exercises can improve the control of anxiety & depression, mood, self-confidence, managing sleep disorders, nutrition and appetite, stress coping, workload, social interaction, and enabling the work return while diminishing the dependence on others. Exercise also can aid in managing high blood pressure, insulin resistance, endothelial dysfunction, dyslipidemia, inflammation and oxidative stress. Thus, it is postulated that exercise may have a positive influence on the sleep quality and anxiety among HD patients (**Patricia, 2011)**.

Intradialytic exercises are better to be organized at the second hour of dialysis session because the body fluids shifting and blood pressure changes. Contrariwise, the start and end time of the dialysis session are unsuitable times due to the increased extracellular volume and blood pressure at the beginning while at the end of dialysis there is great risk for hypotension and muscle cramps. (**Johansenk, 2014).**

Exercises programs for HD patients incorporate three types of exercises: cardiovascular (aerobic or endurance) exercises, strengthening (resistance) exercises and range of motion exercises which involve muscle stretching to improve the range of motion around a variety of joints. Each exercises program can be done separately or combined with each other and can be done individually or within a group **(Wang and Jardin 2012).** Intradialytic exercises are deemed as an auspicious option for HD patients, it could be carried out in a setting with adjacent monitoring, does not cost patients extra time or travel, have greater applicability, providing motivation in a structured environment and may lessen the patient's fear of musculoskeletal injury. This further may improve exercises related medical compliance, monitoring and supervision on non-dialysis days **(Kristin, 2016)**.

Significance of the study

Evidence portrayed that; exercise training can improve physical function and performance, nutritional status, cardiovascular function, HD efficiency and quality of life among HD patients **(Tentori et al.,2010)**. Despite this, there is a rare incorporation of the intradialytic exercises in the routine clinical care in hemodialysis centers. Therefore, physicians and nurses can have a major role in educating the HD patients about intradialytic exercises and encouraging them to perceive these exercises as a pleasant addition to daily routines. Thence, the existing study was commenced to boost further evidence about the effectiveness of muscle stretching and range of motion exercises on sleep quality and anxiety among hemodialysis patients.

Aim of the study:

Determine the effect of muscle stretching and range of motion exercises

on sleep quality and anxiety among hemodialysis patients.

Research hypotheses

H0: Hemodialysis patients who practice muscle stretching and range of motion exercises will exhibit the same sleep quality and anxiety as those who do not practice it.

H1: Hemodialysis patients who practice muscle stretching and range of motion exercises will exhibit improve sleep quality and less anxiety than those who do not practice it.

Materials and method

Study design

A quasi-experimental research design (pre-posttest control group) was employed.

Setting

This study was performed in the hemodialysis unit at El Fayoum General Hospital. The unit consists of ten rooms (two small rooms, two large rooms, one nursing room, one statistical room, one stock room, one room for physicians, one small room for head nurse and one small room for pediatric dialysis patient. There are 52 hemodialysis machines in two large rooms and three small rooms. The unit worked three shifts per day /week expect Friday.

Subjects

A purposive sample of 60 adult patients of both genders on maintenance hemodialysis were recruited from the aforementioned setting who were available at the data collection time based on the subsequent inclusion criteria:

- Aged between 21 and 60 years.
- Scheduled for hemodialysis sessions three times per week since at least 6 months.
- Good compliance with dialysis treatment
- Free from uncontrolled heart diseases, pulmonary diseases, malignant hypertension, low blood pressure < 90/60 mmHg and musculoskeletal disorders
- Interested in study participation.

The selected patients were allocated into two equal subgroups of 30 patients in each (study and control)**.** The sample size was calculated using the Epi-Info 7 program based on the following parameters:

- Total population = 200
- Expected frequency p = 50%
- Acceptable error = 5%
- Confidence coefficient = 95%
- This results in a sample size of 60 hemodialysis patients.

Tools

Three tools were handled in collecting the necessary data.

Tool (I): A structured interview questionnaire: it was developed by the researchers and included two parts:

Part 1: Demographic characteristic: age, gender, educational level, occupation and residence.

Part 2: Medical and clinical data. It included past disease, causes of renal failure, prescribed medications, hemoglobin level, duration of hemodialysis session and if practicing exercises at home.

Tool (II): The Pittsburgh Sleep Quality Index (PSQI) Scale

This scale was adopted from **Buysse, Reynolds and Monk 1989**. It was used to measure sleep quality during the last month and discriminate between good and poor sleepers. The PSQI contains 19 self-rated questions and other five questions rated by bed partner. The 19 self-rated questions only are incorporated in the scoring which are combined to form seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications and daytime dysfunction due to sleepiness. The score of each component ranged between 0 to 3 points where zero score reflects no difficulty and 3 scores reflects severe difficulty.

Scoring system

Addition of the scores of the seven components was done to calculate the global PSQI score (0-21) where zero represents no difficulty and 21 represents severe difficulty. A score of 5 and higher can be an indicator to considerable sleep disturbance. The global PSQI score was calculated before exercises as a baseline and at the end of the study (after 6 weeks).

Tool (III): Spielberger State-Trait Anxiety Inventory scale/STAI

This scale was adopted from **(Spielberger, Gorsuch, Lushene, Vagg & Jacobs, 1983)**. It was used by the researchers to appraise the existing anxiety state. It consisted of two subscales; the first was the State Anxiety Scale (S-Anxiety) which asking how respondents feel “right now,” using items that measure subjective feelings of apprehension, tension, nervousness, worry and activation/arousal of the autonomic nervous system. The second was The Trait Anxiety Scale (T-Anxiety) that evaluated the relatively stable aspects of “anxiety proneness,” including general states of calmness, confidence and security. State Anxiety Inventory was configured to appraise the present state of anxiety by asking how respondents feel "right now" "at this moment". The range of responses for each item was rated on a scale of 1 to 4 where 1 is not at all for that item and 4 is the most severe: (1) not at all, (2) somewhat, (3) moderately so and (4) very much so.

Whereas the responses for the T-Anxiety scale assess the frequency of feelings “in general”: (1) almost never, (2) sometimes, (3) often, (4) almost always.

Scoring system: The State Anxiety Scale (S-Anxiety) consisted of 20 items which are added to attain the subtest total scores. Scoring was reversed for anxiety-absent items (10 items). The total score ranged between 20 to 80 and the higher score signpost greater anxiety level. The clinically significant symptoms were detected using the cut-off point (39–40).

Method

The existing study go through the subsequent steps:

1-Approval

An official letter clarifying the purpose of the study was obtained from the Faculty of Nursing, Damanhour University and El Fayoum University forwarded to the concerned personnel at General El Fayoum Hospital to take their approval for data collection**.**

2. Tools:

- Tool (I) was developed by the researchers after widespread review of modern and relevant literature.

▪ Tools (II and III) were translated into Arabic language by specialist in English language translation. The translation was refined until agreement was obtained among the researchers.

Reliability of the tools

▪ It was tested by test- retest method within two weeks interval on 6 patients using Cronbach's alpha test which seemed to be reliable (Tool II= 0.87 & Tool III= 0.82).

Validity of the tools

▪ The content validity of the tools was tested by a jury of 5 experts in the fields of medical surgical nursing, faculty of nursing, El Fayoum and Damanhour University and 2 experts in psychiatric nursing from Ain Shames University. They were requested to give their opinion regarding the tool's content, accuracy, relevancy and appropriateness to the research objective. Ultimately, minor modifications were performed to match the jury opinion.

3. Pilot study:

▪ It was operated on six patients on maintenance hemodialysis who were not incorporated in the actual study to assess the clarity and applicability of the tools and to pinpoint any difficulties that may be encountered during the actual study. In addition, the completion time of the tools was also assessed. The tools were proved to be clear and necessary modification was done.

4. Booklet preparation:

▪ The researchers reviewed the recent medical and nursing knowledge and relevant literature then developed a booklet. It contains information about benefits of intradialytic exercises, types of intradialytic exercises, duration of performance, timing of demonstration and how to perform these exercises. Also, it contains illustrative pictures; simple language and attractive presentation were considered during the preparation. The booklet was then reviewed by jury of 5 experts in medical surgical nursing and 2 nephrology physicians. After that, the needed modifications were done. 30 booklets were printed and given to each patient in the study group before the beginning of the study.

5. Collection of data:

• Collection of data consumed 6 weeks (from the beginning of May 2020 to the end of October).

• Each patient in both the study and control groups was interviewed individually by the researchers and in total privacy to assure confidentiality of information and its utilization only for the purpose of the research. The researchers presented themselves to the patients and clarified the study purpose, then an oral consent was gained for study participation. During this interview tool I was collected from the patients and pre-assessment of sleep quality was done using tool (II) and anxiety level was assessed using tool (III) for both groups. It took about 20 to 30 minutes.

• The control group was taken first to avoid contamination of data and left for routine unit care and followed up for 6 weeks.

• **Training session for the study group**, intradialytic exercises were done by interviewing each patient for 20-30 minutes individually and privately. The session includes an overview about exercises and its possible effect on sleep quality and anxiety level and how to perform these exercises. These

information present in previously prepared booklet.

- The researchers were available in the morning and afternoon shift 3 days per week for 6 weeks.

- The exercises program included two parts. Part I: range of motion exercises for upper and lower extremities. Part II: muscle stretching exercises for the muscles of whole body, muscle of neck, thigh and back muscles.

- During the training session each patient was taught to perform range of motion exercises and muscle stretching exercise as follows:

- Ask each patient to take comfortable position. As these exercises can be performed in the supine and sitting position. Using illustrated pictures each patient was trained to demonstrate these exercises individually.

- These exercises were performed in the second hour of hemodialysis session three times per week in the presence of the researcher for 6 weeks. These exercises took about 30 minutes.

- Pulse, respiration and blood pressure was measured by the researcher before and after these exercises.

- The patient performed these exercises with less number of frequency 2-3 times in the first session then increased the number frequency to 6-8 times for range of motion exercises and 2-4 times for muscle stretching exercises

- The arm with arteriovenous fistula was relaxed and lying down and not activated during these exercises

- Cooling down the body was done by taking deep breathing exercise at the end of exercises program.

- The components of these exercises were as follow:

Part I: Range of motion exercises

Upper extremities

- Wrist joint: hyperextension and flexion with 6-8 times of repetition.

- Elbow joint: flexion and extension with touching the shoulder with palm and repeat 6-8 times as patient tolerance

- Shoulder joint: elevate the elbow at shoulder level and rotate the shoulder joint in circumduction motion and repeat for 6-8 times as patient tolerance.

Lower extremities

- Hip joint: flexion by moving the leg up with knee joint straight then put leg on bed repeat 6-8 times as patient tolerance.

- Knee joint: flexion and extension of right knee then repeat for left knee for 6-8 times as patient tolerance.

- Ankle joint: flex the tips of feet towards the chin dorso-flexion and planter flexion of ankle joint for 6-8 times as patient tolerance.

Part II: Muscle stretching exercises

- Muscles of the whole body: stretch arm upward, breathe in, release and breathe out. Alternately stretch legs and one arm. Do not hold the breath and do not

lift your shoulders repeat 6-8 times as patient tolerate.

- Neck extensors muscles: stretch neck and head in line with the neck spine while breathing out the chin is pressed towards the chest and head rests on a pillow. Repeat 2-4 times holds the stretched position for 10 –15 seconds.

- Muscles on the back of the thigh: one leg is flexed at the knee, arms clasp below the knee as breathe out; the leg is pulled towards the chest. The other leg reaches out as much possible while remaining on the bed. Perform the same to the other side. Repeat 2-4 times and hold the stretched position for 10 – 15 seconds.

- Inner thigh muscles: knees are flexed with feet flat on the bed arms are alongside the body, lower your knees to the side towards the bed and soles remain connected to bed. Repeat 2-4 times and hold the stretched position for 10 – 15 seconds.

Ethical Consideration:

Each patient in both groups was interviewed separately to assure privacy and explaining the purpose of the study, take his/her oral informed consent for study participation. The confidentiality and anonymity of patients' answers was assured, volunteer participation and right to reject participation in the study and withdrawal at any time were stressed to the patients without any consequences.

Statistical Analysis:

After data collection, it was fed to the computer and analyzed using IBM Statistical Package for Social Sciences (SPSS) version 20. (Armonk, NY: IBM Corp). Qualitative data were described using number and percent. The normality of distribution was verified by The Kolmogorov-Smirnov test. Quantitative data were described using range. The test of significance was judged at the 5% level. **The employed analytical tests were as follows:**

- Chi-square test: For categorical variables to compare between different groups.

- Fisher's Exact or Monte Carlo correction: Correction for chi-square when more than 20% of the cells have expected count less than 5.

- Student t-test: For normally distributed quantitative variables to compare between two studied groups.

- Friedman test: For abnormally distributed quantitative variables, to compare between more than two periods or stages and **Post Hoc Test** (**Dunn**'s**)** for pairwise comparisons.

Results:

Table (1): illustrates that, mean age of the studied patients was (51.6±13.7, 52.9±8.5) in both control and study groups respectively. Control groups males represent 60.0% while study group had 46.7%. The majority of the studied patients in both control and study groups were married (66.7%, 83.3%) respectively. As regards to educational level more than one third (36.7%) of the studied patients in the control groups were completed primary education while in the study group 33.3% were illiterate. Concerning occupation the majority of the studied patients in both control and study groups were not working (43.3%, 50.0%) respectively. Regarding residence the majority (56.7%, 73.3%) of the studied patients in both control and study groups respectively were from rural areas. No statistically significant differences were found between the study and control groups where p-value >0.05 as regards age, gender, marital status, level of education and occupation which indicated

proper matching between study and control groups in these variables.

Table (2) illustrates that, more than two fifth (46.7%) in both the control and study groups had diabetes mellitus. Regarding causes of chronic renal failure hypertension represents the most cause (73.3%, 60.0%) in both the control and study groups respectively. No statistically significant differences between the study and control groups as regards past medical history, causes of CRF, medication received, hemoglobin level and practicing exercises with p-value >0.05; which indicated proper matching between study and control groups in these variables.

Table (3): Showed that; there was no statistically significant differences were found between the control and study groups regarding seven components of Pittsburgh Sleep Quality Index before intervention but after practicing range of motion and muscle stretching exercises for 6 weeks, statistically significant differences were found between control and study groups regarding Subjective sleep quality, Sleep latency, Sleep duration Habitual sleep efficiency, Sleep disturbances and Day time dysfunction where p value=(0.002, 0.001, 0 .006, 0.001, 0.048, 0.001) respectively.

Table (4): illustrates that, somewhat difficult in sleep quality was noticed in both control and study groups (50%, 60%) respectively before intervention, but after intervention more than half (60.0%) in the study group were have no difficulty comparing to more than two third (76.7%) in the control group had somewhat difficulty. There is no statistically significant difference were found between the control and study groups as regards Global Pittsburgh Sleep Quality Index(PSQI) score before practicing range of motion and muscle stretching exercises with p-value >0.05. On the other hand, there is statistically significant difference improvement in PSQI with higher percentage of no difficulty among study group following practicing range of motion and muscle stretching exercises for 6 weeks with p-value <0.001.

Table(5): showed that, more than two fifth (46.7%, 43.3%) in control and study groups respectively had moderate level of anxiety before intervention but, after intervention the majority(70.0%) in the study had mild anxiety while, in the control group more than half(53.3%) had moderate anxiety. No statistically significant difference were found between the control and study groups as regards anxiety level before practice muscle stretching and range of motion exercises with p-value >0.05. On the other hand there is statistically significant difference improvement in anxiety level with higher percentage of mild degree among study group following practicing muscle stretching and range of motion exercises for 6 weeks with p-value <0.001.

Table (1): Number and percentage distribution of the study subjects regarding their demographic characteristics

Demographic data	Control group N=30		Study group N=30		Test of significance
	No	%	No	%	
Age (Years) Less than 35	6	20.0	2	6.7	
35 to less than 45	4	13.3	7	23.4	FET:7.152 P:0.401
45 to less than 55	14	46.7	13	43.3	
55 to 65	6	20.0	8	26.6	
Mean±SD	51.6±13.7		52.9±8.5		
Min-Max	28-87		33-67		
Sex Male	18	60.0	14	46.7	X^2:1.071 P:0.301
Female	12	40.0	16	53.3	
Marital status Single	5	16.7	2	6.7	
Married	20	66.7	25	83.3	FET:5.925 P:0.098
Divorced	4	13.3	3	10.0	
Widow	1	3.3	0	0.0	
Education Illiterate	6	20.0	10	33.3	
Read and write	11	36.7	8	26.7	FET:4.551 P:0.353
Primary	6	20.0	2	6.7	
Prep	6	20.0	7	23.3	
Secondary	1	3.3	3	10.0	
Occupation Non-working	13	43.3	15	50.0	X^2:0.272 P:0.892
Manual	7	23.4	6	20.0	
Employee	10	33.3	9	30.0	
Residence Urban	13	43.3	8	26.7	X^2:1.832 P:0.176
Rural	17	56.7	22	73.3	

FET: Fisher Exact test X2: Chi-square test P: P value of test of significance

Table (2) Number and percentage distribution of study subjects according to their clinical data

Clinical data	Control group N=30		Study group N=30		Test of significance
	No	%	No	%	
Past diseases					
Diabetes mellitus	14	46.7	14	46.7	
Thyroid disease	2	6.7	2	6.7	FET:2.222
Liver diseases	8	26.6	10	33.3	P:0.695
Respiratory disease	4	13.3	1	3.3	
Allergies	2	2.7	3	10.0	
Causes of CRF					X^2: 1.2000
Hypertension	22	73.3	18	60.0	P:0.273
Diabetes mellitus	12	40.0	14	46.7	FET: 0.271 P:0.602
Urinary stones	3	10.0	2	6.7	FET: 0.218 P:0.640
Congenital anomalies of urinary tract	1	33.3	1	3.3	----------
Medication					
No	0	0.0	0	0	----------
Yes	30	100.0	30	100.0	
Types of medication received					
Antihypertensive	30	100.0	30	100.0	
Vitamins_B12_vit.D	30	100.0	30	100.0	----------
Iron supplementation	30	100.0	30	100.0	
Antacid	30	100.0	30	100.0	
Ca supplementation	30	100.0	30	100.0	
Diabetes drugs	3	10.0	2	6.66	FET:0.220 P:0.639
Hemoglobin level					----------
Below 12 mg/dl	30	100.0	30	100.0	
Above 12mg/dl	0	0.00	0	0.00	
Practicing exercises					----------
No	30	100.0	30	100.0	
Yes	0	0.00	0	0.00	

FET: Fisher Exact test X^2: Chi-square test P: P value of test of significance

Table (3) Number and percentage distribution of the control and study groups according to seven components of Pittsburgh Sleep Quality Index before and after intervention

Components of Pittsburgh Sleep Quality Index	Before intervention				Test of sig	After intervention				Test of sig
	Control group N=30		Study group N=30			Control group N=30		Study group N=30		
	No	%	No	%		No	%	No	%	
Component one: Subjective sleep quality										
• Very good	1	3.3	0	0.0	FET:1.758 P:0.700	1	3.3	4	13.3	FET:11.998 P:0.002*
• Fairly good	10	33.3	13	43.3		13	43.3	22	73.3	
• Fairly bad	13	43.3	13	43.3		11	36.7	4	13.3	
• Very bad	6	20.0	4	13.3		5	16.7	0	0.0	
Component two: Sleep latency										
• ≤ 15 minutes	0	0.0	0	0.0	FET:0.556 P:0.872	0	0.0	3	10.0	FET:15.126 P:0.001*
• 16-30 minutes	4	13.3	6	20.0		8	26.7	19	63.3	
• 31-60 minutes	19	63.3	18	60.0		17	56.7	8	26.7	
• > 60 minutes	7	23.3	6	20.0		5	16.7	0	0.0	
Component three: Sleep duration										
• > 7 hours	1	3.3	0	0.0	FET:1.490 P:0.807	1	3.3	2	6.7	FET:10.947 P:0.006*
• 6-7 hours	3	10.0	4	13.3		10	33.3	20	66.7	
• 5-6 hours	16	53.3	18	60.0		13	43.3	8	26.7	
• < 5 hours	10	33.3	8	26.7		6	20.0	0	0.0	
Component four: Habitual sleep efficiency										
• > 85%	2	6.7	0	0.0	FET:2.710 P:0.485	2	6.7	0	0.0	FET:16.479 P:<0.001*
• 75-84%	4	13.3	7	23.3		5	16.7	15	50.0	

• 65-74%	10	33.3	8	26.7		14	46.7	15	50.0	
• < 65%	14	46.7	15	50.0		9	30.0	0	0.0	
Component five: Sleep disturbances										
• Not during the past month	3	10.0	0	0.0	FET:3.545 P:0.309	3	10.0	3	10.0	FET:6.688 P:0.048*
• Less than one a week	4	13.3	7	23.3		8	26.7	17	56.7	
• Once or twice a week	16	53.3	15	50.0		17	56.7	10	33.3	
• Thre e or more times /week	7	23.3	8	26.7		2	6.7	0	0.0	
Component six: Use sleeping medication										
• Not during the past month	30	100.0	30	100.0		30	100.0	30	100.0	
• Less than one a week	0	0.0	0	0.0		0	0.0	0	0.0	
• Once or twice a week	0	0.0	0	0.0		0	0.0	0	0.0	
• Thre e or more times/week	0	0.0	0	0.0		0	0.0	0	0.0	
Component seven: Day time dysfunction										
• Neve r	2	6.7	0	0.0	FET:1.862 P:0.698	2	6.7	9	30.0	FET:15.035 P: <0.001*
• Once or twice	4	13.3	5	16.7		6	20.0	11	36.7	
• Once or twice each week	14	46.7	14	46.7		14	46.7	10	33.3	
• Thre e or more times /week	10	33.3	11	36.7		8	26.7	0	0.0	

FET: Fisher Exact Test P:P value of FET *Significant at P value ≤0.05

Table (4) Number and percentage distribution of the control and study groups according to their global Pittsburgh Sleep Quality Index score before and after intervention

Global Pittsburgh Sleep Quality Index score	Before intervention				Test of significance	After intervention				Test of significance
	Control group N=30		Study group N=30			Control group N=30		Study group N=30		
	No	%	No	%		No	%	No	%	
No difficulty	3	10.0	2	6.7	FET:0.793 P:0.841	4	13.3	18	60.0	FET:15.190 P:0.001*
Somewhat difficult	15	50.0	18	60.0		23	76.7	12	40.0	
Severe difficulty	12	40.0	10	33.3		3	10.0	0	0.0	
Mean±SD (Maximum allowed score=21)	13.3±3.7		12.3±2.6		t:1.209 P:0.232	10.9±2.9		7.1±2.2		t:5.554 P:<0.001*

FET: Fisher Exact Test t: Student t-test P:P value of test of significance *Significant at P value ≤0.05

Table (5) Number and percentage distribution of the control and study groups according to their anxiety level before and after intervention

Anxiety level	Before intervention				Test of significance	After intervention				Test of significance
	Control group N=30		Study group N=30			Control group N=30		Study group N=30		
	No	%	No	%		No	%	No	%	
Mild	13	43.3	12	40.0	FET:0.158 P:1.00	11	36.7	21	70.0	FET:11.573 P:0.002*
Moderate	14	46.7	13	43.3		16	53.3	9	30.0	
Severe	3	10.0	5	16.7		3	10.0	0	0.0	
Mean±SD (Maximum allowed score=63)	39.9±7.9		41.4±6.7		t:0.172 P:0.864	37.5±7.2		32.2±5.3		t:3.759 P:<0.001*

FET: Fisher Exact Test t: Student t-test P: value of test of significance *Significant at P value ≤0.05

Discussion

Sleep disorders and psychological disturbances such as anxiety, stress and depression are common in ESRD patients. Despite their frequency and importance these disorders often go unnoticed where all HD patients do not clearly manifest fully expressed symptoms. Hemodialysis patients faced with various physical, functional and psychological complications because of the changes to their personal life style, recurrent hospitalization, pain, chronic symptoms, dietary restrictions and fear of death which make them highly susceptible for various psychological consequences. **(Deal and Grassley, 2012 & Wang, and Chen, 2012)**

The results of the current study revealed that, most of the study subjects were from rural areas and had limited educational level. This gave them the liability to neglect periodic checkup and

follow therapeutic regimen in many diseases as diabetes mellitus and hypertension which represented the most common causes of renal failure in this study. These findings were in congruence with **Appell , et al (2010)** who stated that, high blood pressure is considered a major cause of kidney disease and ESRD as it is the second major cause after diabetes mellitus. Also the findings of the current study revealed that, there are no statistically significant differences between the study and control groups regarding patients' demographic characteristics and clinical data between including age, sex, marital status, level of education and occupation. Also regarding past medical history, causes of CRF, medication, hemoglobin level and performing exercises. These findings roll out the extraneous factors that might confuse the effect of muscle stretching and range of motion exercises on sleep quality and anxiety.

In the current study no statistically significant differences were found between the study and control groups regarding the components of Pittsburgh Sleep Quality Index scale (Subjective sleep quality, Sleep latency, Sleep duration, Habitual sleep efficiency, Sleep disturbances and Day time dysfunction) before intervention. This might be due to HD patients often complain from sleep disorders due to the stress from dialysis procedure, they need to comply with treatment regimen which create strong emotional stress and anxiety and causing inability to sleep or even wake up. After practicing range of motion and muscle stretching exercises for 6 weeks, statistically significant differences were found in the study group. At the same time, such significant was not found among the control group after the implementation of routine hospital care. These results may be attributed to the fact that, practicing range of motion and muscle stretching exercises during dialysis session increases blood flow to the exercised muscles which in turn leads to greater amount of open capillary surface area in working muscles. Consequently this will result in greater removal of urea and others toxins from the blood to the vascular compartment for subsequent removal at the dialyzer. This improves dialysis efficacy and reduces muscle tension and thereby improving sleep quality, decreasing anxiety and psychological and physical comfort. These findings were highlighted in this study by comments from the study subjects as they mentioned that they enjoy of performing exercises some of them expressed that "I feel better ", "I can move and walk easy ", I can sleep and eat well". All of these comments reflect the study results.

These results are similar with the results of the study conducted by **Cengic and Colleagues, (2012)** who reported that, 73% of HD patients had poor sleep quality on weekly basis, the average sleep duration was 4.9 hours and the average sleep latency was 48.2 minutes also they found that the most common sleep disturbances were insomnia. Also similar to the results of the study by **D'Onofrio et al., (2016**) who reported that, poor sleep quality was associated with hemodialysis and HD patients who had sleep disordered breathing were having poor sleep quality compared with those not on hemodialysis. **(Chu et al,. 2018)** reported that, high prevalence of sleep disorders among hemodialysis patients such as sleep apnea, restless legs syndrome and periodic limb movement is considered a major factor which leads to poor sleep quality of those patients.

The results of the present study illustrates that no statistically significant difference were found between the control and study groups regarding Global Pittsburgh Sleep Quality Index score

(PSQI) before intervention and somewhat difficult in sleep quality was noticed in both control and study groups before intervention. But after practicing range of motion and muscle stretching exercises for 6 weeks more than half in the study group were have no difficulty comparing to more than two third in the control group had somewhat difficulty. On the other hand there is statistically significant difference improvement in PSQI with higher percentage of no difficulty among study group. These findings suggests a possible positive cumulative effect of practicing exercises as these exercises performed three times per week for 6 weeks and thus may be enough to improve sleep quality and decrease anxiety level.

These results are in line with **Smart, Farlane, & Cornelissen (2013)** who revealed on their study which conducted on HD patients that, sleep quality was improved after 8 weeks exercise in study groups. Also in the same line with study by **Maniam et al.,(2014)** that showed 15 min of stretching exercises before hemodialysis three times a week for 12 weeks could decrease improve sleep disorders and fatigue in those patients. Systematic meta-analysis study conducted by **Song et l,.(2018)** and **Smart, Farlane, & Cornelissen, 2013** showed that, exercise training helps hemodialysis patients to reduce the severity of restless leg syndrome, anxiety, depression and fatigue. Also **(Smart, Farlane, & Cornelissen 2013)** stated that, exercises during hemodialysis session dilated muscular arteries which in turn improves perfusion and alleviates disorders affecting blood circulation in the muscles. **(Edley et al,. 2020)** stated that; , improvement in muscle perfusion leads to enhanced blood circulation, better toxin and waste products elimination and higher muscular strength consequently these benefits lead to lower levels of fatigue, better sleep and improvement in the quality of life of hemodialysis patients.

The results of the present study illustrates that, no statistically significant difference were found between the control and study groups as regards anxiety level before intervention and more than two fifth in the control and study groups had moderate level of anxiety. But after practice muscle stretching and range of motion exercises for 6 weeks there is statistically significant improvement in anxiety level with higher percentage of mild level among the study group on the other hand, in the control group more than half had moderate anxiety.

These findings are in congruent with **Stavrou et al., (2019)** who reported that; dependence of the hemodialysis machine causes anxiety, depression and impaired physical health in hemodialysis patients. Also in congruent with results **of Gomes et al., (2018)** who reported that; ten weeks of intradialytic exercises program improved physical functioning and psychological well-being in hemodialysis patients which in turn lead to an improvement of their quality of life. In congruent with **Dziubek et al. (2016)** who stated that, an exercise training program for six weeks leads to low rates of anxiety symptoms and depression on patients undergoing hemodialysis. **Chiang et al. 2013** and **Liu et al., 2017** who carried out a cross-sectional study with 270 patients with ESRD found that, HD patients who did not participating exercises activities had high possibility to develop anxiety and depression which in turn making them unable to carry out their activities of daily living without assistance.

The results of the current study is similar to the results of **Barroso et al (2019)** as their results revealed that; the levels of anxiety was significantly decrease in the training group than the

control group. Moreover, the results of a systematic review that conducted by (**Zhao et al,. 2019)** showed that; exercises during dialysis are significantly lowering anxiety levels among HD patients. However, the review recommended conducting other types of physical exercise programs to confirm the appropriate types and the best timing for those patients**.** Furthermore, **Santhi., Samson and Pethuru, (2018)** reported that; patients undergoing hemodialysis who practicing range of motion exercises which including flexion and extension for elbow joint. For wrist joint circumduction, fingers flexion and extension and flexion, extension and hyper extension for ankle and toes joint were significantly reducing the levels of anxiety, depression and improving their sleep quality.

Finally the present study clarify the fact of intervention that combines intradialytic range of motion and muscle stretching exercises is effective in improving sleep quality and reducing anxiety symptoms in maintenance hemodialysis patients. Thus education and encouragement of those patients and their family about the importance of these exercises are essential.

Conclusion

In the light of the present results of this study, it can be concluded that H1 is accepted while; H0 is rejected where hemodialysis patients who practice muscle stretching and range of motion exercises will exhibit improve sleep quality and less anxiety than those who don't practice it. So intradialytic range of motion and muscle stretching exercises with no need to expensive and highly morbid procedures may be enrolled as routine care for hemodialysis patients.

Recommendation

Based on the findings of present study, the following recommendations are suggested:

- Intradialytic exercise programs should be incorporated into routine clinical practice.
- A simple manual of intradialytic exercises should be available for all nurses working at hemodialysis unit and for hemodialysis patients
- Replication of the current study under dissimilar circumstances (sampling size, setting, measurement, duration of intervention) is recommended to confirm its results.

Financial support

No funding was received

Conflicts of Interest Disclosure

The authors declare that there is no conflict of interest.

References

Appell, L., Robert, C. and Grigss, M., (2010). Intensive blood pressure control in hypertensive chronic kidney disease. England Medical Journal; 63(1):918-20.

Barroso, R., Silva-Filho, A, C., Dias, C. J., Soares, Jr., Mostarda, A.and Azoubel, (2019). Effect of exercise training in heart rate variability, anxiety, depression and sleep quality in kidney recipients: A preliminary study. Journal of health psychology 24(3), 299-308.

Buysse, DJ., Reynolds, CF. and Monk, T., (1989). The Pittsburgh Sleep

Quality Index. A new instrument for psychiatric practice and research. Psychiatr Res; 28:193-213

Cengic, B., Resic, H., Spasovski, G., Avdic, E and Alajbegovic (2012). Quality of Sleep in Patients Undergoing Hemodialysis. International Journal of Urology Nephrology 44(5), 557-67.

Chiang, H., Livneh, H., Yen, M., Li, T., and Tsai, T.,(2013). Prevalence and correlates of depression among chronic kidney disease patients in Taiwan. BMC Nephrology.14:78.

Chu, G., Szymanski, K., Tomlins, M., Yates, N., and McDonald (2018). Nursing care considerations for dialysis patients with a sleep disorder. Journal of Renal Society of Australasia 14(2), 52.65

Cohen, SD., Cukor, D., Peterson, RA., and Kimmel, PL., (2011). Psychosocial aspects of chronic disease: ESRD as a paradigmatic illness. Journal of American Society and Nephrology 18 (4): 3042–55.

Cukor, D., Ver Halen, N. and Fruchter, Y., (2013). Anxiety and quality of life in ESRD. Sem Dial;26 (6):265–68.

Das, S., Halim, H., Hassan, H. and Letchmi, S., (2011). Fatigue experienced by patients receiving maintenance dialysis in hemodialysis units. Nursing Journal of Medical Science and Health Services; 13(1):60-4.

Dziubek, W., Kowalska, J., Kusztal, M., Rogowski, Ł., Gołębiowski, T., Nikifur, M., Szczepańska-Gieracha, J., Zembroń-Łacny, A., Klinger. M. and Woźniewski, M., (2016). The level of anxiety and depression in dialysis patients undertaking regular physical exercise training—a preliminary study. Kidney Blood Press Res 41(4); 86–98.

Edley, R., (2020). Can non-pharmacological interventions improve sleep quality for hemodialysis patients?. Journal of Kidney Care, 5(1), 6-12.

Gomes, N, M., de Lacerda, F, R., Lopes, A, A., Martinez, B. P. and Saquetto, M. B. (2018). Intradialytic exercise training modalities on physical functioning and health-related quality of life in patients undergoing maintenance hemodialysis: systematic review and meta-analysis. Clinical rehabilitation, 32(9), 1189-1202.

Irwin, MR., Carrillo, C and Olmstead, R., (2013). Sleep loss activates cellular markers of inflammation: sex differences. Brain, Behavior and Immunity Journal; 24(1):22-33.

Ji‐Hyung, C, Ji‐Yeon, L., Sukyung, L., Hyuntae, P., Seung‐Wook C. and Jun, C, K.,(2018). Effect of intradialytic exercise on daily physical activity and sleep quality in maintenance hemodialysis patients. International Urology and Nephrology 50:745–754
https://doi.org/10.1007/s11255-018-1796-y

Johansenk, P., (2014). Exercises in end stage renal disease population. Journal of the American Society of Nephrology;18(1):1845-54.

Kristin, P., (2016). Intradialytic Exercise is Medicine for Hemodialysis Patients. The American College of Sports Medicine; 15 (4):269–75.

Kuany, T., (2016). Sleep quality and associated factors in hemodialysis patients. American Journal of Nephrology; 25(3): 97-104.

Liu, X., Yang, X., Yao, L., Zhang, Q., Sun, D., Xinwang, Z., Xu, T., Liu, Q., and Wang, L., (2017). Prevalence and related factors of depressive symptoms in hemodialysis patients in northern China. BMC Psychiatry;8(3), 17:128.

Maniam, R., Subramanian, P., Singh, SKS., Lim, SK., Chinna, K. and Rosli, R.,(2014). Preliminary study of an exercise program for reducing fatigue and improving sleep among long-term hemodialysis patients. Singap Medical Journal.;55(9):476.483.

Mohamed, M, I. and Mokhtar, I, M., (2018). Leg Exercise: Effect on Reducing Fatigue and Improving Activities of Daily Living For Hemodialysis Patients. IOSR Journal of Nursing and Health Science (IOSR-JNHS) e- ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 7, Issue 3 Ver. IV, PP 11-19 www.iosrjournals.org

Murtagh, FE., Addington-Hall, J. and Higginson, IJ., (2010). The prevalence of symptoms in end-stage renal disease: a systematic review. Advanced Chronic Kidney Disease 14(3): 82–99.

Patricia, P.,(2011). Physical functions of end stage renal disease patients. Hemodialysis International Journal; 9(3):218-35.

Reinhold, JA and Rickels, K.,(2015). Pharmacological treatment for generalized anxiety disorder in adults: an update. Expert Opin Pharmacother 16(4): 1669–1681.

Santhi, A., Samson, R and Pethuru, D.,(2018). Effectiveness of Physical Activity on Depression, Anxiety, Stress and Quality of Life of Patients on Hemodialysis. Biomedical Research; 29(6), 1885-1890.

Smart, N., McFarlane, J and Cornelissen, V.,(2013). The Effect of Exercise Therapy on Physical Function, Biochemistry and Dialysis Adequacy in Hemodialysis Patients: A Systematic Review and Meta-Analysis. Open J Nephrol 9(3); 3:25.

Smart, W and Steele, M., (2014). Exercise training in hemodialysis patients. A systematic review and meta-analysis. Journal of Clinical Nephrology; 16(7):626–632.

Song, YY., Hu, RJ., Diao, YS., Chen, L and Jiang. XL., (2018). Effects of Exercise Training on Restless Legs Syndrome, Depression, Sleep Quality, and Fatigue among Hemodialysis Patients: A Systematic Review and Meta-analysis. J Pain Symptom Manage;55(4):1184–95.

Spielberger , C. D., Gorsuch , R. L., Lushene , R., Vagg , P. R and Jacobs, G. A. (1983). Manual for the State-Trait Anxiety Inventory. Palo Alto, CA: Consulting Psychologists Press; 2: 159-187.

Stavroula K, G and Fotoula P, B., (2014). Psychological Aspects in Chronic Renal Failure. *Health Science Journal;* 8 (2) :205- 214.E-ISSN:1791-809x | hsj.gr

Stein, MB and Sareen, J., (2015). Generalized Anxiety Disorder. N Engl J Med 373(12): 2059–2068.

Sullivan, D. and Carthy, G., (2014). Exploring the symptom of fatigue in

patients with end stage renal disease. Journal of Nephrology Nursing Journal; 36 (37): 9- 47.

Tentori, F., Elder, SJ., Thumma, J., Pisoni, RL., Bommer, J., Fissell, RB., Fukuhara, S., Jadoul, M and Keen, ML., (2010). Physical exercise among participants in the Dialysis Outcomes and Practice Patterns Study (DOPPS): correlates and associated outcomes. Nephrol Dial Transplant 25(9):3050–3062.

Trbojević-Stanković, J., Stojimirović1, B., Bukumirić, Z., Hadžibulić,E., Andrić, B., Djordjević, V., Marjanović, Z., Birdjozlić, F., Nešić, D. and Jovanović1, D.,(2014). Depression and Quality of Sleep in Maintenance Hemodialysis Patients. Srp Arh Celok Lek. Jul-Aug;142(7-8):437-443.

United State Renal Data System(2014). Annual data report: Atlas of chronic kidney disease and end stage renal disease in the United State. Bethesda, MD: National Institute of health, National Institute of Diabetes and Digestive Kidney Disease.

Vajihe, B., Tayybi, A., Nemati E,Shermeh, M. and Ebadi, A., (2016). Different aspects of fatigue experienced by patients receiving maintenance dialysis in hemodialysis units. Nepher-Urology Monthly;5(4):879-890.

Wang, Y., Jardin, M. and Benft, T., (2012). Benefits of exercises program for hemodialysis patients. British Nephrology Journal; 45(1):1165-1170.

Zhao, Q., Zhang, H., Wen, X., Wang, Y., Chen, X., Chen, N., Sun, Y., Liu, H. and Lu, P (2019). Exercise Interventions on Patients with End-Stage Renal Disease: A Systematic Review. Clinical Rehabilitation, 33(11): 147-156.