The effect of exercise during hemodialysis on fatigue and self-efficacy in patients: a blind randomized clinical trial

Kobra Parvan[1], Farank Jabar-Zadeh[1], Parvin Sarbakhsh[2], Ebrahim Akhtari-Shojai[3], Tahereh Zarei[4]
[1]Department of Medical-Surgical Nursing, Faculty of Nursing and Midwifery, [2]Department of Health and Nutrition, Faculty of Health and Nutrition, [3]PhD in Exercise Physiology, Department of Emam Reza Hospital, [4]Graduate student of Nursing (internal surgery), Faculty of Nursing and Midwifery, Tabriz University of Medical Sciences, Tabriz, iran

Abstract

Aim: Due to the increased prevalence of chronic diseases such as kidney failure, physical, mental and social needs of these patients have also increased and their well-being seems essential. The aim of this study was to investigate the effects of exercise during hemodialysis on fatigue and self-efficacy of hemodialysis patients. Method and Material: This study is a clinical trial; study sample consisted of 46 patients undergoing hemodialysis and who had referred to hemodialysis center of Sahid Madani Hospital in Tabriz; availability sampling method had been used based on the inclusion criteria and with a consent for participating in the study; the sample had been selected from research population and have been divided randomly into two groups of control and experiment. The measuring tools for collecting data included Fatigue Severity Scale (FSS) and Sherer General Self-efficacy scale (SGSES) which were used after determining validity and reliability. After collecting data, the results had been analyzed using SPSS 20 software. For describing quantitative data, the symmetry of the mean and standard deviation had been used and for qualitative data, frequency and percentage had been used and for comparing two groups, analysis of covariance had been used. Results: The results of the current study showed that all patients with chronic renal failure suffered from fatigue and their self-efficacy decreased. Self-Efficacy in patients from the experiment group significantly increased, but it was not significant (p-value = 0.06) and after treatment, fatigue was significantly reduced in the intervention group (p-value <05). Discussion: The results of this study showed that exercising during hemodialysis not only reduces fatigue of these patients, but also leads to improvement of self-efficacy and exercise is recommended in dialysis centers.

Keywords

Hemodialysis; Fatigue; Self-Efficacy; Sports

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Corresponding Author: Tahereh Zarei, Graduate student of Nursing (internal surgery), faculty of Nursing and Midwifery, Tabriz University of Medical Sciences, Tabriz, iran. E-Mail: nursezarei@yahoo.com

Introduction

The most prominent event on the eve of the twenty-first century which health communities and faculties face is the prevalence of chronic diseases. Kidney failure is one of the common diseases of mankind which 2 to 3 percent of people worldwide suffer from this disease. (1) The prevalence of chronic kidney failure in the world was 242 cases per million which increases each year (2). Worldwide, the incidence of kidney disease is growing steadily at a rate of 6% (3). Annual statistics of hemodialysis patients in Iran is increasing by 15% (4). The number of patients with end stage of renal failure was around 3 million and 200 thousand at the end of 2013. At the end of 2013, 2 million 250 thousand individuals used hemodialysis treatment and 272 thousand used peritoneal dialysis; and the number of patients who received transplant was also about 678 thousand people. Dialysis Community of Iran have estimated the number of dialysis patients at the end of 2014 to be about 26,500 people which approximately 25 thousand of these individuals (94%) are undergoing hemodialysis treatment and a thousand and 450 individuals are benefited from peritoneal dialysis (2). According to the Support Society for kidney patients of East Azarbaijan province, now there are about 1524 dialysis patients in the province (3).

Hemodialysis is the most common method of Dialysis and the major purpose for this treatment is to try and make the life of kidney failure patients similar to normal life as much as possible (4). Several studies reported that patients undergoing hemodialysis have less physical ability and capacity comparing to normal people which is due to anemia, impaired blood flow through distal limbs, body edema, reduced cardiovascular function, depression and malnutrition, and so on (5). One of the main points in treating hemodialysis patients is to maximize their performance and welfare, which refers to the ability of performing daily activities and to feel good (6). Physical exercises, as one of the treatment options and accessories can be used in dialysis patients which leads to beneficial effects on physical, psychological and social problems and it is a way to maintain stamina and physical performance and help improve quality of life; not only has personal benefits, but it also has social benefits such as reducing the cost of health and social cares (7).

Fatigue is one of the most annoying and most severe symptoms reported by hemodialysis patients (8). Physiological factors include anemia, age and body size, malnutrition, uremia, high cholesterol levels and treatment-related factors and personal characteristics are some causes of fatigue in these patients (9). Fatigue reduces well-being in these patients and it has several various effects on physical, emotional and cognitive aspects (10).

Exercise is beneficial for patients with kidney failure who have fatigue and limit daily functioning. Since hemodialysis patients spend much time in dialysis centers, sport programs during dialysis have many advantages such as saving time as well. Exercise during dialysis increases functional capacity. However, improvement in functional capacity, physical activity and fatigue are not guaranteed. Nurses have an important role in improving the quality of life, the need for security, cost and availability of services, and the exercixes which patients are able to do (11).

One of the most important factors in improving the quality of life in hemodialysis patients is self-efficacy which means the confidence in one's ability for performing self-care behaviors in certain circumstances (12). Studies show individuals who are confident in their abilities, participate more actively in health improvement programs (13). Correlational studies show that increased self-efficacy is correlated with adherence to treatment, health improvement and reduction of physical and psychological symptoms; and inability to adapt to the disease may lead to negative consequences such as non-compliance with treatment (14). According to studies, changes in sport behavior in many chronic diseases have led to an increase in self-efficacy (15). However, in patients with ESRD, little research has examined the relationship between exercise and self-efficacy. Nurses have an important and effective role in promoting self-care, self-efficacy, compliance, continuity and coping with the disease; and they also have a multi-dimensional role in helping patients with chronic diseases to achieve the highest performance with lowest level of symptoms (16). Therefore, current study aimed to investigate the effects of exercise during hemodialysis on fatigue and self-efficacy of hemodialysis patients.

Material and Method

This study is a clinical trial with registration code of IRCT2016063028715N1; the study population included hemodialysis patients who referred to hemodialysis center of Shahid Madani hospital. For determining the sample size, the basic information for calculating the effect size had been extracted form a study by Hadian et al. (17); a certainty degree of 95% and a test power of 90% had been considered; 17 participants had been calculated for each group as the minimum sample size by considering 16.73 units for variability of intervention for fatigue variable and with the use of Pukak formula. Considering 30% downfall, the sample sized was increased to 23 cases in each group.

The data collection tools included: Fatigue Severity Scale (FSS) and Sherer General Self-Efficacy Scale (SGSES). Also, demographic characteristics included age, sex, marital status, level of education, employment status, and years of dialysis and history of other diseases. Fatigue Severity Scale (FSS) has 9 questions and each question is based on the Likert scales, ranging from strongly disagree to strongly agree. For scoring, each item is scored from 1 to 7, low scores indicate less fatigue and high scores indicate high fatigue. The maximum score that a person can obtain in this scale is 63 and a minimum score is 9. Fatigue Severity Scale had been developed by Krupp et al. (1989) and the reliability of this scale in Iran had been approved by Farahani et al (1391), which internal consistency of items for "Fatigue Severity Scale" had been calculated as 0.96 using Cronbach's alpha coefficient, which shows that the items of the questionnaires assess one concept. After correcting for overlaps, the correlation of each item with another was higher than desired level of 0.4. ICC coefficient for investigating the relative repeatability of Persian version of the Fatigue Severity Scale was 0.93 which was higher than the acceptable level of 0.7 (18). Sherer General Self-efficacy Scale (SGSES) measures individuals' beliefs and ability to overcome different situations; this scale has 17 questions and each question is based on the Lik-

ert scales, ranging from strongly disagree to strongly agree. For scoring this scale, each item receives a score from 1 to 5. Question 1, 3, 8, 9, 13 and 15 are scored from right to left and the rest of the questions are reversed, meaning that they are scored from left to right. Therefore, maximum score that a person can obtain in this scale is 85 and the minimum is 17. This scale had been developed by Sherer and Maddox (1982) and it has been translated and validated by Barati (1996); based on Cronbach's alpha, reliability coefficient for the subscales of general self-efficacy and social self-efficacy had been reported to be 0.86 and 0.71 respectively. The reliability of this test had been reported as 0.70 based of Spearman-Brown correlation and 0.76 using split method of Gottman (19).

The reliability of the questionnaires had been studied after completion by 20 hemodialysis patients within two weeks; the internal consistency for fatigue scale had a Cronbach's alpha 0f 0.89 and reliability over time (intra-group correlation) for the same questionnaire had ICC coefficient 0f 0.99. Moreover, the internal consistency of Self-efficacy questionnaire had a Cronbach's alpha of 0.87 and reliability over time (intra-group correlation) for self-efficacy questionnaire had ICC coefficient of 0.99.

The patients had been selected base on availability method and inclusion criteria, and they had been randomly assigned into two groups of control and experiment. Randomized blocking was also included in the analysis. Inclusion criteria included: age over 18 years, history of hemodialysis for at least 6 months, lack of physical limitations in self-care, lack of orthopedic problems that prevent exercising, lack of any regular sport programs in past six months, lack of cardiovascular disease, shortness of breath and severe heart failure based on the approval of specialist physician and patient's records which prevent them from any exercise program, minimum ability to read and write, willingness to participate in a sports program and an informed consent. Exclusion criteria included: receiving a kidney transplant during the study, having incurable disease (cancer, AIDS, and so on), not wanting to continue in the study, repeated drop of blood pressure to less than 50/90 or severely elevated blood pressure over than 90 / 160 during the intervention, and shortness of breath and chest pain during exercise.

Then, self-efficacy and fatigue have been assessed in both groups using questionnaires. Participants in the intervention group received an eight week exercise program which including pedal bicycle during hemodialysis in the dialysis center and under the supervision of medical doctors specializing in exercise physiology. Before starting the exercise, vital signs (blood pressure, pulse and respiration) had been measured in all patients. Exercise program included pedal bicycling based on proposed sport activities for ESRD individuals; which consisted of 3 days per week, and each session was about 30 to 60 minutes in the first two hours of hemodialysis (20-25). Also during cycling vital signs of patients had been monitored every 15 minutes and if there was a rise or drop of blood pressure, the exercise would be stopped. The speed of cycling had been adjusted according to the physical ability of patients; it started from 30 RPM and based on heart rate and vital signs of patients, it increase to 60 RPM in the last weeks of the program. Exercising on stationary bicycles had been performed which is designed for individuals who are lying on the dialysis bed. Cycling exercise had been selected because it is safe and doable during dialysis; in addition, the patient learns easily how to work with the device. After 8 weeks of exercise, fatigue and self-efficacy of patients had been assessed in both control and experiment groups using questionnaires. We did not have sample loss during the study. The bicycles were handmade customized specifically for dialysis center of Shahid Madani learning hospital of Tabriz which is approver by physicians and the physical education department of University of Tabriz. The diameter of the wheels was 20 cm, the distance from the wheel to pedals was 21 cm and pedal size was 10 × 8 cm.

After collecting data from all subjects, results had been analyzed using SPSS 20 software. To describe the quantitative data, symmetrical mean and standard deviation had been used; and for qualitative data, frequency and percentage had been used. Analysis of covariance had been used for the comparison of quantitative variables between the two groups at the beginning and end of the study.

Results

The study sample included 46 patients undergoing hemodialysis at Shahid Madani Hospital of Tabriz; 23 patients assigned to intervention group which consisted of 18 men and 5 women, and 23 patients were assigned to control group which consisted of 18 men and 5 women; the demographic information is shown in Table 1.

After the intervention, and obtaining the data, the normality of self-efficacy and fatigue had been studied with the use of drawing histograms and the Kolmogorov-Smirnov test and after their normality had been approved, covariance analysis (to adjust confounding) had been used to evaluate the effect of intervention on self-efficacy and fatigue. After the intervention, mean scores for fatigue in both experiment and control groups had decreased as it can be seen in table 3; and this declination was greater for the experiment group. Mean scores for self-efficacy increased in both experiment and control groups after intervention as it can be seen in table 3; moreover, the inclination was higher in experiment group. Although, the two groups did not have any significant differences for self-efficacy and fatigue confounding factors, age, gender, level of education (table 1), the comparison between two groups using covariance analysis and considering confounding variables for each person for age, sex, and level of education in self-efficacy and fatigue had been performed, and self-efficacy of patients had increased in experiment group, but it was not significant (P-value = 0.06); also fatigue was significantly lower in experiment group after intervention (p-value <05) (Table 3).

Table 1) demographic data of participants in the study as distinguished in intervention and control groups

(Quantitative data had been reported as mean and standard deviation, and qualitative data as frequencies and percentages.)

Tale 2) comparing mean scores for self-efficacy and fatigue before and after intervention

For comparison the mean scores for fatigue and self-efficacy, covariance analysis had been performed before and after the intervention for both control and experiment groups which showed significant results.

Table 1.

	Variable Frequency	Control Group		Experiment Group		Sum of Frequencies	Sum of Percentages
		Percentage - Mean	Frequency		Percentage - Mean		
Sex	Male	5	21.7	5	21.7	10	21.7
	Female	18	78.3	18	78.3	36	78.3
Marital Status	single	1	4.3	1	4.3	2	4.3
	Married	14	60.9	18	78.3	32	69.6
	Divorced	8	34.8	4	17.4	12	26.1
Education	elementary	18	78.3	17	73.9	35	76.1
	junior school	4	17.4	1	4.3	5	10.9
	Diploma	1	4.3	2	8.7	3	6.5
	university	0	0	3	13	3	6.5
Employment Status	unemployed	8	34.8	3	13	11	23.9
	house wife	5	21.7	5	21.7	10	7.21
	Farmer	2	8.7	0	0	2	4.3
	self-employed	4	17.4	7	30.4	11	23.9
	retired	4	17.4	8	34.8	12	26.1
Economic Status	less income than expense	16	69.6	17	73.9	33	71.7
	More income than expense	7	30.4	6	26.1	13	28.3
Disease History	Diabetes	6	26.1	7	30.4	13	28.3
	Hypertension	9	39.1	5	21.7	14	30.4
	Non	8	34.8	11	47.9	19	41.3
Age (Year)		23	60.17±10.52	23	89.04±9.51	46	-
History of Hemodialysis (year)		23	3.91±1.97	23	4.04±2.20	46	-

Table 2.

Variable	Groups	Number	Minimum	Maximum	Mean
Fatigue	Before Intervention	46	20	63	49.30±10.55
	After Intervention	46	18	61	45.02±11.45
Self-Efficacy	Before Intervention	46	20	81	52.67±15.77
	After Intervention	46	32	85	57.34±14.93

Table 3) comparing the mean scores for fatigue and self-efficacy before and after the intervention for both control and experiment groups

Conclusion

The results of the current study showed that exercising with a stationary bicycle during hemodialysis for 8 weeks and three times a week reduced the fatigue of patients undergoing hemodialysis and increases self-efficacy of these patients; consistent with the results of the current study, a study in Tehran in 2014 by Zeinab Motedayen and colleagues studied the effects of exercise on fatigue of patients; the sample included 66 hemodialysis patients that had been randomly divided into experiment and control groups. The experiment group received an exercise program twice a week for two months. Fatigue of patients had been measured using FSS before and after the exercise program in both groups of experiment and control. Fatigue of patients in the experiment group increased significantly comparing to control group after the exercise program ($p < 0.05$))26). Another study by Riahi and colleagues at the dialysis center of Shariati in Isfahan that was conducted in 2013, studied the effects of exercise on quality of life and muscle strength in hemodialysis patients. This studies was experimental with pre-test and post-test and with both experiment and control groups. The results of this study showed quality of life of these patients had improved significantly ($p>0.05$) after 5 months of exercis-

Table 3.

Variable	Group		Number	Mean	Difference of two groups	Lower limit of 95% confidence interval for the difference	Higher limit 95% confidence interval for the difference	p-value
Fatigue	before intervention	control	23	48.78±9.79	1.043	-5.295	7.382	0.74
		experiment	23	49.82±11.47				
	After intervention	control	23	48.39±9.49	-6.739	-13.312	-0.165	0.04
		experiment	23	41.65±12.43				
Self-efficacy	before intervention	control	23	51.95±16.25	1.434	-8.035	10.904	0.76
		experiment	23	53.39±15.60				
	After intervention	control	23	53.26±14.60	8.173	-0.450	16.798	0.06
		experiment	23	61.43±14.25				

ing while the control group had not any significant inclination; also muscle strength in the experiment group had a significant increase comparing to control group ($p < 0.05$). The results of this study showed that exercise training had an effect on quality of life and fatigue and improve muscle strength in hemodialysis patients. (27)

A study in California in 2008 had been conducted by Cynthia K. Straub et al., and studied the effects of exercise in fatigue management of peritoneal dialysis patients; the sample included 14 patients undergoing peritoneal dialysis. In this study, patients received exercising programs for 3 or 4 times a week for 2 months and each session were about 30-minutes; exercise program included walking, cycling and swimming. Based on the results of this study, there was no significant change in fatigue of the patients after exercise (28). The sample size was probably low in this study which our study had solved this problem.

In a study that was conducted in 2010 in Canada by Hilary Anna Felice, they investigated the effects of exercise during hemodialysis on self-efficacy and physical activity of these patients. Samples of this study included 8 cases of hemodialysis patients that had been divided randomly into experiment and control groups; the experiment group received exercise on stationary bicycles for 60 minutes in the first 2 hours of hemodialysis; exercise continued for 8 weeks, 3 times week. The results showed, after 8 weeks, no significant changes had observed in self-efficacy and physical activity. And at the end, the authors recommend a repeated study with a larger sample (29). The current study had been conducted with 46 samples, and the results showed significant impact of exercise on improving self-efficacy in hemodialysis patients after 8 weeks of bicycle exercise ($p<0.001$).

In a study that had been conducted in Australia in 2013 by Fiona Barnett, they investigated the effect of exercise on activity and self-efficacy in older women and young people; the samples included 25 young women with an average age of 19 years; and 25 older women with an average age of 57 years. The results showed that all patients with chronic renal failure complications suffered from fatigue and loss of self-efficacy, and this fact indicates the importance of fatigue and self-efficacy and its impact on all aspects of life in these patients; therefore, fatigue and reduced self-efficacy may have devastating effects; although with fatigue being one of the most important signs and symptoms of the disease, exercise and rehabilitation can be considered as noninvasive and easily performed method should gain the attention of care-givers for using it.

Among all sports, exercising with stationary bicycles can be one of the best physical activities for hemodialysis patients due to its convenience usage for the patient and its controllability for nurses during hemodialysis. Other advantages of regular exercise are increased strength, improvement of posture, reduced fatigue, and improvement of mood, increased confidence and general well-being and so on. Doing physical exercises increase the autonomy of the individual and not only leads to improvement of quality of life but also affects balance of the person, upper and lower limb coordination and prevents cardiovascular disease (31).

Conclusion

The results of this study shows positive effects of exercise during hemodialysis in improving self-efficacy and reduce fatigue in hemodialysis patients, so exercise during hemodialysis can be considered as a routine and effective program by supervision of medical staff in hemodialysis centers, and due to its low cost and availability, this method is a step to reduce the suffering of patients undergoing hemodialysis.

Study Limitations

The limitation of this study was that fatigue and self-efficacy are mental phenomena and measuring them is very difficult and is affected by many variables such as emotional changes and other uncomfortable Symptoms accompanied with chronic disease, therefore, careful consideration is difficult and controlling these aspects was out of reach of reaserchers.

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