International Journal of Advance Research in Medical Surgical Nursing

E-ISSN: 2663-2268
P-ISSN: 2663-225X
www.surgicalnursingjournal.com
IJARMSN 2024; 6(2): 42-51
Received: 21-05-2024
Accepted: 27-06-2024

Ghada Nasser Hathal Alqahtani
Alumni Student, College of Nursing, Riyadh ELM University, Riyadh, Saudi Arabia

Faten Fawaz Khalil Alnezi
Alumni Student, College of Nursing, Riyadh ELM University, Riyadh, Saudi Arabia

Fatma Hassan Saeed Alrefaei
Alumni Student, College of Nursing, Riyadh ELM University, Riyadh, Saudi Arabia

Ebtesam Obilik Ateya Alanazi
Alumni Student, College of Nursing, Riyadh ELM University, Riyadh, Saudi Arabia

Ashwaq Matar Muberk Almrzooq
Alumni Student, College of Nursing, Riyadh ELM University, Riyadh, Saudi Arabia

Renad Ahmed Al Tahsi Alzahrani
Alumni Student, College of Nursing, Riyadh ELM University, Riyadh, Saudi Arabia

Shahad Saeed Mohammed Aldosari
Alumni Student, College of Nursing, Riyadh ELM University, Riyadh, Saudi Arabia

Hissah Sameer Saroor Bin Mohaimeed
Alumni Student, College of Nursing, Riyadh ELM University, Riyadh, Saudi Arabia

Nseem Mohamed Alameen Ahmad Alshanqeti
Alumni Student, College of Nursing, Riyadh ELM University, Riyadh, Saudi Arabia

Corresponding Author:
Dr. Shaimaa Allam
Assistant Professor, College of Nursing, Riyadh ELM University, Riyadh, Saudi Arabia

Effectiveness of intradialytic leg ergometry exercise for improving quality of life and fatigue among hemodialysis patients

Ghada Nasser Hathal Alqahtani, Faten Fawaz Khalil Alnezi, Fatma Hassan Saeed Alrefaei, Ebtesam Obilik Ateya Alanazi, Ashwaq Matar Muberk Almrzooq, Renad Ahmed Al Tahsi Alzahrani, Shahad Saeed Mohammed Aldosari, Hissah Sameer Saroor Bin Mohaimeed, Nseem Mohamed Alameen Ahmad Alshanqeti and Shaimaa Allam

DOI: https://doi.org/10.33545/surgicalnursing.2024.v6.i2a.193

Abstract
Background: Hemodialysis patients often face fatigue and reduced quality of life (QoL), affecting their overall well-being. Intradialytic leg ergometry exercise could help mitigate these effects, improve health-related QoL, and manage chronic diseases.
Aim: This study aims to evaluate the impact of intradialytic leg ergometry exercise on improving fatigue and QoL among hemodialysis patients.
Method: A mixed clinical observational and questionnaire-based study was utilized. This study was conducted in a dialysis unit in King Fahd Medical City. A purposive sample of 60 hemodialysis patients was enrolled in the current study and divided into study and control groups. Tool: Three tools were used for data collection: Tool I: General demographic data; Tool II: The Functional Assessment of Chronic Illness Therapy - Fatigue Scale (FACIT Fatigue); and finally, Tool III: QoL questionnaire.
Results: The results indicate that the intervention may be effective in improving several health-related QoL indicators. The study groups' total score, t = 6.956 p = <0.001* post-intervention, was statistically significant. Higher energy levels, improved daily functioning, and improved mental and physical well-being were all noted by the participants. The findings also show a significant improvement in the study group's level of fatigue following the intervention; the group's percentage of fatigue changed from 100% severe to 100% better, with highly significant differences 2= 49.091* (*p*< 0.001*) between the study group and the control group.
Conclusion: This study offers proof that intradialytic leg ergometry training helps hemodialysis patients feel less fatigued and live a better QoL. The results imply that regular dialysis sessions with intradialytic leg ergometry exercise can be a beneficial supplementary therapy for improving the general health of hemodialysis patients.

Keywords: Intradialytic leg ergometry exercise, quality of life, fatigue, hemodialysis patients

1. Introduction
One of the body's essential organs, the kidney's primary job is to eliminate waste and extra water from the blood. When you have kidney disease, your kidneys are damaged and unable to properly filter blood [1, 2]. The illness known as chronic renal failure is characterized by a decline in the kidney's capacity to remove fluid and waste from the blood. Another popular name for the illness is chronic kidney disease (CKD) [3, 4]. One form of renal replacement therapy for CKD patients is hemodialysis. Numerous side effects, such as low blood pressure (hypotension), muscle cramps, itching, difficulty sleeping, a decline in quality of life, anemia, bone disorders, fluid overload, hyperkalemia (high potassium levels), pericarditis (inflammation of the heart's membrane), and problems with the access site, can be brought on by the disease or its treatment [5, 6].
One potential preventive measure to lessen the loss of muscle protein and preserve muscle function is exercise. Numerous studies have demonstrated the value of exercise or regular physical activity in preventing muscle atrophy in people with chronic kidney disease. Consequently, the goal was to examine the advantages of exercise during hemodialysis, or intra-dialytic exercise. Hemodialysis patients participating in various training programs

report several benefits from physical activity, such as improved QoL and increased physical capacities [7, 8].
Intra-dialytic leg ergometer is a safe and effective exercise that helps patients with chronic renal disease that is already active feel less tired and fit. It also allows patients who are sedentary to feel less tired. For eight weeks, the leg ergometer exercise is done for thirty minutes during the first hour of each hemodialysis session [9, 10]. Our study shows that exercise during hemodialysis can reduce fatigue and increase the potential for physical activity without adding extra time to the patient's stay. Therefore, 30 minutes of intra-dialytic leg ergometer exercise can be standard treatment when hemodialysis is administered.

Significance of the study
A common, progressive medical problem is CKD. When compared to healthy people, the majority of patients have lower functional abilities and a lower quality of life. [11] Long-term hemodialysis (HD) treatment exposure causes muscles to catabolize, which can have a major negative influence on mortality, fall risk, quality of life, and independence [12, 13].
Our goal in this study is to assist HD patients in becoming more active, as this is a promising way to counteract muscle atrophy and the related decline in physical function. HD patients will spend less time immobilized overall if they can complete intradialytic exercises throughout the session without needing to take additional time from their treatment.

General Aims of the Study
This study aims to evaluate the effect of intradialytic leg ergometry exercise for improving fatigue and quality of life among hemodialysis patients.

Research Hypotheses
H1: The quality of life among patients with hemodialysis patients will be improved and fatigue will reduce after the implementation of leg ergometry exercises in the study group than the control group.
H2: There will be a significant difference between control and study groups in the level of fatigue and quality of life among patients with hemodialysis patients.

2. Materials and Methods
Research design
A mixed clinical observational and questionnaire-based study was utilized.

Sample characteristics
A purposive sample of 82 hemodialysis patients of both sexes who are conscious and able to communicate; cooperative patients accepting to participate in the study, and aged from 20 to 60 years were invited to participate in the study. Patients with anxiety disorders, hearing problems, heart failure, inflammatory joint disorders, musculoskeletal disability or fractures, and patients with respiratory diseases were excluded from the study. After 10 people were eliminated and 12 patients died throughout the study, the final sample was calculated from 60 participants. The sample was divided into two equal groups: a study group and a control group, each of which included 30 hemodialysis patients. The sample size calculated using the Steven K. Thompson equation was used to estimate the appropriate sample size for this study [14].
According to the total number of admitted hemodialysis patients in the last year, the total number of hemodialysis patients was 105. As the confidence level is 95%, the error proportion is 0.05 and the probability (50%).

Sample randomization
To do this, a sheet of paper was given to each patient. Patient option number one is a member of the control group, while patient option number two on the paper is a member of the study group. The control group just received standard routine treatment, whereas the study group received intradialytic leg ergometry exercise and standard routine care.

Study setting
The study was conducted in a dialysis unit in King Fahd Medical City.

Tool
Three tools were used for data collection:

Tool I: General demographic Data
The Socio-demographic data (Age, gender, marital status, residence, educational level occupation, and nature of work were developed by researchers.

Tool II: The Functional Assessment of Chronic Illness Therapy - Fatigue Scale (FACIT Fatigue)
This 13-item test evaluates self-reported exhaustion and how it affects day-to-day tasks and functioning. A quick and simple tool to use, the FACIT exhaustion Scale gauges a person's degree of exhaustion from the previous week's regular activities. A four-point Likert scale (4 = not at all exhausted to 0 = very much fatigued) is used to quantify the degree of weariness [15]. The FACIT Fatigue Scale demonstrated strong test-retest reliability (ICC = 0.95) and strong internal validity (Cronbach's alpha = 0.96) in 2007 research [16-18].
Every item on the FACIT fatigue measure is added up to provide a single fatigue score that ranges from 0 to 52. When applicable, items are reverse-scored to create a scale where higher scores indicate less weariness or greater functioning. The score categories are as follows:
- A score below thirty was regarded as low fatigue.
- Severe fatigue was defined as a score of more than thirty.

Tool III: Quality of life questionnaire
Making use of the SF-36 health scale survey: Every question was given a score between 0 and 100. A score of 100 denotes the maximum feasible functional level. A mean score was obtained by adding up all of the item scores and dividing the total by the total number of things. Standard deviations and means were used to express these scores. It originated from [19, 20] and was adapted from [21, 22]. The 36 questions measured eight aspects of health status: physical functioning (3:12); role limitations resulting from physical health problems (13:16); role limitations resulting from emotional problems (17:19); energy/fatigue questions (23, 27, 29, 31); emotional well-being questions (24, 25, 26, 28, 30); questions about bodily pain (21, 22); questions about social functioning (20, 32); and questions about general health perception (1, 2, 33, 34, 35, 36).

Validity & reliability

Based on a review of the literature and translation, researchers created a research tool. Seven experts in the disciplines of medicine, surgery, and biostatistics evaluated its validity. We evaluated the tool's readability, applicability, simplicity, ease of use, and comprehensiveness. Based on recommendations from experts, the researchers implemented the required modifications. The reliability of the instruments was assessed using Cronbach's alpha and Tool II and Tool III had scores of 0.93 and 0.87, respectively, showing a respectable level of reliability.

Pilot study

First, a pilot study was carried out with six (10%) of the participants. However, they were later removed from the study. Our first investigation was conducted to make sure the study tool was understandable, practical, and helpful, in addition to determining the time needed to complete and submit it. Before gathering data, we carried out a preliminary investigation and made the necessary corrections and improvements.

Data collection

The study was conducted in four phases:

A. Preparation phase

Ethical approval was granted by the research ethics committee of the Riyadh ELM University research center. The dialysis centers and the appropriate authorities at King Fahd Medical City provided official written authorization to perform the research when the study's purpose was explained. The researcher created the program using a recent study of pertinent literature, and patient questionnaires were converted into straightforward Arabic and vice versa. A panel of specialists from the fields of medicine and nursing evaluated the instruments to ensure their validity and reliability, and any required adjustments were made by their evaluation. This dependability of the instruments was assessed by using appropriate statistical tests, like Cronbach's alpha coefficient. Six (10%) of the study sample will be used in a pilot study to examine the viability and applicability of the produced tool. The remaining study sample was excluded, and the required alterations were made in response.

B. Assessment phase

In addition to books, journals, periodicals, and online searches, the researchers also examined more recent and older literature that was accessible. Demographics, medical history, degree of discomfort, and stress were the first things the researchers collected when compiling their data. Subsequently, an individual interview was conducted with every patient in each group to gather essential data. The researcher initiated data collection by selecting patients with CKD disease undergoing hemodialysis and assessing socio-demographic data using Tool I.

C. Implementation phase

The dialysis facility in King Fahd Medical City served as the site for the researchers' data collection, which took place between June 2023 and March 2024. Participants were selected based on the required standards following formal clearance from Riyadh Elm University's (REU) Institutional Review Board (IRB). - Before the researcher began gathering data, every patient getting hemodialysis for chronic renal disease gave their oral consent. Before the patients took part in the interview process, which was used to complete the tools, they were informed of the study's goals. The investigation was done in the morning and afternoon for every patient. - To get baseline patient data, each patient in the study and control group underwent an individual interview using Tool I (general demographic datasheet), Tool II (FACIT scale), and QoL by using Tool III (quality of life questionnaire). It took roughly 25 to 30 minutes for this interview. - Following the use of Tools I, II, and III to evaluate the patients, the researcher addressed the study group and illustrated the benefits of leg ergometric exercise. Every dialysis patient received verbal encouragement and motivation at the start of each session regarding the exercise regimen, which included warm-up, stretching, leg ergometer biking, knee flexion, and extension, as well as exercises for the ankles and feet (plantarflexion, dorsiflexion, eversion, and inversion). A forty-minute exercise regimen was divided into two parts: five minutes of pre-session exercise and thirty-five minutes of in-session exercise for hemodialysis patients. - Each individual received the leg ergometric workout from the researcher. - First session: Before introducing herself and outlining the goal of the meeting, the researchers gave the patients an orientation to the leg ergometric training program. Second session: Range-of-motion exercises including the hip, knee, ankle, and foot range of motion are covered in this session. A summary of the first session's topics was given at the outset. The session ended with a summary of the patient's replies and discussion. Many of the patients were cooperative, showed interest in a specific topic, and asked for the program to go on. Third session: The goals of this session are outlined, and the exercises performed are quadriceps, hamstring, gastrocnemius, and soleus stretching. Together with ankle and foot workouts, it also consists of leg ergometric exercises that involve knee flexion and extension (Dorsiflexion, Plantarflexion, eversion, and inversion). The session ended with a summary of the patient's replies and discussion. A summary of the subjects covered in the previous sessions kicked off the fourth one. A hamstring set and hip abductor and adductor exercises are the day's objectives and subjects. The patients offered feedback during the session by discussing it and posing queries.

Control group: Patients in the control group received routine nursing care; the selected individuals' clinical and demographic data was collected; and the degree of weariness was measured using the FACIT scale. There was no ergometric leg exercise for this group that was performed by the study group to evaluate patient QoL using Tool III.

D. Evaluation phase

After four weeks of applied leg ergometric exercise for the study group, all patients were evaluated again by using Tools II and III to evaluate the effect of intradialytic leg ergometry exercise on improving the level of fatigue and QoL among patients undergoing hemodialysis in the study group and also the control group by using the same tools.

Statistical analysis of data

The IBM SPSS software package version 20.0 was utilized for analysis once data was loaded into the computer. (Armonk, NY: IBM Corp.) Utilizing percentages and numbers, the qualitative data was described. The Shapiro-Wilk test was run to verify the distribution's normality. The terms range (minimum and maximum), mean, and standard deviation were used to characterize quantitative data. The results were deemed significant at the 5% level. The Chi-square test was used to compare less than five groups for categorical variables. Fisher's exact correction for chi-square is used when more than 20% of the cells have an expected count of less than five. The student t-test is used to compare two study groups for normally distributed quantitative variables. Use the Paired T-test when comparing data from two periods with normally distributed quantitative variables. To connect two quantitative variables that are regularly distributed, use the Pearson coefficient.

This study utilized a quantitative descriptive correlational research design. This study was performed in Riyadh City. The study population composed of registered nurses working in Riyadh hospitals. The sample size of the study was 392 nurses. Sample was selected using purposive sampling technique. The eligibility criteria in selecting registered nurses using the following. The inclusion criteria include: (1) female; (2) any marital status; (3) working in public and private hospitals; (4) registered nurses in Saudi Arabia. The exclusion criteria include: (1) not active license; (2) unwillingness to participate in the study.

Tool validity and reliability

The main research collecting tool of this research was a self-constructed questionnaire. This underwent validity and reliability. For validity, the questionnaire was submitted to experts for checking. These panels of experts evaluated the research instrument in terms of applicability, clarity, contents, and relevance. The suggestion and recommendation was followed by the researchers before a pilot testing was done. This questionnaire was answered by 10 nurses which were not part of the actual study. Those responses were computed using reliability testing. This helps the researchers to ensure the data accurately to reflect the intended research objectives and is consistent and reproducible. These protect the credibility and its impact to this research as it is essential in producing high-quality research.

Research Instrument and Implementation methods

A self-constructed questionnaire was formulated for the data collection to achieve the purpose of the study. This questionnaire measures the cosmetic utilization using 6 categories; no makeup; limited makeup; low makeup; average makeup; high makeup; celebrity-type makeup. The self-confidence scale, however, utilized 20 items which measure self-confidence in uni-directional manner about oneself. It has a 5 point Likert Scale as: (5) Often (4) Always; (3) Sometimes; (2) Rarely; (1) Never. The instrument for self-confidence scale was adapted.

Ethical consideration

The researcher respects the rights of study participants, treat data with confidentiality with no harm for the subject. All study participants provided consent prior to participation in the study. An approval from university was taken and permission from study area was secured.

Statistical treatment of data

Data was entered in statistical package for social science (SPSS) version 23. A total of 500 online survey forms were distributed, and 392 responses were collected and analyzed. The data analysis was carried out using the SPSS version 23.0 with descriptive statistics (frequency analysis, percentage, weighted mean) and inferential statistics (Pearson product moment correlation, analysis of variance) were conducted.

3. Results and Discussions

Table 1: Hemodialysis patients control & study groups' distribution related to their socio-demographic characteristics, n = 60

Socio-demographic characteristic	Control (n = 30)		Study (n = 30)		Test of Sig.	p
	No.	%	No.	%		
Age (Years)						
< 40	7	23.3	12	40.0	FET=6.059	0.058
40 - <50	1	3.3	5	16.7		
≥ 50	22	73.3	13	43.3		
Min.-Max.	23.0-60.0		21.0-60.0		t=1.478	0.145
Mean±SD.	48.17±12.39		43.30±13.10			
Gender						
Male	16	53.3	14	46.7	χ^2= 0.267	0.398
Female	14	46.7	16	53.3		
Marital status						
Married	8	26.7	10	33.3	FET=0.919	0.875
Divorced	14	46.7	12	40.0		
Single	1	3.3	2	6.7		
Widow	7	23.3	6	20.0		
Residence						
Urban	19	63.3	26	86.7	χ^2= 4.356*	0.037*
Rural	11	36.7	4	13.3		
Level of education						
Not read & write	3	10.0	6	20.0	FET=12.286*	0.006*
Read & write	13	43.3	2	6.7		
Secondary	2	6.7	7	23.3		
Universal	12	40.0	15	50.0		

Occupation						
Working	13	43.3	18	60.0	χ^2=1.669	0.196
Not working	17	56.7	12	40.0		
Nature of work						
Mild	6	46.2	3	16.7	FET=3.227	0.212
Moderate	5	38.5	9	50.0		
Sever	2	15.4	6	33.3		

SD: Standard deviation, t: Student t-test
χ^2: Chi-square test, FET: Fisher's exact test
p: p-value for comparing between the studied groups
*: Statistically significant at $p \leq 0.05$

Table 1 presents the distribution of the patient control and study groups is influenced by their socio-demographic characteristics. In the control and study groups, the ages of those over 50 were (73.3% & 22. 43.3%), with Mean±SD values of (48.17±12.39 & 43.30±13.10), respectively. 53.3% of the control group was male patients, in the study group; the same proportions of patients were female. Furthermore, (46.7% & 40%) respectively, of the control and study groups were divorced. The study and control groups differed significantly in terms of residency (χ^2= 4.356*, p = 0.037*), with (63.3% &86.7%) of them residing in urban areas, respectively. In terms of education, 50% of the study group completed universal education, compared to roughly 43.3% of the control group who read and write, and there was a significant difference between the study and control groups (FET = 12.286*, p = 0.006*). 60% of the study group was employed, compared to 56.7% of the control group who were unemployed. Regarding the nature of the work, roughly 46.2% of the control group and 50% of the study group, respectively, had mild and moderate types of employment.

Table 2: Comparison of the study's total FACIT Fatigue Scale score pre and post-leg ergometry exercises between the control group and the study, n = 60

Tool III: FACIT Fatigue Scale	**Control (n = 30)**				**Study (n = 30)**				**Test of sig. (p_1)**	**Test of sig. (p_2)**
	Pre		**Post**		**Pre**		**Post**			
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**		
Severe (>30)	26	86.7	27	90.0	30	100.0	0	0.0	χ^2= 4.286	χ^2= 49.091*
Better quality of life (≤30)	4	13.3	3	10.0	0	0.0	30	100.0	^{FE}p=(0.112)	(<0.001*)
Total score (0-52)										
Min.-Max.	24.0-51.0		27.0-50.0		38.0-52.0		0.0-19.0		0.695 (0.490)	18.394* (<0.001*)
Mean±SD.	44.50±8.85		39.70±5.55		45.83±5.65		11.40±6.34			
Average score (0-4)	3.42±0.68		3.05±0.43		3.53±0.44		0.88±0.49			
% score (Mean±SD.)	85.58±17.03		76.35±10.68		88.14±10.87		21.92±12.19			
t_0 (p_0)	1.914 (0.207)				21.846* (<0.001*)					

t_0: Paired t-test
p_0: p-value for comparing between pre and post in each group
p_1: p-value for comparing between the studied groups in pre
p_2: p-value for comparing the studied groups in the post
*: Statistically significant at p ≤ 0.05

The table above provides valuable insights into the effectiveness of the intervention in reducing fatigue levels, as measured by the FACIT Fatigue Scale. The results indicate a significant improvement in fatigue levels after the intervention in the study group the percentage of fatigue levels changed from 100% severe fatigue level before to 100% better quality of life after leg ergometry exercises with highly significant differences χ^2= 49.091*, p= (<0.001*), compared to the control group, increase in the percentage of severity of fatigue scores increased from 86.7 to 90% more sever pre &post leg ergometry exercises respectively. The study group's pre and post-intervention groups' total scores showed extremely significant differences, with χ^2= 18.394* p= (<0.001*). Overall, the results suggest that the intervention had a positive impact on reducing fatigue levels.

Table 3: Comparing the study and control groups based on the overall SF-36 domain scores pre and post-leg ergometry exercises, n = 60

Tool II: The short-Form- 36 health survey)	**Control (n = 30)**		**Study (n = 30)**		**t (p_1)**	**t (p_2)**
	Pre	**Post**	**Pre**	**Post**		
Physical functioning						
Total score (10 -30)					7.183* (<0.001*)	14.035* (<0.001*)
Min.-Max.	24.0-29.0	15.0-27.0	15.0-27.0	24.0-30.0		
Mean±SD.	28.60±1.10	17.30±4.09	22.90±4.20	28.63±1.67		
Average score	2.86±0.11	1.73±0.41	2.29±0.42	2.86±0.17		
% score (Mean±SD.)	93.0±5.51	36.50±20.47	64.50±21.02	93.17±8.35		
t_0 (p_0)	0.172 (<0.521)		7.564* (<0.001*)			
Physical health						
Total score (4-8)					13.012* (<0.001*)	7.782* (<0.001*)
Min.-Max.	4.0-5.0	4.0-15.0	4.0-8.0	4.0-6.0		

Mean±SD.	4.83±0.38	7.73±2.30	7.47±1.04	4.37±0.56		
Average score	1.21±0.09	1.93±0.58	1.87±0.26	1.09±0.14		
% score (Mean±SD.)	20.83±9.48	93.33±57.59	86.67±26.04	9.17±13.90		
t_0 (p_0)	1.482 (<0.321)		14.333*(<0.001*)			
Role limitations						
Total score (3-6)						
Min.-Max.	3.0-6.0	3.0-12.0	3.0-6.0	3.0-4.0	5.535* (<0.001*)	7.606* (<0.001*)
Mean±SD.	3.10±0.55	5.83±1.91	4.60±1.38	3.13±0.35		
Average score	1.03±0.18	1.94±0.64	1.53±0.46	1.04±1.0		
% score (Mean±SD.)	3.33±18.26	94.44±63.78	53.33±45.99	4.44±11.52		
t_0 (p_0)	2.01 (<0.061)		6.279*(<0.001*)			
Energy / Fatigue						
Total score (4-26)						
Min.-Max.	12.0-19.0	6.0-16.0	15.0-22.0	14.0-20.0	11.150* (<0.001*)	13.524* (<0.001*)
Mean±SD.	13.33±1.30	9.40±2.13	18.23±2.03	16.70±2.05		
Average score	3.33±0.32	2.35±0.53	4.56±0.51	4.18±0.51		
% score (Mean±SD.)	46.67±6.48	27.0±10.64	71.17±10.14	63.50±10.27		
t_0 (p_0)	1.068 (<0.201)		2.911* (0.007*)			
Emotional well						
Total score (5-30)						
Min.-Max.	13.0-23.0	9.0-20.0	16.0-22.0	15.0-24.0	4.638* (<0.001*)	12.439* (<0.001*)
Mean±SD.	16.90±1.83	12.00±2.51	19.27±2.12	19.93±2.43		
Average score	3.38±0.37	2.40±0.50	3.85 ±0.42	3.99±0.49		
% score (Mean±SD.)	47.60±7.30	28.0±10.02	57.07±8.46	59.73±9.74		
t_0 (p_0)	1.050 (0.302)		9.910*(<0.001*)			

Cont. Table 3: Comparing the study and control groups based on the overall SF-36 domain scores pre and post-leg ergometry exercises, n=60

Tool II: The short-Form- 36 health survey)	Control (n = 30)		Study (n = 30)		t (p_1)	t (p_2)
	Pre	Post	Pre	Post		
Bodily pain						
Total score (2-11)						
Min.-Max.	6.0-10.0	5.0-8.0	4.0-9.0	8.0-11.0	9.767* (<0.001*)	19.455* (<0.001*)
Mean±SD.	8.07±0.64	6.30±0.75	5.67±1.18	10.27±0.83		
Average score	4.03±0.32	3.15±0.37	2.83±0.59	5.13±0.41		
% score (Mean±SD.)	67.41±7.11	47.78±8.33	40.74±13.16	91.85±9.20		
t_0 (p_0)	1.273 (<0.361)		18.962*(<0.001*)			
Social function						
Total score (2-10)						
Min.-Max.	7.0-10.0	4.0-8.0	4.0-8.0	6.0-10.0	7.921* (<0.001*)	11.213* (<0.001*)
Mean±SD.	8.13±0.57	5.43±1.04	6.17±1.23	9.20±1.52		
Average score	4.07±0.29	2.72±0.52	3.08±0.62	4.60±0.76		
% score (Mean±SD.)	76.67±7.14	42.92±13.0	52.08±15.43	90.0±18.97		
t_0 (p_0)	1.970 (<0.401)		10.333*(<0.001*)			
General healthy						
Total score (6-30)						
Min.-Max.	19.0-23.0	13.0-21.0	14.0-20.0	17.0-23.0	14.568* (<0.001*)	5.532* (<0.001*)
Mean±SD.	21.70±1.18	18.17±2.02	16.87±1.38	20.70±1.49		
Average score	3.62±0.20	3.03±0.34	2.81±0.23	3.45±0.25		
% score (Mean±SD.)	65.42±4.91	50.69±8.41	45.28±5.76	61.25±6.20		
t_0 (p_0)	8.525*(<0.001*)		11.078*(<0.001*)			
Overall						
Total score (36-149)						
Min.-Max.	90.0 –112.0	70.0-117.0	88.0-111.0	106.0-121.0	2.225* (0.032*)	16.945* (<0.001*)
Mean±SD.	104.7±3.45	82.17±9.33	101.2±7.90	113.0±3.45		
Average score	2.91±00.10	2.28±0.26	2.81±0.22	3.14±0.10		
% score (Mean±SD.)	60.77±3.05	40.85±8.25	57.67±6.99	68.08±3.06		
t_0 (p_0)	1.250 (0.422)		6.956*(<0.001*)			

The table 3 shows that, as assessed by the SF-36 questionnaire, the study demonstrates statistically significant improvement in health-related QoL for the study group following the intervention. In terms of physical functioning, physical health, role restrictions, energy/fatigue, emotional well-being, bodily pain, social function, and general health pre and post-leg ergometry exercises. Overall, the study's findings demonstrate the intervention's potential efficacy in raising several health-related QoL indicators, with a total score that was statistically significant in the study groups, t = 6.956 p= <0.001* post intervention.

Table 4: Relation and correlation between study pre and post and demographic characteristics of % score of FACIT Fatigue Scale and SF-36 domains, n=60

Item/s	N	Study (n = 30)			
		Overall SF-36 HRQoL		Overall FACIT Fatigue	
		Pre	Post	Pre	Post
		Mean±SD.	Mean±SD.	Mean±SD.	Mean±SD.
Sex					
Male	14	59.80±5.11	67.83±3.12	86.40±11.65	19.51±13.34
Female	16	55.81±7.99	68.31±3.09	89.66±10.27	24.04±11.08
t (p)		1.649 (0.111)	0.425 (0.674)	0.816 (0.422)	1.017 (0.318)
Age (Years)					
< 40	12	59.66±6.07	68.44±3.42	85.58±12.61	18.75±14.04
40 - <50	5	60.0±7.65	66.73±1.84	95.38±3.22	23.85±10.67
≥ 50	13	54.94±7.10	68.28±3.13	87.72±10.37	24.11±11.12
F (p)		1.866 (0.174)	0.583 (0.565)	1.505 (0.240)	0.663 (0.524)
Marital status					
Married	10	59.65±6.13	68.76±3.69	87.89±12.59	17.12±14.83
Divorced	12	57.82±7.51	68.44±2.62	90.55±10.09	25.16±9.15
Single	2	60.62±8.13	65.04±0.63	82.70±13.60	31.74±4.08
Widow	6	53.10±6.46	67.26±2.96	85.57±10.23	20.19±12.86
F (p)		1.279 (0.302)	1.026 (0.397)	0.449 (0.720)	1.314 (0.291)
Residence					
Urban	26	58.75±6.69	68.04±3.23	88.46±11.08	21.82±12.51
Rural	4	50.67±4.87	68.36±1.83	86.06±10.58	22.60±11.47
t (p)		2.309* (0.029*)	0.194 (0.848)	0.406 (0.688)	0.117 (0.908)
Level of education					
Not read & write	6	53.25±6.75	68.73±1.74	85.26±9.93	20.19±12.86
Read & write	2	61.95±0.0	65.93±0.62	97.12±4.08	4.81±6.80
Secondary	7	58.66±8.58	68.14±4.06	89.84±11.09	26.10±9.80
Universal	15	58.41±6.42	68.08±3.22	87.31±11.76	22.95±12.30
F (p)		1.175 (0.338)	0.396 (0.757)	0.657 (0.586)	1.802 (0.172)
Occupation					
Working	18	58.85±6.69	67.65±2.87	88.36±10.95	21.37±12.29
Not working	12	55.90±7.34	68.73±3.34	87.82±11.22	22.76±12.54
t (p)		1.138 (0.265)	0.948 (0.351)	0.130 (0.898)	0.301 (0.766)
Nature of work					
Mild	3	57.82±10.56	68.14±3.54	87.18±10.59	21.16±13.33
Moderate	9	59.59±7.56	68.73±3.13	91.03±10.58	24.15±9.23
Sever	6	58.26±3.77	65.78±.91	84.94±12.49	17.31±16.50
F (p)		0.102 (0.904)	2.245 (0.140)	0.547 (0.590)	0.527 (0.601)

The above table revealed that there is no statistically significant relationship between demographic characteristics and the score of the FACIT Fatigue Scale and the SF-36 domains in the study group.

Discussion

Through the use of stationary cycling or pedaling equipment during hemodialysis treatments, patients can participate in physical activity while receiving dialysis thanks to the intradialytic leg ergometry exercise. Leg ergometry training is one possible strategy to help hemodialysis patients feel less fatigued and have a higher quality of life. To enhance health outcomes, this exercise modality focuses on muscular strength, cardiovascular fitness, and general well-being. However, additional data is required to evaluate its efficacy [23, 24]. The purpose of this study is to assess how intradialytic leg ergometry exercise can help hemodialysis patients feel less fatigued and have a higher quality of life.

We observed that the majority of the study participants were over 50 years old, with the main ages of the control and study groups being (48.17±12.39 and 43.30±13.10), respectively. These ageing-related changes can increase the chance of kidney failure and make the kidneys more susceptible to damage.

They can also raise the risk of hypertension and diabetes, two conditions that can harm the kidneys. Regarding gender, over half of the control group consisted of male patients, and the study group consisted of female patients. The majority of the study and control groups were divorced. CKD and hemodialysis can significantly impact a person's health and well-being, leading to physical and emotional stress. The demands of treatment, dietary restrictions, and lifestyle changes can strain relationships, potentially leading to divorce or separation.

The present findings are consistent with the research conducted by Mohammed in 2023 under the title "Effect of Intradialytic Leg Exercise on Functional Status among Patients on Hemodialysis." Their findings indicated that only 2/3 of the study and control groups consisted of male individuals aged fifty to less than sixty [23]. Demographic information has an impact on kidney disease, particularly in hemodialysis patients. This is a well-known factor in many other countries as well. A recent study by Farag in 2022 supported these conclusions by reporting that, in 2020, 59% of patients receiving dialysis in Egypt were men, and 50% of them were over the age of 55 [25]. The aforementioned findings were corroborated by Gaipove in 2020, which provided testimony indicating that 56% of their 5,000-

person hemodialysis sample consisted of females [26].

The study's participants lived in urban areas, with significant differences between the two groups. The educational attainment of the study and control groups differed significantly; half of the study group had completed universal education, while the other half of the control group could read and write. More than half of the people in the study group were working, compared to more than half of the control group who were unemployed. Living in an urban region and having low levels of education may contribute to a patient's progression to chronic renal failure. This result was in line with the findings of Kim in 2022, who reported that the majority of participants lived in urban areas and that the study group was more highly educated than the control group. The study was titled "An Intradialytic Aerobic Exercise Programme Ameliorates Frailty and Improves Dialysis Adequacy and Quality of Life among Hemodialysis Patients [27]."

The study's participants lived in urban areas, with significant differences between the two groups. The educational attainment of the study and control groups differed significantly; half of the study group had completed universal education, while the other half of the control group could read and write. More than half of the people in the study group were working, compared to more than half of the control group who were unemployed. Living in an urban region and having low levels of education may contribute to a patient's progression to chronic renal failure. This result was in line with the findings of Kim in 2022, who reported that the majority of participants lived in urban areas and that the study group was more highly educated than the control group. The study was titled "An Intradialytic Aerobic Exercise Programme Ameliorates Frailty and Improves Dialysis Adequacy and Quality of Life among Hemodialysis Patients [28].

Another study was carried out by Tamilmozh, in 2021 to assess how intradialytic leg ergometry exercise helps individuals with chronic renal illness feel less fatigued and engage in more physical activity each day [29]. The experimental group was significantly less exhausted than the control group, citing the study's findings. Similarly, Tamilmozhi found that a leg exercise programme effectively reduced fatigue and improved the quality of life for patients undergoing hemodialysis. These results are in line with a study conducted in 2016 by Shemy, which employed pre-post testing on sixty participants and discovered that an exercise regimen during hemodialysis improved patients' quality of life and reduced fatigue. This study also suggested that hemodialysis be used to create a leg exercise programme for those with renal failure [30].

Regarding QoL, the study demonstrates statistically significant improvement in all domains of health-related quality of life between the study and control groups following the intervention. Overall, the study's findings demonstrate the intervention's potential efficacy in raising several health-related QoL indicators. Leg ergometric exercise enhances hemodialysis patients' QoL by improving physical performance, cardiovascular health, energy levels, and psychological well-being, leading to improved social functioning and overall well-being.

The current results are in line with a study by Tamilmozh, in 2021 titled "A quasi-experimental study to evaluate the effectiveness of intradialytic leg exercise on pain, fatigue, and QoL among patients undergoing hemodialysis in selected hospitals at Erode." The study's conclusions showed that engaging in intradialytic leg exercise was helpful and that patients in the experimental group experiencing hemodialysis experienced significantly less pain, fatigue, and an improvement in their QoL [29].

Limitation of the study

The study's short intervention period may limit long-term effects on quality of life and fatigue, while challenges in participant compliance and adherence may affect outcomes. Measures of self-report subjectivity to recollection bias and social desirability bias are possible. The interpretation of the data may be affected by potential confounding factors such as concurrent interventions, medication use, or comorbidities.

4. Conclusion

The study found that, by lowering fatigue and boosting physical activity, intradialytic leg ergometry can enhance the quality of life for hemodialysis patients with chronic renal illness. Based on the current study's findings, hemodialysis patients who engage in leg ergometric exercise show a statistically significant reduction in their levels of fatigue compared to those who do not.

Recommendation for further Study

Based on the current study's findings, the following suggestions should be made:

- All units should have a basic handbook with instructions for leg ergometric training programs available for newly admitted patients receiving hemodialysis.
- To validate and generalize the results, the study should be conducted again with a sizable sample size in an alternative setting.
- It is recommended that administrators create and execute recurring patient education initiatives on leg ergometric exercises as part of the hospital's rules and procedures.
- Patients receiving hemodialysis should be enrolled in leg ergometric exercise programs on a regular and ongoing basis.

Ethical consideration

The researchers were permitted by the Institutional Review Board (IRB) of Riyadh Elm University (REU) "FUGRP/2023/300/966/885." Each participant was informed of the study's purpose before their consent was obtained electronically. The researchers told the students that they were free to choose not to take part in the study. During the study, everyone's identity, privacy, and well-being were protected. Participants may withdraw from the study at any point by clicking the "exit" button on the Internet survey. The computerized questionnaire contained no participant names or other personally identifiable information. Each person gave their permission, and their legal rights were respected. The moral precepts outlined in the Declaration of Helsinki were adhered to throughout the study.

Acknowledgment

The dialysis unit at King Fahd Medical City and all of the patients who participated in this study are appreciated by the authors.

Conflict of Interest

The writers have declared that they have no potential conflicts of interest pertaining to the investigation, authorship, and/or publication of this work.

Financial Support

This research received no specific funding from any government agencies, commercial enterprises, or private sector entities.

Reference

1. Stasi E, Sciascia S, Naretto C, Baldovino S, Roccatello D. Lymphatic system and the kidney: From lymphangiogenesis to renal inflammation and fibrosis development. Int. J Mol. Sci. 2024 Mar 1;25(5):2853. DOI: 10.3390/ijms25052853.
2. Carswell C, O'Neil S. Applied anatomy and physiology, the kidney disease process, and kidney investigations. In: Renal Nursing: Care and Management of People with Kidney Disease. 2024 Sep 16:14-51. DOI: 10.1002/9781394178797.ch2.
3. Kumahor EK. The biochemical basis of renal diseases. In: Current Trends in the Diagnosis and Management of Metabolic Disorders. CRC Press; c2024. p. 185-200. Available from: https://orcid.org/0000-0001-7327-4887.
4. Clark-Price SC, Fischer JR. Physiology, pathophysiology, and anesthetic management of patients with renal disease. In: Veterinary Anesthesia and Analgesia: The Sixth Edition of Lumb and Jones. 2024 Jun 26:922-943. DOI: 10.1002/9781119830306.ch43.
5. Masià-Plana A, Alhameedi R. Kidney replacement therapies: hemodialysis. In: Principles of Nursing in Kidney Care: Under the Auspices of EDTNA/ERCA and EKPF. Cham: Springer International Publishing; c2024 Apr 2. p. 115-138. DOI: 10.1007/978-3-031-30320-3_7.
6. Doan V, Shoker A, Abdelrasoul A. Quality of life of dialysis patients: exploring the influence of membrane hemocompatibility and dialysis practices on psychosocial and physical symptoms. J Compos Sci. 2024 May 7;8(5):172. DOI: 10.3390/jcs8050172.
7. Alkhaqani AL. Effect of exercise therapy on functional balance, physical performance and quality of life among patients undergoing hemodialysis: randomized controlled trial. Nurs Commun., 2022, 6. DOI: 10.53388/IN2022010.
8. Huang M, Lv A, Yang F, Tang Y, Li Y, Hua Y, Gao J, Ni C. Impacts of cognition of exercise on physical activity participation in hemodialysis patients. Semin Dial. 2023 Sep;36(5):366-373. DOI: 10.1111/sdi.13138.
9. Palar R, Lobo D. Impact of intradialytic exercise on fatigue, biochemical and physiological parameters in patients on maintenance hemodialysis: A pilot study-Part 1. Clin. Epidemiol. Glob Health. 2022 May 1;15:101064. DOI: 10.1016/j.cegh.2022.101064.
10. Wahida AZ, Rumahorbo H. The effectiveness of intradialytic exercise in ameliorating fatigue symptoms in patients with chronic kidney failure undergoing hemodialysis: A systematic literature review and meta-analysis. J Taibah Univ. Med. Sci. 2023 Jun 1;18(3):512-525. DOI: 10.1016/j.jtumed.2022.11.004.
11. Pession A, Bertulli C. Frailty in patients with chronic kidney disease. In: Frailty in Children: From the Perioperative Management to the Multidisciplinary Approach. Cham: Springer International Publishing; c2023 Mar 4. p. 61-68. DOI: 10.1007/978-3-031-24307-3_5.
12. Nieves-Anaya I, Várgas MB, García OP, Biruete A, Kistler B, Atilano-Carsi X. Effect of oral nutritional supplementation combined with impedance vectors for dry weight adjustment on the nutritional status, hydration status and quality of life in patients on chronic hemodialysis: a pilot study. Clin. Nutr. ESPEN. 2023 Apr 1;54:23-33. DOI: 10.1016/j.clnesp.2022.12.023.
13. Cha RH. Pharmacologic therapeutics in sarcopenia with chronic kidney disease. Kidney Res Clin. Pract. 2024 Mar;43(2):143. DOI: 10.23876/j.krcp.23.094.
14. Thompson SK. Sampling. John Wiley & Sons; 2012 Mar 13. DOI: 10.1111/j.1083-6101.2007.00336.x.
15. Webster K, Cella D, Yost K. The Functional Assessment of Chronic Illness Therapy (FACIT) measurement system: Properties, applications, and interpretation. Health Qual. Life Outcomes. 2003 Dec;1:79. DOI: 10.1186/1477-7525-1-79.
16. Chandran V, Bhella S, Schentag C, Gladman DD. Functional assessment of chronic illness therapy-fatigue scale is valid in patients with psoriatic arthritis. Ann Rheum Dis. 2007 Jul 1;66(7):936-939. DOI: 10.1136/ard.2006.065763.
17. Cheminet G, Corbasson A, Charmettan M, Namaoui W, Khimoud D, Flamarion E, *et al*. Assessment of fatigue in adult patients with sickle cell disease: Use of the Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-fatigue) questionnaire. Br J Haematol. 2024 May 27. DOI: 10.1111/bjh.19568.
18. Correa GP, Oliveira CC, Vieira GC, Cabral LF, Malaguti C, José A. Validity of the Functional Assessment of Chronic Illness Therapy Fatigue Scale (FACIT-F) in individuals with Chronic Obstructive Pulmonary Disease in Brazil. Fisioter Pesqui, 2024 May 17, 31. Available from: https://orcid.org/0000-0001-7327-4887.
19. Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. Med Care. 1992 Jun;30(6):473-483. PMID: 1593914. Available from: http://www.jstor.org/stable/3765916.
20. Li MT, Wu M, Xie QL, Zhang LP, Lu W, Pan MJ, *et al*. The association between vascular access satisfaction and quality of life and depression in maintained hemodialysis patients. J Vasc. Access. 2024 Mar;25(2):439-47. DOI: 10.1177/11297298221113283.
21. El-Shafiey ME, Qalawa AS, Sheble MA, Ali AM. Effect of instructional scheme for patients undergoing liver transplantation surgery on their performance. Port Said Sci. J Nurs. 2017 Jun 1;4(1):105-122. DOI: 10.21608/PSSJN.2017.33091.
22. Elghreeb SM, Othman WN, Shebl AM, Fouad AA. Effect of pre-operative health education program on post-operative health outcomes of colorectal cancer patients; c2018. DOI: 10.9790/1959-0701096880.
23. Mohammed HA, Hassanein SM. Effect of intradialytic leg exercise on functional status among patients on hemodialysis: Explanatory randomized control study.

Egypt J Nurs. Health Sci. 2023 Nov 1;4(4):21-32. DOI: 10.1186/s12882-023-03158-6.

24. Barbalho-Moulim MC, Paro FM, Pedrosa DF, Serafim LM, Kuster E, Carmo WA, *et al*. Effects of upper limbs' neuromuscular electrical stimulation (NMES) superimposed to voluntary contraction added to a protocol of intradialytic leg cycle ergometer exercise, in muscle strength, functional capacity and quality of life of adult patients with CKD: A randomized clinical trial protocol. Physiother Res. Int. 2024 Apr, 29(2). DOI: 10.1002/pri.2079.
25. Farag YM, El-Sayed E. Global dialysis perspective: National Library of Medicine. Global dialysis perspective: Egypt. Kidney 360. 2022 Jul 28;3(7):1263-1268. DOI: 10.34067/KID.0007482021.
26. Gaipov A, Issanov A, Kadyrzhanuly K, Galiyeva D, Khvan M, Aljofan M, *et al*. Epidemiology of dialysis-treated end-stage renal disease patients in Kazakhstan: data from nationwide large-scale registry 2014–2018. BMC Nephrol. 2020 Dec;21:1-9. DOI: 10.1186/s12882-020-02047-6.
27. Kim S, Park HJ, Yang DH. An intradialytic aerobic exercise program ameliorates frailty and improves dialysis adequacy and quality of life among hemodialysis patients: A randomized controlled trial. Kidney Res Clin. Pract. 2022 Jul;41(4):462. DOI: 10.23876/j.krcp.21.284.
28. Eaid Elgazzar S, Mohamed Ramadan Farag E, Ahmed Ibrahim Elhaweet E, Fikry Mohamed Abd Elrasol Z. The effect of practicing leg ergometric exercises on fatigue level among patients undergoing haemodialysis. Egypt J Health Care. 2022 Dec 1;13(4):1850-1860. DOI: 10.21608/ejhc.2022.303948.
29. Tamilmozhi TD, Valarmathi A, Tamilselvi S, Mekala C. A quasi-experimental study to evaluate the effectiveness of intradialytic leg exercise on pain, fatigue and quality of life among patients undergoing hemodialysis in selected hospitals at Erode. Int. J Adv. Nurs. Manag. 2021;9(2):176-180. DOI: 10.5958/2454-2652.2021.00039.1.
30. Shemy MB, Elghite Elhossiny Elkazeh EA, Radwa EL. Efficacy of exercise program in intra hemodialysis on patients' quality of life. IOSR-JNHS. 2016;5(1):18-30. DOI: 10.9790/1959-05151730.

How to Cite This Article
Alqahtani GNH, Alnezi FFK, Alrefaei FHS, Alanazi EOA, Almrzooq AMM, Al Tahsi RAA, *et al*. Effectiveness of intradialytic leg ergometry exercise for improving quality of life and fatigue among hemodialysis patients. International Journal of Advance Research in Medical Surgical Nursing 2024; 6(2): 42-51.