



Combination of AROM with deep breathing exercise against fatigue and quality of life of hemodialysis patients; an experimental study

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ABSTRACT

Introduction: In hemodialysis patients, the main problem that often occurs is experiencing fatigue. Untreated fatigue conditions have an impact on decreasing quality of life.

Objectives: In this study, we aimed to analyse the effect of the combination of AROM with deep breathing on fatigue and quality of life in the Jemursari Islamic hospital of Surabaya.

Patients and Methods: This study is a quasi-experimental investigation with a pre-post-test control group design. The population was 244 of all hemodialysis patients at our hospital. The research sample was 220 respondents, 110 respondents in the intervention group and the control group. The intervention group was given a combination of active range of motion (AROM) and deep breathing exercises for 30 minutes daily for one month. Meanwhile, the control group was assigned training according to hospital procedures.

Results: The results showed that almost all of the intervention group (96.4%) had mild fatigue and almost half (40%) had good quality of life. In the control group, most participants (54.5%) experienced severe fatigue, and most (53.6%) experienced a poor quality of life. Data analysis showed that the combination of AROM with deep breathing affected hemodialysis patients' fatigue and quality of life ($P=0.000$), which means that the combination of AROM with deep breathing affects the fatigue and quality of life of hemodialysis patients.

Conclusion: A combination of air exercise regularly can reduce fatigue levels and improve quality of life. Nurses can provide a combination of AROM with deep breathing exercises in hemodialysis patients as an exercise program for hemodialysis patients.

Implication for health policy/practice/research/medical education:

Management of hemodialysis patients in dealing with fatigue is very important to do. Fatigue conditions in hemodialysis patients can interfere with concentration resulting in decreased concentration, malaise, sleep disturbances, emotional disturbances, and a decrease in the patient's ability to carry out daily activities, as well as the hemodialysis therapy process, which takes a long time, generally will cause physical and psychosocial stress and ultimately have a negative impact on the patient's quality of life. The results of this study indicate that the combination of AROM and deep breathing exercises can reduce fatigue and improve quality of life. These results can be applied to one of the nursing cares programs for hemodialysis patients and can realize the achievement of quality services.

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Introduction

Patients with end-stage of chronic renal failure will receive alternative renal replacement therapy. Renal replacement therapy is hemodialysis. Hemodialysis is a process used in patients with acute renal failure or irreversible renal failure with fluid and electrolyte imbalance disorders; it is a long-term or permanent therapy carried out three times a week with a duration of 3-4 hours per session

(1). Complications arising from hemodialysis include hypotension, air embolism, chest pain, pruritus, balance disturbances during dialysis, nausea and vomiting, anemia, fatigue, muscle cramps, and increased urea levels (2). High urea levels will interfere with the production of erythropoietin which causes decreased appetite and anemia. Poor nutritional intake can cause sufferers to complain of malaise and fatigue. In addition, low oxygen

levels in the body due to anemia will cause the body to experience extreme fatigue, it will force the heart to work harder to supply the oxygen needed by the body, which is the occurrence of fatigue from physiological factors (2,3). Other factors that can cause fatigue besides physiological factors are socioeconomic and situational (4). The impact of fatigue conditions resulting in decreased concentration, malaise, sleep disturbances, emotional disturbances, and a decrease in the patient's ability to carry out daily activities, as well as the hemodialysis therapy process, which takes a long time, generally will cause physical and psychosocial stress and ultimately have a negative impact on the quality of life (5).

According to the study by Ju et al, fatigue is a major problem for hemodialysis patients, with a prevalence of 60%-97% (6), and is closely associated with a higher risk of cardiovascular disease, death, depression, and impaired quality of life (7). This is supported by research from Gerasimoula et al, which states that the longer patients carry out hemodialysis therapy, the lower their quality of life (8). This phenomenon was also experienced by hemodialysis patients at the Jemursari Islamic hospital in Surabaya from initial data taken in February 2021 with interview techniques from 15 respondents, 13 respondents experienced fatigue or feeling tired, therefore they limited their daily activities and felt their quality of life was lacking, while two respondents had to feel tired but still able to do activities well but not doing strenuous activities and good quality of life. In addition, respondents also said that during hemodialysis, they never did physical exercise. The patient's activities were only eating, lying down, sleeping, sitting, and talking, so the patient felt bored and tired.

Measurement of the level of fatigue is very necessary for hemodialysis patients because the fatigue experienced makes sense of isolation, inhibits socialization, loses of time with family, and causes difficulties in carrying out activities. The continued impact of fatigue experienced by patients will cause a decrease in physical function and ability to carry out daily activities, reduce the quality of life, and reduce survival (2,9). In addition to hemodialysis patients, it is also important to measure the quality of life of patients considering hemodialysis patients who continue to depend on devices and other people for activities. Quality of life is an important criterion for assessing the effectiveness of health care and the impact of disease on a person's life (10). Handling or intervention in dealing with fatigue and improving quality of life can be done in two ways, namely pharmacological therapy and non-pharmacological therapy. Pharmacological therapy includes adding L-carnitine, vitamin C, erythropoietin, and medication to treat anemia. In contrast, non-pharmacological methods that can be used are exercise, yoga, relaxation, acupressure, acupuncture, family support, electrical stimulation, and dialysis (11). According to Potter and Perry, physical exercise is the most important thing to do because it is useful for increasing blood flow

and has an impact on body health (12).

Physical exercise performed during hemodialysis can increase blood flow to muscles, and increase the number of capillaries and capillary surface area, thereby increasing the transfer of urea, creatinine, potassium, and toxins from the interstitial tissue to the vasculature during hemodialysis, which is then transferred to a dialyzer or hemodialysis machine, thereby increasing the clearance of urea in the blood through the ultrafiltration mechanism, which results in a decrease in the level of urea in the blood. Exercise can also make muscles stronger and joints more flexible, making it easier for patients to reach, bend, and perform other daily activities (13). When doing physical exercise, it can also stimulate the body to release endorphins, where endorphins can have a direct psychological effect, namely feeling relaxed, reducing tension, increasing feelings of pleasure, making a person more comfortable, and launching oxygen delivery to the muscles so that it can reduce levels of stress and fatigue which will affect the patient's quality of life (7,14). Another treatment that can be done to deal with fatigue is by using deep breathing techniques. Deep breathing exercises are natural healing techniques and are part of a holistic self-care strategy that is useful in overcoming various problems such as fatigue, pain, sleep disturbances, stress, and anxiety (15). According to the study by Jablonski and Chonchol, deep breathing techniques can reduce oxidative stress, increase cellular energy and the elasticity of blood vessels and improve circulation to all tissues (16). Deep breathing techniques can produce energy and reduce or even overcome fatigue in hemodialysis patients, thereby improving their quality of life (15).

Research on the combination of AROM with deep breathing exercises on fatigue and quality of life while treating hemodialysis patients has so far not been carried out. Based on this description, the researcher was interested in examining the effect of the combination of AROM with deep breathing exercises on fatigue and the quality of life of hemodialysis patients.

Objectives

This study aims to analyze the effect of the combination of AROM with deep breathing on the level of fatigue and quality of life at the Jemursari Islamic hospital of Surabaya.

Patients and Methods

Study design

This study used a quasi-experimental research design with the untreated control group design with dependent pre-test and post-test samples. This research was conducted in April-June 2021 at the Jemursari Islamic Hospital, Surabaya.

The population in this study were all hemodialysis patients at the Jemursari Islamic hospital who met the inclusion and exclusion criteria of the study.

Sampling technique: This study used a non-probability

sampling technique with consecutive sampling. The sample of the research was 220 participants, with 110 participants in intervention and control groups.

Eligibility criteria

Inclusion criteria: Undergoing hemodialysis >6 months, having stable condition during hemodialysis, controlled hypertension, controlled blood sugar, vital signs: blood pressure: >100/50 mm Hg or <140/100 mm Hg, pulse 60-100 bpm, respiration 16-20 x/min, hemoglobin > 9.5 g/dL, and adequate dialysis therapy with Kt/V value>1.2.

Exclusion criteria: Ischemic stroke with complications of DM with glucose level 300 mg/dL, myocardial infarction, congestive heart failure, stage renal disease and arrhythmias, age >60 years, patients with mental disorders, patients with uncontrolled hypertension grade 2

Instruments and procedure

The instrument used to measure fatigue was the Assessment of Fatigue in Older Adults: The FACIT Fatigue Scale (version 4) questionnaire (17), and to measure the quality of life was the KDQOL SFTM 1.3 questionnaire (18).

Procedure: This research was conducted in April-June 2021. Researchers first held a coordination meeting regarding the management and benefits of research with medical personnel and prospective respondents, then asked for informed consent from respondents and distributed questionnaires via google form assisted by hemodialysis room nurses. The pre-test was carried out one day before conducting the intervention. Researchers

acted as therapists assisted by nursing staff as research assistants, where the intervention group got a combination of active range of motion (AROM) with deep breathing exercises. Therapy was carried out twice a week for one month, with 30 minutes in the first two hours during hemodialysis. During the process of implementing AROM combination therapy with deep breathing exercises, it was divided into two sessions. In session 1, with a duration of 20 minutes, participants did the AROM exercise, which was performed on all upper and lower joints, with each movement repeated three times except for the body parts connected to the dialysis machine to avoid interruption of the hemodialysis process. In session 2, by doing breathing exercises for 10, the control group was not given any intervention, only running the hospital program. The post-test was carried out one day after one month of the intervention.

Statistical analysis

In this study, data were analyzed on fatigue and quality of life before and after the intervention. Data in the intervention and control groups were analyzed using the Wilcoxon sign rank statistical test. The post-test data of the intervention group and the control group were analyzed using the Mann-Whitney statistical test with the hypothesis of $P < 0.05$.

Table 1 shows the characteristics of the research respondents, in which most of the participants (56.4%) were in the intervention group, and almost half of the participants (43.6%) were in the control group in early old age (46-55 years). For gender, most of the

Table 1. Demographic characteristics of respondents

Demography	Intervention group (n=110)		Control group (n=110)		P value
	No.	%	No.	%	
Age (y)					
Late adulthood (36-45)	10	9.1	30	27.3	0.011
Early old age (46-55)	62	56.4	48	43.6	
Late old age (56-65)	38	34.5	32	29.1	
Gender					
Male	66	60	80	72.7	0.046
Female	44	40	30	27.3	
Education					
Basic	54	49.1	26	23.6	0.018
Intermediate	42	38.2	76	69.1	
High	14	12.7	8	7.3	
Job status					
Working	22	20	26	23.6	0.516
Not working	88	80	84	76.4	
Long hemodialysis					
1-3 years	14	12.7	18	16.4	0.486
4-5 years	80	72.7	66	60	
>5 years	16	14.5	26	23.4	

respondents (66.7% and 72.7%) were male. Based on the level of education, it was found that in the intervention group, almost half of the participants (49.1%) had a basic education background. In the control group, it was found that most participants (69.17%) had a secondary education background. In terms of employment status, it was found that almost all of the participants (80% and 76.4%) had the status of no longer working in both the intervention and the control groups. The length of time undergoing hemodialysis was found in the intervention group and control group; most respondents (72.7% and 60%) underwent hemodialysis for 4-5 years.

The incidence of fatigue from the results of the study is based on Table 2. It shows that the intervention group mostly (67.3%) experienced severe fatigue before doing a combination of AROM with deep breathing exercises. After doing the exercise, a small part of the participants (3.6%) experienced severe fatigue, and almost all participants (96.4%) experienced mild fatigue. In the control group before and after receiving the intervention, according to the hospital's standard procedure, the results showed that most participants (58.2% and 54.5%) experienced severe fatigue. Based on statistical tests with the Mann-Whitney test, there is an effect of physical exercise combined with deep breathing on the level of fatigue in hemodialysis patients ($P = 0.000$).

The results of the study regarding the quality of life indicate that in the intervention group, most participants

(65.5%) experienced a low quality of life before doing a combination of AROM with deep breathing (Table 3). After exercise, half of the respondents (50.9%) experienced a moderate quality of life, and almost half of the respondents (40%) experienced good quality of life. In the control group, participants received the intervention according to the hospital's standard procedure. The results showed that most participants (58.2%) experienced poor quality of life, and most participants (53.6%) experienced poor quality of life. The results of statistical tests with the Mann-Whitney U test show that there is a difference in the quality of life between the intervention group and the control group ($P = 0.000$). So, there is an effect of physical exercise combined with deep breathing on the quality of life of hemodialysis patients.

Discussion

The results showed that there was a significant difference in the level of fatigue in the two groups after the combination of AROM with deep breathing exercises was carried out, which means that the combination of AROM with deep breathing exercises affected reducing fatigue levels which can be seen from Table 2. This is supported by research conducted by Solaiman, who stated that there was a decrease in fatigue levels after physical exercise (19). Another study conducted by Zhou et al also stated that there were differences in the level of fatigue in hemodialysis patients who did routine, non-routine physical exercise

Table 2. Fatigue before and after intervention

Fatigue	Intervention Group				Control Group			
	Pre		Post		Pre		Post	
	No.	%	No.	%	No.	%	No.	%
Severe	74	67.3	4	3.6	64	58.2	60	54.5
Mild	36	32.7	106	96.4	46	41.8	50	45.5
Total	110	100	110	100	110	100	110	100
Wilcoxon	$P = 0.000$				$P = 0.317$			
Mann-Whitney Pre	$P = 0.164$							
Mann-Whitney Post	$P = 0.000$							

Table 3. Quality of life before and after intervention

Quality of life	Intervention Group				Control Group			
	Pre		Post		Pre		Post	
	No.	%	No.	%	No.	%	No.	%
Less	72	65.5	10	9.1	64	58.2	59	53.6
Medium	38	34.5	56	50.9	46	41.8	51	46.4
Good	0	0	44	40	0	0	0	0
Total	110	100	110	100	110	100	110	100
Wilcoxon	$P = 0.000$				$P = 0.059$			
Mann-Whitney Pre	$P = 0.268$							
Mann-Whitney Post	$P = 0.000$							

and who never did physical exercise (20).

Fatigue is a major problem complained of by patients undergoing hemodialysis, which will impact activities and daily life. Table 1 shows that almost all participants have not worked in either the intervention or the control groups. Participants stated that the fatigue experienced made the patients tired and unable to work optimally, so they chose to stop working, and two respondents were removed from their jobs. This is in line with the results of research from Kefale et al, which stated that almost half of the respondents (25.4%) who underwent hemodialysis were no longer working. Respondents who were no longer working generally answered that their daily activities were just sitting, watching, sleeping, eating, and no other activities because they felt that their energy was no longer strong; they felt tired easily (21). According to Sondergaard, hemodialysis patients will easily feel tired, lethargic, joint pain, and other symptoms that make patients not optimal at work and lose their jobs due to physical conditions that have decreased the effects of hemodialysis therapy carried out routinely (2).

Giving a combination of AROM with regular deep breathing exercises during hemodialysis can increase blood flow to the muscles, thereby increasing the number of capillaries and capillary surface area, which can increase the transfer of urea, creatinine, potassium, and toxins from the interstitial tissue to the vascular system during hemodialysis which is then transferred to the dialyzer or hemodialysis machine to increase the clearance of urea. The decrease in urea in the body is a good thing for the patient's condition because high levels of urea will interfere with the production of erythropoietin which causes a decrease in appetite and anemia, causing the body to experience extreme fatigue and will force the heart to work harder to supply the oxygen needed by the body and will cause fatigue. So the decrease in urea will have an impact on reducing the fatigue experienced (22,23). In addition, breathing exercises performed after exercise are also beneficial in increasing pulmonary ventilation so that it can develop optimally and the muscles become relaxed. Breathing in will make the body get adequate oxygen input. When people do deep breaths, it will also increase oxygen perfusion to peripheral tissues and all body tissues, remove toxins and unused metabolic waste, increase metabolism, and produce energy to reduce fatigue levels (13).

The benefits of the combination of AROM with deep breathing exercises began to be felt by respondents, especially in the third and fourth weeks. At the beginning of the exercise, most participants said they felt a little afraid to do physical exercise for fear of interfering with the hemodialysis process. Still, from the second week onwards, the participants no longer felt afraid. When interviewing about the patient's condition after exercise, the average patient said that his body felt more fit, the feeling of fatigue had decreased so that he could carry

out daily activities well, he did not get tired easily, felt fitter and more energetic, felt weak in the weak limbs during this time so making it easier to do activities at home. Exercise will make muscles stronger and joints more flexible, and it will be easier for patients to reach, bend down, and feel more energized so that it can reduce the fatigue felt (13,14). These results are supported by research conducted by Roberge et al, which explains that physical exercise can reduce fatigue levels and increase energy in carrying out daily activities. In this study, 1 participant in the intervention group did not experience a decrease in fatigue levels after a combination of AROM with deep breathing exercise was carried out. This was due to the participant's lack of motivation during exercise, so he was less than optimal in performing every exercise movement. The obstacles in conducting exercise programs in hemodialysis patients are a lack of motivation and an inability to schedule exercise programs that affect fatigue levels and quality of life (24).

The combination of AROM with deep breathing exercises also showed that there was a significant difference in the quality of life in the two groups after the intervention, which means that the combination of AROM with deep breathing exercises affected the quality of life of hemodialysis patients. This can be explained because when a combination of AROM and deep breathing exercises are carried out for ± 30 minutes during hemodialysis, where the movement starts at the upper and lower joints will make the muscles stretch so they do not become stiff to improve elasticity or flexibility of body tissues and reduce cramps on muscles and increase resistance; muscle strength and physical fitness which will reduce fatigue levels and improve quality of life (12,15). A combination of AROM with deep breathing physical exercises done regularly in hemodialysis patients in the intervention group reduces ventilation and shortness of breath during activities and can improve body functions by distributing more oxygen to the muscles. This can occur due to changes in the muscles and cardiovascular system. The occurrence of changes will have an impact on cardiac output and stroke volume to increase and the resting pulse rate to decrease so that there is an increase in the efficiency of the heart's work; the patient will not get tired easily so they can carry out daily activities as desired and will improve their quality of life (14,24). This is supported by research conducted by Kharbteng et al, which explains that physical exercise program therapy carried out for four weeks can improve the physical performance and quality of life of hemodialysis patients (15).

The exercise will also stimulate impulses to the thalamus, which are then forwarded to the sensory processing area in the neocortex (frontal lobe) to increase a positive mood. Feelings of relaxation and calm will stimulate the limbic system to release neurotransmitters in the form of serotonin, dopamine, and melatonin, while the

hypothalamus will release endorphins (12,24). Increased endorphins can affect the decrease in cortisol which has an impact on feeling relaxed, reducing tension, increasing feelings of pleasure, making a person more comfortable, and launching oxygen delivery to the muscles so that it can reduce levels of fatigue, anxiety, stress, and depression which will affect the quality of life of patients (7,9)

Exercise can also maximize oxygen in the body which can reduce oxidative stress and produce energy that can reduce fatigue levels. Reduction of oxidative stress also has a good impact on improving quality of life and sleep quality (15,16). The results of interviews regarding the patient's condition after doing the exercise, on average, the patient stated that his body felt better, felt not stiff, and did not get tired easily so that he could carry out daily activities and rarely asked for help from others. In addition, there were also participants who said that after participating in this exercise, when the hemodialysis process was carried out, they did not go to sleep immediately, so at night they felt better sleep and woke up refreshed. There was a feeling of comfort and calm during the exercise, so they were more energized and felt better after doing the exercises.

The motivation of the participants when participating in this exercise was quite good, which was indicated by their consistency in doing the exercises from the first week to the end of the fourth week with pleasure. This is also supported by the results of this study where there was 1 participant who initially experienced a lack of quality of life into a good quality of life after doing the exercise because during the exercise process, the patient did it happily and the motivation in the patient was very strong to live a better life. From the results of the interview, the participant stated that he did not want to be sad about his illness and had left everything to Allah. This is in line with the results of research by Al Naamani et al and Filipčić et al, which explain that improving a person's quality of life depends on participation in exercise programs, the impact of exercise and the reduction of depression levels (9,25) Thinking positively and surrendering to God will make the occurrence of anxiety lower and make the quality of life better. A combination of AROM with deep breathing exercise has the advantage that this action is easy and can be done independently, can accelerate blood circulation, and has a relaxing effect on hemodialysis patients, which can reduce fatigue levels so that they can carry out daily activities optimally which will ultimately improve their quality of life.

Conclusion

The combination of AROM with deep breathing exercises carried out routinely during hemodialysis therapy procedures can reduce fatigue and improve the quality of life of hemodialysis patients. In future research, researchers will develop self-care management for hemodialysis patients to prevent complications by involving families and the medical team.

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Limitations of the study

The present study had some limitations; for instance, the patients who were not followed up for a long period of study for data collection could increase the value of information. In addition, this study assessed fatigue and quality of life at a point in time, and measuring fatigue and quality may fluctuate at different points.

Authors' contribution

Conceptualization: RYS, YK, SNN.

Methodology: RYS.

Validation: RR.

Formal analysis: RYS.

Investigation: RYS, YK, IF.

Resources: RYS.

Data curation: RR, YK.

Writing-original draft: RYS, IF.

Writing-review and editing: RYS, IF.

Visualization: RYS.

Supervision: SNH.

Project administration: RYS, RR.

Funding acquisition: IF.

Conflicts of interest

The authors declare that they have no competing interests.

Ethical issues

The research followed the tenets of the Declaration of Helsinki. This research has been approved by the Ethics Committee of the Jemursari Surabaya Islamic Hospital with the number (Ethical code# 00024/KEPK-RSI JS/III/2021). Accordingly, written informed consent was taken from all participants before conducting any intervention. This study was extracted from the Magister of Nursing thesis with the number (Thesis# 004/thesis/VII/2018) of Ratna Yunita Sari at Universitas Nahdlatul Ulama Surabaya. Besides, ethical issues (including plagiarism, data fabrication, and double publication) have been completely observed by the authors.

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