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Effects of physical activity by the teach-back educational method on the physical ability and quality of life in hemodialysis patients: a clinical trial†

Original Article

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Abstract: **Objective:** To determine the effect of physical activity by using the teach-back educational method on hemodialysis patients' quality of life (QOL) and physical ability.

Methods: This is a single-blind clinical trial study involving a control group. A total of 90 patients who admitted to the dialysis centers of Beheshti and Besat hospitals in Hamadan were selected using a convenience sampling method and were randomly assigned to intervention (n = 45) and control (n = 45) groups. Data were collected using a demographic information checklist, a kidney disease QOL questionnaire, and a 6-minute-walk distance (6MWD) checklist. The patients' QOL questionnaire was completed, and the 6MWD was recorded before and at the end of the 2nd, 4th, 6th, 8th, and 12th weeks of the intervention. In the intervention group, the patients were taught to perform physical activities with Pilates stretches in different resistances using the teach-back educational method during dialysis sessions for 12 weeks. Data were analyzed by using the independent t-test and chi-square test using SPSS-22 software.

Results: Before the intervention, no differences were observed between the experimental and control groups in terms of demographic characteristics, QOL, and physical ability ($P > 0.05$). The physical ability and QOL levels of patients exercising in the test group were higher than those in the control group after the intervention ($P < 0.05$). Based on the results, the 2 groups significantly differed with regard to the scores of various dimensions of QOL and physical ability after the intervention ($P < 0.05$).

Conclusions: Physical activity by using the teach-back method can effectively increase physical ability and improve QOL of hemodialysis patients. Therefore, the recommendations and inclusion of exercise in the dialysis care plan can effectively promote patients' health.

Keywords: *hemodialysis patients • physical ability • physical activity • quality of life • teach-back education*

1. Introduction

Nowadays, health communities and workers encounter an increasing prevalence of chronic diseases as the most prominent event.[1] Meanwhile, chronic kidney disease (CKD) threatens public health worldwide, the

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prevalence of which is on the rise, particularly in people >60 years of age.[2,3] CKD is kidney damage or loss of kidney function caused by the progressive and irreversible loss of numerous active nephrons, leading to the entry of excreta into the blood.[4]

The annual prevalence of CKD is 262 cases per million population globally, which increases by approximately 8% every year. Hemodialysis is the most common treatment for CKD.[5] In Iran, there are 58,000 kidney patients and >35,000 hemodialysis patients, and an annual increase of 15%–17% clearly indicates the high incidence of kidney disease in the country and the need to pay attention on kidney patients.[6,7] Although dialysis increases a patient's lifetime, it does not alter the course of kidney disease and cannot completely replace kidney function. According to Brunner,[8] despite hemodialysis, CKD patients suffer from a wide range of physical, psychological, economical, and social problems, which affect their quality of life (QOL). Nowadays, the QOL of different patients, especially those undergoing hemodialysis, has been of interest to many researchers because it allows a more fundamental evaluation, and patients' QOL can affect different aspects of their lives.[9]

On the other hand, hemodialysis treatment affects the life of patients in the long term, which results in an inactive lifestyle in most hemodialysis patients.[8] Moreover, hemodialysis is implemented in a horizontal position, and the patients spend approximately 800 h a year without physical activity, causing several side effects such as decreased physical endurance, muscle atrophy, muscle weakness, and decreased strength.[10] Hemodialysis patients have less physical ability and exercise capacity than normal people, and some studies have attributed it to anemia, decreased cardiac function, and decreased daily physical activity.[11,12] Decreased endurance and physical capacity of hemodialysis patients can negatively affect their lives[13,14] and lead to increased dependence on others for self-care activities.[15]

Supportive therapies in CKD patients include physical exercise as an adjuvant therapy, which improves the physical ability and QOL of patients and has beneficial physical, psychological, and social effects; however, it has unfortunately received less attention.[16–18] Any educational intervention in this field requires the use of appropriate educational methods that seek to address educational needs by making an appropriate interpersonal relationship with the patient.[19] The teach-back method is considered as an educational technique for ensuring patients' understanding.[20,21]

In addition, it is a comprehensive, interdisciplinary, and evidence-based approach that assesses learners' comprehension by asking them to express, in their own language, the educational items that they have heard and understood from the instructor without feeling ashamed.[22,23]

Based on the reports of similar previous studies, the physical condition and QOL of patients undergoing hemodialysis improved by practicing different types of physical activity and exercise during hemodialysis. Hatef et al.[24] reported that a 6-minute walk distance (6MWD) test for 8 weeks (2 weeks during dialysis and 6 weeks at home) led to an improvement in the physical condition and quality of dialysis patients. Similarly, Abbasnejad and Salesi[25] found that resistance exercise for 3 months during dialysis increased the performance of hemodialysis patients. Bulckaen et al.[26] also presented evidence that a 6MWD test and a stationary treadmill for 6 months could increase body function in hemodialysis patients. Jo-Han Chang et al. revealed that Tai Chi exercise for 12 weeks during dialysis improved the QOL and physical function of patients undergoing hemodialysis.[27] Moreover, Aliasgharpour et al.[28] observed that stretching movements for 8 weeks during dialysis could improve patients' QOL.

According to the literature review, previous studies have evaluated and used the teach-back educational method for teaching physical activity to patients undergoing hemodialysis and determined its effect on compliance with physical activity in these patients. Furthermore, effective physical activities require accurate repetition and continuity, necessitating the use of an appropriate educational method to learn and master the correct movements. In this respect, the present study sought to determine the effect of the teach-back educational method of physical activity on the QOL and physical ability of hemodialysis patients.

2. Methods

The present study is a single-blind clinical trial study consisted of an intervention group and a control group and was registered (code IRCT2017013003230N5) in the Iranian Registry of Clinical Trials (IRCT). In this research, subjects were blinded about the treatments. In total, 90 hemodialysis patients meeting the inclusion criteria were selected using the convenience sampling method from the dialysis centers of Beheshti and Besat hospitals in Hamedan and were enrolled in the study. The subjects were then assigned to intervention and control groups using the block randomization method according to the pattern mentioned in Table 1. Then, subjects with odd and even file numbers were given codes A and B, respectively. The samples were allocated to 15 equal blocks of 6 individuals, and every 3 samples were coded as A and B, respectively (Table 1). Next, patients with codes A and B were allocated to intervention and control groups, respectively. The formula reported by Wu et al.[29] was used to determine the sample size. A minimum of 42 patients was needed in each of the control and intervention groups

considering a 95% confidence level, the second type error of 10%, and a maximum significant difference of about 1.5. Finally, a sample size of 45 patients was estimated in each group considering the 15% probability of withdrawal.

$$n = \frac{2\left(z_{\alpha/2} + z_{b}\right)^{2} S^{2}\{1+(m-1)r\}}{md^{2}}$$

The inclusion criteria were the age range of 18–65 years, literacy, satisfaction and cooperation in the study, hemodialysis for at least 6 months, no history of hospitalization for at least 6 months, and no participation in other regular exercise programs for 6 months, as well as the lack of musculoskeletal problems, cardiovascular disease, dyspnea, and severe heart failure preventing exercise. The exclusion criteria included participating in no exercise programs for 4 times during the entire test program, failing to cooperate and withdrawing from the exercise program, and leaving dialysis due to kidney transplantation or any other action. It is noteworthy that both hospitals were similar in terms of the type of dialysis machine, equipment, type of filters, type of dialysis fluid, and the like.

In this study, demographic and disease information checklists, the QOL questionnaire for kidney patients, and the 6MWD checklist were used for data collection.

The Kidney Disease Quality of Life-Short Form (KDQOL-SF) questionnaire, which was designed by Hays et al. (1995)[30], is a self-administered instrument that includes 2 general and specific dimensions of QOL consisting of physical and mental health with 8 domains, respectively. The physical condition includes 4 domains of general health (6 items), physical function (10 items), physical role-playing (4 items), and physical pain (3 items). The mental condition also encompasses 4 domains of emotional role-playing (3 items), social functioning (2 items), and mental health (6 items) and vitality (2 items). The specific dimension includes 11 domains, namely, symptoms/problems (12 items), effects of kidney disease (8 items), burden of kidney disease (4 items), cognitive function (3 items), quality of social interaction (3 items), social support (2 items), sleep status (4 items), work status (2 items), sexual function (2 items), and dialysis staff encouragement (3 items). This questionnaire is a valid and reliable multidimensional instrument that covers all the dimensions of the 36-SF questionnaire in addition to variables related to kidney disease with high degrees of homogeneity and internal consistency. Each dimension is scored from 0 to 100, and a score >50 in each dimension and domain of QOL indicates a better QOL.[31] The formal validity of the KDQOL-SF was studied and confirmed by 10 faculty members of the Department of Internal Surgery, School of Nursing and Midwifery, Hamadan University

Patient number	Group	Patient number	Group	Patient number	Group	Patient number	Group	Patient number	Group
1	A	25	A	49	A	67	B	85	A
2	B	26	B	50	A	68	A	86	B
3	A	27	A	51	B	69	B	87	A
4	B	28	B	52	B	70	A	88	B
5	A	29	A	53	A	71	A	89	A
6	B	30	B	54	B	72	B	90	B
7	B	31	B	55	B	73	B		
8	A	32	A	56	A	74	A		
9	B	33	B	57	A	75	A		
10	A	34	A	58	B	76	B		
11	B	35	B	59	A	77	A		
12	A	36	A	60	B	78	B		
13	B	37	A	61	B	79	B		
14	A	38	B	62	B	80	B		
15	B	39	B	63	A	81	A		
16	A	40	A	64	A	82	A		
17	B	41	A	65	A	83	A		
18	A	42	B	66	B	84	B		

Table 1. Block randomization of subjects in intervention and control groups.

of Medical Sciences. The reliability of the questionnaire was calculated with a Cronbach's alpha of 0.85.[32] In the present study, the reliability of the questionnaire was obtained by calculating Kendall's coefficient of concordance (0.89), indicating the appropriate reliability of this instrument.

The patients' physical capacity was measured using the 6MWD checklist. To this end, the distance traveled by the patient on a surface measured with a meter scale was accurately recorded by the researcher. The formal validity of the checklist was examined and approved by 10 faculty members of the Department of Internal Surgery, School of Nursing and Midwifery, Hamadan University of Medical Sciences.

After obtaining reference letters and making necessary arrangements, hemodialysis wards were visited in morning, evening, and night shifts. The study objectives were explained to subjects who met the inclusion criteria, along with obtaining informed consent forms.

In the pre-test stage before the education and exercise programs, the checklist of demographic and disease characteristics and the KDQOL-SF were completed by patients in both intervention and control groups under the same conditions after providing necessary explanations about the filling method. Patients in both groups were then asked to walk in a rectangular hall (10 m long and 3 m wide) for 6 min. The hall was a covered space located next to the dialysis ward in both Beheshti and Besat hospitals. After 6 min, the distance traveled by the patients in both experimental and control groups was recorded by the researcher.

In the hemodialysis departments of both hospitals in Hamadan, there is no exercise or regular exercise for patients. With this in mind, during dialysis,

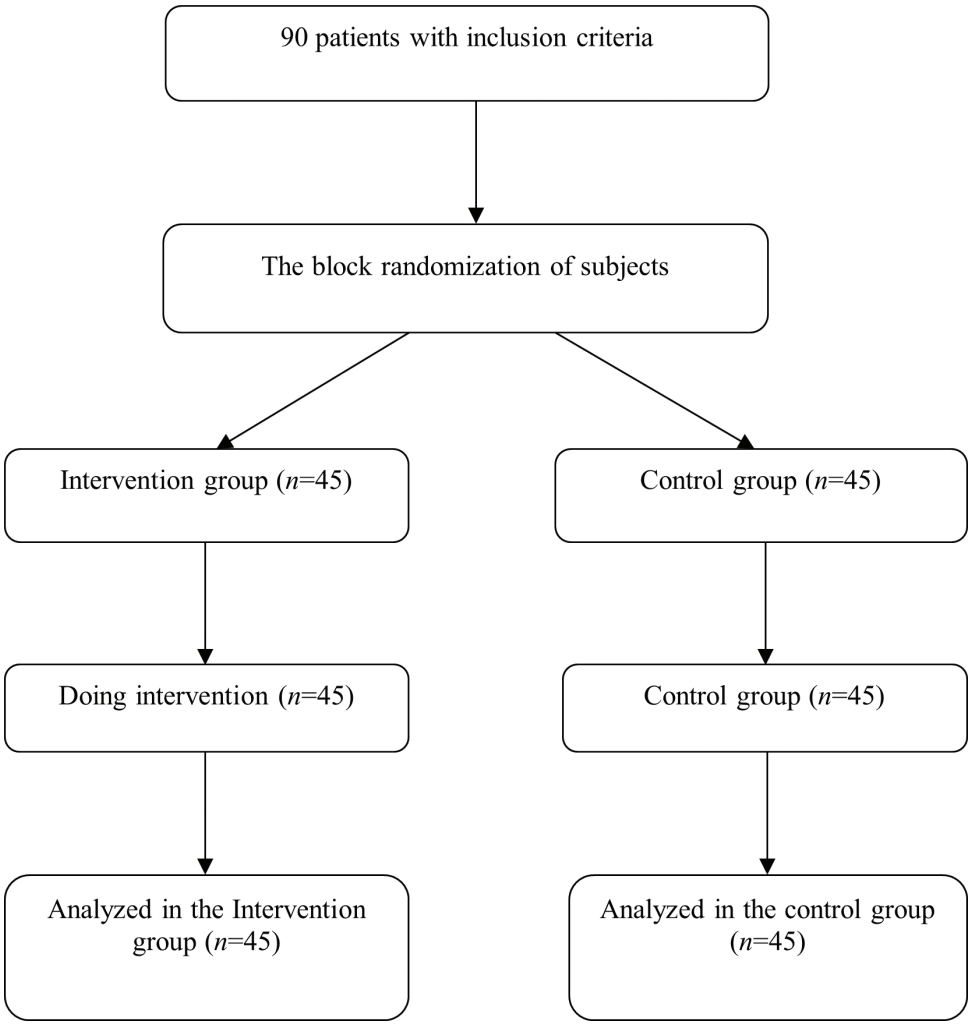

Figure 1. The CONSORT of the research steps.

patients in the intervention group were taught the method of performing physical activities with Pilates stretches in different resistances during first 20 min of all weekly dialysis sessions for 12 weeks. Then, the patients performed core stability exercises, along with isotonic and isometric exercises tailored to the age and individual characteristics of each patient by a sports medicine expert. To prevent hypotension, exercises in the first 2 h of dialysis were performed on a dialysis bed.[32] The patient's vital signs were examined before the exercises, and the exercise was canceled on the day the symptoms were not normal or if the patient expressed illness. The patients were taught using the teach-back method during the 12 weeks. For this purpose, the patient was verbally taught the exercise, the associated benefits, and the consequences of failure in doing exercises. The patients were then asked to repeat the content and type of exercise for the instructor and taught the exercise again when they did not understand it correctly. During the 12 weeks, patients in the control group received only routine care. The QOL of patients and the amount of distance traveled for 6 min in intervention and control groups were measured at the end of the 2nd, 4th, 6th, 8th, 10th, and 12th weeks The steps of conducting this clinical trial are summarized in the consort in Figure 1.

Data were analyzed by SPSS software, version 22. The normal distribution of data was indicated by using the Kolmogorov–Smirnov test, and chi-square, one-way analysis of variance (ANOVA), and repeated-measures ANOVA were used for data analysis at a confidence level of 95%.

3. Results

The mean ages of patients were 44.2 ± 9.85 years and 43.28 ± 10.31 years in the control and intervention groups, respectively. The duration of treatment was 11.76. ± 4.19 years and 11.76. ± 4.21 years, on average, in the control and intervention groups, respectively. The majority of subjects in the intervention group were men (51.1%) without a high school diploma (55.6%), and the control group consisted of women (57.8%) with a high school diploma (60%). Married subjects comprised the highest percentage in both test and control groups (57.8%), the details of whom are presented in Tables 2 and 3.

The results of this study showed that the highest mean among the QOL dimensions belonged to the symptoms and effects of kidney disease, respectively, while role disorders caused by physical and emotional health have the lowest mean values. In addition, significant differences were observed between the intervention and control groups in terms of QOL and the 6MMD during different times. In the intervention group, the average traveled distance increased after the 12th week compared to that before the intervention (Tables 4 and 5).

Demographic characteristic	Intervention group	Control group	P-value
	Number (percent)	Number (percent)	
Gender			0.387
Female	22 (48.9)	26 (57.8)	
Male	23 (51.1)	19 (42.2)	
Marital status			0.148
Married	26 (57.8)	26 (57.8)	
Single	13 (28.9)	14 (31.1)	
Divorced	5 (11.1)	4 (8.9)	
Spouse of the deceased	1 (2.2)	1 (2.2)	
Level of education			0.329
High school	25 (55.6)	11 (24.4)	
Diploma	14 (31.1)	27 (60.0)	
College education	6 (13.4)	7 (15.6)	
Employment status			0.231
Housewife	20 (44.4)	22 (48.9)	
Employee	7 (15.6)	6 (13.3)	
Self-employed	9 (20.0)	8 (17.8)	
Retired	9 (20.0)	9 (20.0)	

Table 2. Comparison of categorized demographic characteristics of participants in the control and intervention groups.

Characteristic	Intervention		Control		*P*-value
	Mean	SD	Mean	SD	
Age (years)	43.28	10.31	44.20	9.85	0.669
Duration of hemodialysis treatment (years)	11.76	41.21	11.76	41.19	1

Note: SD, standard deviation.

Table 3. Frequency of age and duration of hemodialysis treatment in control and intervention groups.

Dimension	Before intervention		Wk2		Wk4		Wk6		Wk8		Wk10		Wk12		
	Intervention	Control	Intervention	Control	Intervention	Control	Intervention	Control	Intervention	Control	Intervention	Control	Intervention	Control	
Symptoms and problems	33.91 9.7	33.55 9.9	32.97 10.3		32.19 10.9		32.66 10.1		32.26 10.4		29.75 11.07		30.9 9.2	32.13 10.5	F = 9.009 *P* < 0.001
Effect of kidney disease	25.11 7.2	25.26 7.3	25.70 8.1		25.31 8.4		25.43 8.5		24.60 8.6		24.73 8.9		24.11 8.8	24.66 8.7	F=8.310 *P* < 0.001
Kidney disease burden	10.80 4.3	10.66 4.3	10.64 4.1		10.60 4.5		11.08 4.1		11.0 4.2		10.46 4.6		10.75 4.6	10.64 4.7	F=2.555 *P*= 0.052
Working status	3.48 0.5	3.51 0.5	3.51 0.5		3.51 0.5		3.51 0.5		3.51 0.5		3.51 0.5		3.51 0.5	3.53 0.5	F= *P*=
Cognitive function	9.03 2.74	8.75 2.9	8.42 3.2		9.46 3.3		8.07 2.6		9.30 2.6		8.78 3.4		9.17 3.8	9.14 3.6	F = 14.802 *P* < 0.001
Quality of social interactions	9.95 2.9	9.95 3.2	10.30 2.8		10.00 3.2		10.15 3.04		9.90 2.9		9.60 2.45		9.37 3.3	9.30 3.1	F = 4.303 *P* = 0.007
Sexual function	7.24 3.05	7.22 2.9	7.48 3.1		6.88 2.9		7.14 3.08		7.14 3.08		6.85 3.05		6.97 3.0	6.92 2.9	F = 14.325 *P* < 0.001
Sleep	16.41 3.3	16.38 3.4	16.55 3.5		15.89 3.2		15.21 3.2		16.73 2.9		16.97 3.3		16.45 3.1	16.47 3.3	F = 3.605 *P* = 0.026
Social support	7.07 1.63	7.13 1.61	7.24 1.49		7.22 1.3		7.02 1.7		7.02 1.5		6.93 1.8		7.08 1.5	6.91 1.5	F = 3.596 *P* = 0.037
Encourage dialysis staff	4.95 3.2	4.88 3.00	4.79 2.8		4.70 3.1		4.54 2.8		4.54 3.0		4.61 2.9		4.65 2.9	4.83 2.9	F = 5.668 *P* < 0.001
Patient satisfaction	4.47 3.1	4.45 3.1	4.38 3.1		4.61 3.01		4.97 2.86		4.88 2.78		5.38 2.74		5.15 2.89	5.11 3.04	F = 7.894 *P* < 0.003
Physical function	21. 8 4.97	21.30 5.13	21.59 5.04		21.04 5.19		20.83 5.45		20.80 5.58		21.52 5.11		21.38 5.16	21.53 4.38	F = 5.332 *P* = 0.006
Restrictions of role due to physical problems	6.00 1.66	6.06 1.67	6.26 1.35		6.33 1.50		6.42 1.51		6.55 1.47		6.13 1.45		6.06 1.45	6.13 1.52	F = 3.804 *P* = 0.019
Pain	8.30 2.22	8.27 2.29	7.90 2.54		7.86 2.92		7.47 2.37		7.00 2.15		7.31 1.82		6.56 2.29	6.52 2.22	F = 18.943 *P* < 0.001
General health	16.84 3.24	16.93 3.23	16.61 2.95		15.97 3.17		16.17 3.22		15.45 2.70		15.18 2.99		15.15 3.28	15.04 3.34	F = 24.572 *P* < 0.001
Sense of well-being psychologically	17.73 2.65	17.92 2.55	17.78 2.29		17.54 1.69		17.47 2.43		17.00 2.29		17.59 2.24		17.21 2.63	17.02 2.69	F = 2.412 *P* = 0.087
Restrictions on role due to emotional problems	5.29 1.07	5.25 1.12	5.36 1.13		5.19 1.22		5.26 1.11		5.14 1.25		5.09 1.28		5.04 1.30	5.13 1.25	F = 7.294 *P*[1]= 0.002
Social performance	5.86 1.03	5.86 1.12	5.59 1.46		6.02 1.54		6.38 1.60		6.40 2.19		6.56 1.99		6.47 2.21	6.43 2.44	F = 13.203 *P* < 0.001
Vitality	13.60 2.53	13.91 2.79	14.37 2.32		13.66 2.08		13.95 2.51		13.20 2.86		13.60 2.57		13.48 2.06	13.57 2.91	F = 4.954 *P* = 0.009

Note: QOL, quality of life; SD, standard deviation.

Table 4. Comparison of the means (±SD) of different dimensions of the QOL in the intervention and control groups before the intervention and after the 2nd, 4th, 6th, 8th, 10th, and 12th weeks (M ± SD).

Table 5. Evaluation and comparison of the 6MWD between control and intervention groups before the intervention and after the 2nd, 4th, 6th, 8th, 10th, and 12th weeks (M ± SD).

	Before intervention		Wk2		Wk4		Wk6		Wk8		Wk10		Wk12		
	Intervention	Control	Intervention	Control	Intervention	Control	Intervention	Control	Intervention	Control	Intervention	Control	Intervention	Control	
SMWT	232.22 (68.17)	214.08 (75.33)	233.17 (65.58)		234.86 (68.12)		238.98 (69.67)		245.17 (73.93)		248.46 (71.33)		250.55 (71.92)	240.22 (73.92)	$P < 0.001$

Note: 6MWD, 6-min walking distance; SD, standard deviation.

4. Discussion

The present study investigated the effects of teach-back physical activity education on the physical ability and QOL of dialysis patients. The results demonstrated that the intervention and control groups were significantly different in terms of average physical ability and QOL scores during this research. In other words, patients' physical ability and QOL improved when they performed exercise as taught through the teach-back method.

Moini et al.[33] studied the combined effect of aerobic and anaerobic exercises on hemodialysis patients' QOL and concluded that combined exercise can improve patients' QOL compared to the control group. Similarly, Bastani et al.[34] investigated the effect of selected core stability exercises on restless legs syndrome and the QOL of elderly patients undergoing hemodialysis and found that sports intervention improved the total QOL score from 5.53 to 9.29, which was a significant increase compared to that in the control group.[34] In a study on the effect of individual exercises during hemodialysis on exercise capacity and QOL in hemodialysis patients, the results indicated a positive effect of individual exercise on the QOL and the physical capacity of hemodialysis patients.[29] Aliasgharpour et al.[28] observed statistically significant changes in the mean score of QOL in the intervention group compared to that in the control group concerning the effect of stretching exercise on the QOL of hemodialysis patients after 8 weeks of intervention. In another study on the impact of a 12-week Tai Chi exercise program on the QOL and physical performance of end-stage CKD patients, Chang et al.[27] reported that Tai Chi exercise significantly improved physical performance and the QOL of patients undergoing hemodialysis.

Hatef et al.[24] evaluated the effect of exercise during dialysis and walking at home on the physical ability and adequacy of dialysis in hemodialysis patients. They found a significant change (P = 0.015) in the average distance traveled by the test group compared to the control group using the 6MWD test and concluded that exercise could improve hemodialysis patients' physical condition, in line with the results of the present research.

The results of studies by Parsons et al.[35] and Aliasgharpour and Hadiyan[36] contradict those of the present study. Parsons et al.[35] investigated the effect of exercise on the quality of dialysis and physical performance of dialysis patients and concluded that there were no post-exercise changes in the mean score of patients' QOL in the control and test groups. This observation was attributed to the history of short-term dialysis (4 months) of patients, leading to no

post-exercise changes in the mean score of patients' QOL. Aliasgharpour and Hadiyan[35] studied the effect of exercise programs on increasing the physical capacity of patients by comparing the mean distances walked in 6 min and found no statistically significant differences between the test and control groups before the intervention, after 4 weeks, and at the end of 8 weeks. Additionally, a comparison of values at the beginning and end of the 8th week in the test group revealed a 66-m increase in the average walking distance; however, this difference was not statistically significant. Possible reasons for the non-significant results in their study were a low sample size (25 subjects), exercise activities in only 8 weeks, and the interval between exercise sessions.

5. Conclusions

In general, our findings showed that exercise through reverse training can improve the QOL and physical ability of dialysis patients. But in general, considering the point that these patients did not receive any exercise intervention during dialysis before the exercise intervention using the return training method, it can be presumed that due to the significant effects of exercise activities and long-term immobility of hemodialysis patients and their reduced QOL, it seems that scientific and regular exercise can improve the QOL and physical ability of these patients.

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Ethical approval

The present study was approved by the Ethics Committee of Research (code of ethics IR.UMSHA.REC.1397.734) and registered (project number 9712218009) in the Research Council of Hamadan University of Medical Sciences and the IRCT (the code IRCT2017013003230N5).

Conflicts of interest

All authors declare no conflicts of interest.

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