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Effect of Intradialytic Range of Motion Exercises Sessions on Fatigue Level for Hemodialysis Patients

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ABSTRACT

Chronic kidney disease (CKD) is a major global health concern, with hemodialysis (HD) being one of the most common life-sustaining treatments for end-stage renal disease (ESRD) patients. Despite its necessity, hemodialysis is associated with numerous debilitating symptoms, among which fatigue is one of the most prevalent and distressing. Fatigue in HD patients significantly impairs their physical functioning, mental health, and overall quality of life, often leading to increased dependency on caregivers and reduced engagement in daily activities. This study aimed to evaluate the effect of intradialytic range of motion (ROM) exercise sessions on fatigue levels in hemodialysis patients.

Methods: To evaluate the effect of intradialytic range of motion exercise sessions on fatigue level to hemodialysis patients. Quantitative study quasi-experimental design carried out with two groups in Specialized Center for Kidney Diseases and Transplantation in AL-Najaf City from the period 1 December 2024 to 1 febraury 2025, a total of (100) patient undergoing regulated schedualed hemodialysis were divided into experimental and comparison groups, which were included by Non-probability purposive sampling methods.

Results: After conducting range of motion exercise sessions (post-tests) revealed a significant improvement for hemodialysis patient's activities and daily life and decrease the dependency on family care giver and significant decrease of fatigue. The post-intervention analysis revealed a statistically highly significant reduction in fatigue levels among the experimental group compared to the control group (Mean ± SD: 2.79 ± 0.191 vs. 4.25 ± 0.147, $p < 0.001$). In contrast, the control group showed no significant change in fatigue levels between pre- and post-tests ($p = 0.193$). These findings demonstrate that intradialytic ROM exercise sessions effectively alleviated fatigue in hemodialysis patients.

Conclusion: application of the range of motion exercise sessions for at least eight weeks is an effective approach to improving dialy activities and reduced of fatigue for patients undergoing hemodialysis compared with the control group.

Recommendations: establishing a range of motion exercises sessions program that would reduce fatigue and support the patient's health and apply this program to hemodialysis patients during the hemodialysis period to improve the physical, mental, and psychological condition of the hemodialysis patients.

Keywords: *Range of motion, Exercise session, Fatigue, Hemodialysis.*

1. INTRODUCTION

Hemodialysis is the most common treatment for patients with chronic kidney failure, which is one of the most significant issues in every nation due to the yearly 5–6% increase in the number of patients with this condition [1]. The chronic nature of hemodialysis and its side effects cause patients to constantly struggle with a variety of issues, including weariness, which has a detrimental impact on their quality of life [2]. A subjective feeling of weakness, low energy, exhaustion, and malaise is called fatigue. When human health is in danger, it is referred to as a biological warning. The physical, emotional, and cognitive aspects of a patient's experience are all negatively impacted by this illness, which also lowers their sense of wellbeing [3, 4]. Fatigue impairs self-care, interferes with social and familial responsibilities, and makes it harder to carry

out daily tasks. It can also result in joblessness and a greater reliance on medical care, which can have a detrimental impact on a patient's self-esteem and quality of life [5, 6]. Compared to individuals with normal kidney function, 60 to 97% of hemodialysis patients report feeling fatigued to some extent [7]. Uremia, anemia, sleep difficulties, and psychosocial distress are some of the causes that contribute to weariness in hemodialysis alcoholic hepatitis, and ultimately culminate in alcoholic cirrhosis, the most severe and irreversible form of liver damage caused by alcohol.

patients; many of these conditions may be treatable. A greater propensity to use complementary therapies has resulted from side effects like gastrointestinal disorders, nausea, vomiting, stomach upset, heartburn, diarrhea, and sleep disorders, as well as drug interactions caused by decreased renal excretion and increased drug toxicity, even though pharmaceutical interventions like L-carnitine are available to alleviate fatigue [8]. Patients with end-stage renal illness require renal replacement treatments including kidney transplantation, hemodialysis, or peritoneal dialysis in order to survive [9]. Fatigue is one of the most prevalent symptoms of uremic syndrome, which patients still experience even receiving regular hemodialysis. When compared to healthy individuals, the physical labor ability of patients declines by 50% after uremic syndrome. Decreased physical activity is significantly associated with higher levels of weariness or sadness. The person's strength declines as a result of less activity, which exacerbates their weariness and despair [10]. Weakness, a sense of depletion, and a lack of vitality have all been used to characterize fatigue. Fatigue has an impact on patients' quality of life, psychologic state, and daily self-care in addition to their everyday lives. If receiving additional dialysis would boost their energy levels, around 94% of hemodialysis patients would want to do so. There are two categories of tiredness treatment methods: pharmacological and nonpharmacological [11]. L-carnitine, vitamin C, erythropoietin prescriptions, and other drugs are used in the earlier approach to manage anemia. Exercise, yoga, relaxation, acupressure, acupuncture, electric stimulation, and dialysis are all part of the latter approach. Exercise may help dialysis patients feel less depressed and exhausted, according to research by Kao et al. [12]. The workouts included leg ergometric exercises, progressive muscle relaxation, resistance, endurance, aerobic, and aerobic-strength exercises. According to certain research, dialysis patients' adjustment conditions could be enhanced by using relaxation and visualization techniques [11].

Objectives of the study:

1-To assess intradialytic fatigue level for patients undergoing hemodialysis. (pretest)

2-To determine the effect of range of motion exercises sessions on the level of fatigue for hemodialysis patients. (posttest)

3- To find out relationship between the effect of range of motion exercise sessions and demographical variables of hemodialysis patients such as (age, sex, residence, level of education).

2. METHODOLOGY

Quantitative study, A quasi-experimental, pre-test and post-test design will be used to evaluate the effect of intradialytic range-of-motion (ROM) exercise sessions on the fatigue levels of hemodialysis patients Specialized Center for Kidney Diseases and Transplantation in AL-Najaf City from the period 1 December 2024 to 1 February 2025, a total of (100) patient undergoing regulated scheduled hemodialysis were divided into experimental and comparison groups, which were included by Non-probability purposive sampling methods, all patients are medically diagnosed with end stage renal disease and those who undergoing regulated scheduled for hemodialysis sessions. The study sample consists of (100) patients have the same inclusion criteria according to the specific characteristics that delimit the study population through the eligibility criteria, the study sample subjects are selected such as; agree to participate in the study, age of patient between (30-60) year, He has been undergoing hemodialysis for a year or more and have three sessions per week. Exclusion criteria: Patients with physical or cognitive disabilities preventing exercise, unstable medical conditions (e.g., recent myocardial infarction, severe infections). Those patients are divided into two groups: (50) patients selected as experimental group (28) females and (22) males, the other (50) patients are routine treated as control group (30) females and (20) males. Fatigue assessment scale (FAS) with a 10-item questionnaire which designed to measure current fatigue level of patients with hemodialysis. This scale distributed as 5 items for physical fatigue and 5 items to assess mental fatigue level, The instrument consist of three parts; Demographic Data sheet, consists of (6) items, which included age, sex, marital status, level of education, occupational status, and residency, second part distributed 2 items related to patients clinical information such as (duration of undergoing hemodialysis, and other disease), while third part directed to level of fatigue assessment. The fatigue assessment scale (FAS) consists of 10 questions related to physical and mental fatigue. Total score for fatigue: 50 x 100 = % (If a person does not correctly answer all of the questions, divide by the highest score that may be earned, for example, if one question is missed, divide by 40). Content validity of the study instrument is determined by (9) experts who work in different fields and have not less than (15) years of experience, to investigate the clarity, relevancy, and adequacy of the instrument which measure the concept of interest. Statistical Package of the Social Sciences (SPSS), version (IBM 26) used for statistical analysis. Descriptive statistics (mean, standard deviation) were used to describe the characteristics of the sample, Independent T-test was used to compare the means of fatigue levels between the two groups before and after the intervention, and a statistical significance level of $P < 0.05$ was considered to indicate a statistically significant difference. Un oral permission was obtained to start data collection from the director of the center after explaining the study purpose and objectives to secure the cooperation of the healthcare provider to facilitate data collection. This study obtained ethical approval from the relevant

institutional review board (IRB) prior to data collection. Written informed consent was obtained from all participants after explaining the study's purpose, procedures, benefits, and potential risks. Participants were assured of voluntary participation, with the right to withdraw at any time without affecting their medical care. Confidentiality was maintained by anonymizing data, using coded identifiers, and securely storing records. The control group received routine care, and upon study completion, they were offered the exercise intervention to ensure equity. The research adhered to the Declaration of Helsinki principles for medical ethics. Hemodialysis units are used as an area to collect data from the patients who attend for hemodialysis session. By face-to-face interview each patient needs about 30 minutes to complete an exercise session. Pre-test obtained for all participant (100) patients it take about (7) days, the interventional group member exposed to educational exercises sessions the first post-test finished for all the participant (both groups) at (10/ December/ 2024), the data collection period takes about (60) days.

3. RESULTS

Table 1. Demographic characteristics of the study sample (both group)

Demographical data	**Rating and intervals**	**Control group**		**Interventional group**		**P. value**
		Frequency	Percent	Frequency	Percent	
Age / years	30-39	2	4.0	5	10.0	.428 ns
	40-49	19	38.0	18	36.0	
	50-60	29	58.0	27	54.0	
	Total	50	100.0	50	100.0	
Sex	Male	20	40.0	22	44.0	.689 ns
	Female	30	60.0	28	56.0	
	Total	50	100	50	100.0	
Educational level	Illiterate	5	10.0	14	28.0	.227 ns
	Able to read and write	25	50.0	16	32.0	
	Primary school	20	40.0	20	40.0	
	Total	50	100.0	50	100.0	
Working	work	14	28.0	9	18.0	.239 ns
	Not working	36	72.0	41	82.0	
	Total	50	100.0	50	100.0	
Residence	Urban	17	34.0	26	52.0	.070 ns
	Rural	33	66.0	24	48.0	
	Total	50	100.0	50	100.0	

Ns: not significant, Student's *t* test used in all comparison

Table 2 : Clinical characteristics of study sample for both experimental and control groups.

Clinical V.	Rating and interval	Control group		Interventional group		P. value
		Frequency	Percent	Frequency	Percent	
Duration undergoing hemodialysis	1-3 year	23	46.0	24	48.0	.759 ns
	4-6 year	22	44.0	22	44.0	
	More than 6 year	5	10.0	4	8.0	
	Total	50	100.0	50	100.0	
Chronic disease	None	3	6.0	4	8.0	.699 ns
	Hypertension	47	94.0	46	92.0	
	Total	50	100.0	50	100.0	

Ns: not significant, Student's *t* test used in all comparison

Table 3: Level of fatigue among both groups (control and interventional test)

No.	Questions	N	Control Group		Interventional group	
			Mean	Std. Deviation	Mean	Std. Deviation
1	I am bothered by fatigue	50	4.42	.538	4.50	.544
2	I get tired very quickly	50	4.46	.503	4.56	.501
3	I don't do much during the day	50	4.20	.495	4.56	.541
4	I have enough energy for everyday life	50	4.64	.485	4.40	.495
5	Physically, I feel exhausted	50	4.52	.505	4.60	.495
6	I have problems to start things	50	4.46	.503	4.40	.495
7	I have problems to think clearly	50	3.86	.670	3.76	.657
8	I feel no desire to do anything	50	4.00	.000[a]	4.00	.000[a]
9	Mentally, I feel exhausted	50	3.96	.533	4.04	.727
10	When I am doing something, I can concentrate quite well	50	3.96	.669	4.08	.634

MS. Mild Fatigue ≤ 2.3 , Moderate Fatigue = (2.4 -3.7) , Severe Fatigue < 3.7

Table 4: Overall fatigue assessment among control and interventional groups pre test.

Item	group name	N	Mean	Std. Deviation	P. Value
Fatigue assessment scale	Control	50	4.25	.136	0.193 ns
	Interventional	50	4.29	.181	

MS. Mild Fatigue ≤ 2.3 , Moderate Fatigue = (2.4 -3.7) , Severe Fatigue < 3.7

Table 5 : Changes in fatigue experienced by patients in both studied groups before and after the exercise sessions:

No.	Questions	N	Control Group Mean ± SD			Intervention Group Mean ± SD		
			Pre-trail	Post trail	P. value	Pre-trail	Post trail	P. value
1	I am bothered by fatigue	50	**4.42**±538	4.42±.538	.944	**4.50**±.544	3.06±.240	.000
2	I get tired very quickly	50	**4.46**±.503	4.46±.503		**4.56**±.501	2.88±.480	
3	I don't do much during the day	50	**4.20**±.495	4.20±.495		**4.56**±.541	3.00±.571	
4	I have enough energy for everyday life	50	**4.64**±.485	4.64±.485		**4.40**±.495	3.06±.470	
5	Physically, I feel exhausted	50	**4.52**±.505	4.50±.505		**4.60**±.495	2.76±.625	
6	I have problems to start things	50	**4.46**±.503	4.46±.503		**4.40**±.495	2.50±.614	
7	I have problems to think clearly	50	**3.86**±.670	3.86±.670		**3.76**±.657	2.68±.713	
8	I feel no desire to do anything	50	**4.00**±00	4.00±.000		**4.00**±00	2.50±.614	
9	Mentally, I feel exhausted	50	**3.96**±.533	3.96±.533		**4.04**±.727	2.52±.707	
10	When I am doing something, I can concentrate quite well	50	**3.96**±.669	4.00±.670		**4.08**±.634	2.98±.515	
	General Mean ± SD		**4.25**±.136	4.25±.147		**4.29**±.181	2.79±.215	

	Assessment		**Poor**	Poor		**Poor**	Good	

MS. Mild Fatigue ≤ 2.3 , Moderate Fatigue = (2.4 -3.7) , Severe Fatigue < 3.7

Table 6 : The difference in level of fatigue for patients undergoing regulated scheduale of hemodilysis between interventional and Control groups related to their pre and post test:

Group	**Independent T- test**								
	Pre- interventional					**Post- interventional**			
	N	Mean ±SD	**D.f**	**P.value**	**Evaluation**	Mean ± SD	**D.f**	**P.value**	**Evaluation**
Control	**50**	**4.25**±.136	**98**	**.193**	**NS**	**4.25**±.147	**98**	**.000**	**HS**
Interventional	**50**	**4.29**±.181				**2.79**±.191			

SD.= standerd deviation; D.F= degree of freedom; NS= non significant; HS= high significant

MS. Mild Fatigue ≤ 2.3 , Moderate Fatigue = (2.4 -3.7) , Severe Fatigue < 3.7

Table 7: Relationship between post test overall fatigue level and their demographical data for both groups (interventional and control) :

Demographic characteristics	Interventional				Control			
	Chi-square value	d.f	P-value	Ass	Chi-square value	d.f	P-value	Ass
Age	22.117	18	.227	N.S	17.002	10	.074	N.S
Sex	13.033	9	.161	N.S	5.381	5	.371	N.S
Level of education	24.678	18	.134	N.S	16.190	10	.094	N.S
Working	12.634	9	.180	N.S	2.639	5	.755	N.S
Residence	16.636	9	.055	N.S	4.590	5	.468	N.S

Table 8: Relationship between post test overall fatigue level and their clinical information for both groups (interventional and control) :

Demographic characteristics	Interventional				Control			
	Chi-square value	d.f	P-value	Ass	Chi-square value	d.f	P-value	Ass
Duration undergoing hemodialysis	21.815	16	.149	N.S	5.069	10	.887	N.S

Clinical disease	6.220	8	.623	N.S	2.061	5	.841	N.S

4. DISCUSSION

Part One: Discussion for Patients' Socio-Demographic Data and clincal information:

Demographic results indicate that there were no statistically significant differences between the control group and the experimental group across the various variables, with all P values being non-significant (ns). Age: The age groups are similarly distributed between the two groups, with the age group (50-60 years) constituting the largest proportion in both groups. Gender: The proportion of males and females is similar, indicating a balanced distribution between the sexes.Educational level: There is a higher proportion of illiterates in the experimental group (28%) compared to the control group (10%), but the differences are not statistically significant. Employment: The vast majority in both groups are unemployed, with a slightly higher proportion in the experimental group. Place of residence: The experimental group tends to be more urban compared to the control group, but the difference is not statistically significant (P = 0.070). In general, these results show that the distribution of demographic characteristics is homogeneous between the two groups, which supports the validity of the comparison between them without the influence of different demographic variables. Recent studies indicate that the demographic characteristics of patients with kidney failure undergoing hemodialysis are distributed similarly, supporting the results of the presented table. For example, in a study titled **"Quality of Life in Light of Some Demographic Variables Among a Sample of Patients with Kidney Failure Undergoing Hemodialysis,"** the impact of demographic variables on patients' quality of life was analyzed. The findings revealed that the distribution of age groups, gender, and educational level was similar among patients, with no statistically significant differences in demographic factors affecting quality of life [13]. The clinical results presented indicate that there were no statistically significant differences between the control and experimental groups regarding the duration of hemodialysis and the presence of chronic diseases, as all P values were not significant (ns). Duration of hemodialysis: The proportions were similarly distributed between the two groups across different time periods, indicating homogeneity in the duration of treatment among patients. Chronic diseases: The incidence of hypertension was very high in both groups (94% in the control and 92% in the experimental), with no statistically significant differences

Part Two: Related to the fatigue level among hemodialysis patients pre-experimental:

The table 3 and 4 presented shows the assessment of fatigue in hemodialysis patients, where the mean responses were compared between the control group and the experimental group across several items. The results show that the mean responses and standard deviations were close between the two groups in most of the items, indicating that the level of fatigue reported was similar between the two groups. These results are consistent with a study published in the European Journal of Investigation in Health, Psychology and Education, where a comparison was made between hemodialysis patients and healthy individuals. The study showed that hemodialysis patients suffer from higher levels of fatigue than healthy individuals, which negatively affects their quality of life, especially in the physical and psychological areas. The study also indicated that demographic and clinical factors may affect the levels of fatigue and quality of life in these patients [14].

Part Three: Discussion the Effect range of motion exercise sessions on fatigue level among patients undergoing regulated schedualed hemodialysis:

The presented results indicate the effect of the range-of-motion exercise program on the level of fatigue in hemodialysis patients. Before the program was implemented, the average fatigue level was close between the control group (4.25±0.136) and the experimental group (4.29±0.181), with no statistically significant differences (P=0.193), indicating the homogeneity of the two groups before the intervention. After the program was implemented, there was no significant change in the average fatigue level in the control group (4.25±0.147). In contrast, the experimental group witnessed a significant decrease in the average fatigue level to (2.79±0.191), with a highly statistically significant difference (P=0.000). These results highlight the effectiveness of the range-of-motion exercise program in reducing the level of fatigue in hemodialysis patients. These results are consistent with previous studies that indicated the benefits of regular exercise for hemodialysis patients. According to the website "My Kidney Journey", regular exercise can help increase energy levels, improve sleep quality, and reduce stress and anxiety, which contributes to improving the physical and mental health of these patients[15]. The results also indicated that there was no statistically significant effect between demographic data and the level of fatigue among patients, as well as clinical information. This may indicate the homogeneity of the sample and the method of selecting it, in order to avoid the entry of undesirable variables and factors and their impact on the results of the study other than the study variables.

5. CONCLUSION AND RECOMMENDATION

The results of this study indicate that the application of the range-of-motion exercise program had a clear positive effect in reducing the level of fatigue in hemodialysis patients, which enhances its effectiveness as a non-pharmacological strategy to improve the quality of life of these patients. The experimental group showed a significant decrease in the level of fatigue

after applying the program compared to the control group, which confirms the role of guided physical activity in enhancing physical capacity and reducing the feeling of physical and mental fatigue. Based on these results, range-of-motion exercises can be considered an essential part of supportive care for hemodialysis patients, with the need to follow up with patients regularly to ensure the continuity of benefits and improve treatment outcomes.

Integration of exercise programs: It is recommended to integrate range-of-motion exercise programs as an essential part of the care of hemodialysis patients. Education and awareness: Provide educational sessions to patients about the importance and benefits of exercise, and guide them on how to exercise safely. Ongoing follow-up: Conduct periodic assessments of patients' fatigue levels to monitor their progress and modify treatment programs as needed. Psychosocial support: Provide psychosocial support to patients to enhance their adherence to the treatment program and improve their psychological state.

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