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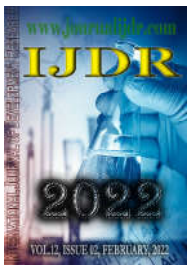

RESEARCH ARTICLE OPEN ACCESS

EFFECTIVENESS OF INTRADIALYTIC LEG ERGOMETRY EXERCISE ON FATIGUE AND PHYSIOLOGICAL PARAMETERS AMONG PATIENTS UNDERGOING HEMODIALYSIS

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ABSTRACT

Introduction: ESRD is a silent killer which largely affects the quality of life. Hemodialysis is a main treatment modality for these patients. It leads to various complications like fatigueand alterations in physiological parameters. Intradialytic Leg Ergometry Exercise is an effective approach to reduce fatigue and for improving physiological parameters. **Methods:** A quasi-experimental design was used to conduct the study. Patientswere selected by using convenience sampling technique and were allocated in experimental group and control group.Standardized Iowa Fatigue Scale (IFS) and self-structured Physiological Parameter Scale (PPS) were used to collect the data. **Results:** In experimental groupsignificant effect was seen inPretest-Posttestlevel of fatigue (t=7.70; p=0.00); calcium (t=2.53; p=0.02); pre dialysis systolic BP (t=3.76; p=0.00); intra dialysisdiastolic BP(t=2.70; p=0.01);post dialysisdiastolic BP(t=2.44; p=0.02); pre dialysis respiration (t=2.25; p=0.04); pre dialysis SpO_2 (t=2.70; p=0.01) and post dialysisSpO_2 (t=2.55; p=0.02). Between experimental and control groupsignificant results were found at posttestin the level of fatigue(t=6.44; p=0.00); pre dialysis pulse (t=2.79; p=0.00); post dialysis pulse (t=2.63; p=0.01); pre dialysis respiration (t=4.49; p=0.00); post dialysis respiration (t=4.03; p=0.00); intra dialysisSpO_2(t=2.74; p=0.01) and post dialysisSpO_2(t=3.20; p=0.00). **Conclusion:** Intradialytic Leg Ergometry Exercise is beneficial in reducing fatigue and improving physiological parameters of the patients undergoing hemodialysis in experimental group as compared to control group.

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INTRODUCTION

Chronic Kidney Disease (CKD) is a major epidemic and public health problem that is very common in many countries with an increasing prevalence.[1] CKD is a slow and progressive loss of kidney function over a period of several years.[2] CKD is classified into 5 stages according to severity depending upon GFR rate.Stage 5 CKD is often called End Stage Renal Disease (ESRD).[3]End stage renal disease represents a major problem for public health and it brings about complex implications to social and economic structures of every nation in the world. Patients with ESRD have low level of physical fitness and function. Because of electrolytes imbalance and alterations in physiological parameters, individuals usually complain of pain, fatigue and muscle weakness in the spine, hips, knees, and lower extremities.[4]In stage 5, renal function declines, the disease ultimately reaches the life- threatening end stage, which requires urgent replacement therapy, either by dialysis or transplantation.[5] Dialysis is a treatment for kidney failure that removes waste and extra fluid from the blood, using a filter.

Two types of dialysis are hemodialysis and peritoneal dialysis.Hemodialysis is the most common method used to treat advanced and permanent kidney failure.[6]Hemodialysis, as one of the main renal replacement therapies in patients with ESRD, is a time-consuming procedure that takes at least 3 to 5 hours a day, two or three times a week.Hemodialysis is a physically stressful procedure and most of the patient can have fatigue and thereby a deterioration within the regular activities.[7] Fatigue and alteration in physiological parameters are the most frequent complaints of patients undergoing hemodialysis. Physiological parameters includeserum electrolytes (sodium, potassium, calcium, phosphorus) hemoglobin, serum urea, serum creatinine; vitals (B.P, heart rate, respiratory rate, pulse, SpO_2) and Intradialytic weight gain.[8] Untreated fatigue and altered physiological parameters may impact greatly on quality of life, leading to increased dependence on others, weakness, decreased physical and mental energy and social withdrawal. According to National Kidney Foundation, exercise is good for kidneys. Low level strengthening exercises like continuous activities such as walking, swimming, bicycling and aerobic exercises are needed to move large muscle groups to improve fatigue and physical activity.[9]Exercise is

the one of the possible preventive maneuvers to reduce muscle function.For healthy life style certain exercises are required to improve fatigue and physiological parameters among patients undergoing hemodialysis.[10] Recentlymany studies have shown the importance of exercise or regular physical activity to prevent muscle wasting in patients undergoing hemodialysis. Various studies conducted in different clinical settings showed that there is greater impact of Intradialytic exercise program in improving fatigue and physiological parameters among hemodialysis patients. Our objective was to study whether Intradialytic exercise program will improve fatigue and physiological parameters among hemodialysis patients.

MATERIAL AND METHODS

A quasi-experimental design (non-equivalent pretest posttest control group design) was used to assess the effect of Intradialytic Leg ErgometryExercise for improving fatigue and physiological parameters among patients undergoing Hemodialysis of DMCH, Ludhiana (Punjab). A written permission was taken from Research and Ethical committee of DMCH, Ludhiana. Consented patients who were above 18 years of age, receiving hemodialysis 2 or 3 times/ week, for 3 or 4 hrs. /session, not recently hospitalized due to any other cause, able to understand Hindi/Punjabi/English, willing to participate for at least 4 weeks were enrolled in the study.

and control group.In this study fatigue is defined as a debilitating state experienced by patients undergoing maintenance hemodialysis as assessed by Iowa Fatigue Scale (Hartz AH, Bentler SE, Watson D, 2003) and Physiological Parameterrefers to the parameters like serum electrolytes (sodium, potassium, calcium, phosphorus) serum urea, serum creatinine, hemoglobin and vitals (B.P, pulse, respiration, SpO_2) and Intradialytic weight gain among the patients undergoing hemodialysis as assessed by self-structured *Physiological Parameter Scale.* Vitals such as B.P, pulse, respiration and $SpO_2$are assessed predialysis, intra dialysis and post dialysis in pretest and posttest. The detailed study algorithm is given in Figure 1.

Statistics

The data was collected and coded in excel sheet and was analyzed according to objectives of the study. Descriptive (mean & SD) statistics and inferential (Chi-square, paired t test and unpaired t test) statistics was used in the study. The level of significance was 0.05. Homogeneity of both the groups was assessed by Chi-square test. The paired t test and unpaired t test was used to assess pre and post level of fatigue and physiological parameters among the experimental and control group. Tables and graphs were used to show the result. The entire data was calculated using statistical software SSP (Smith's statistical package v 2.8, 2005) & SPSS 16.0.

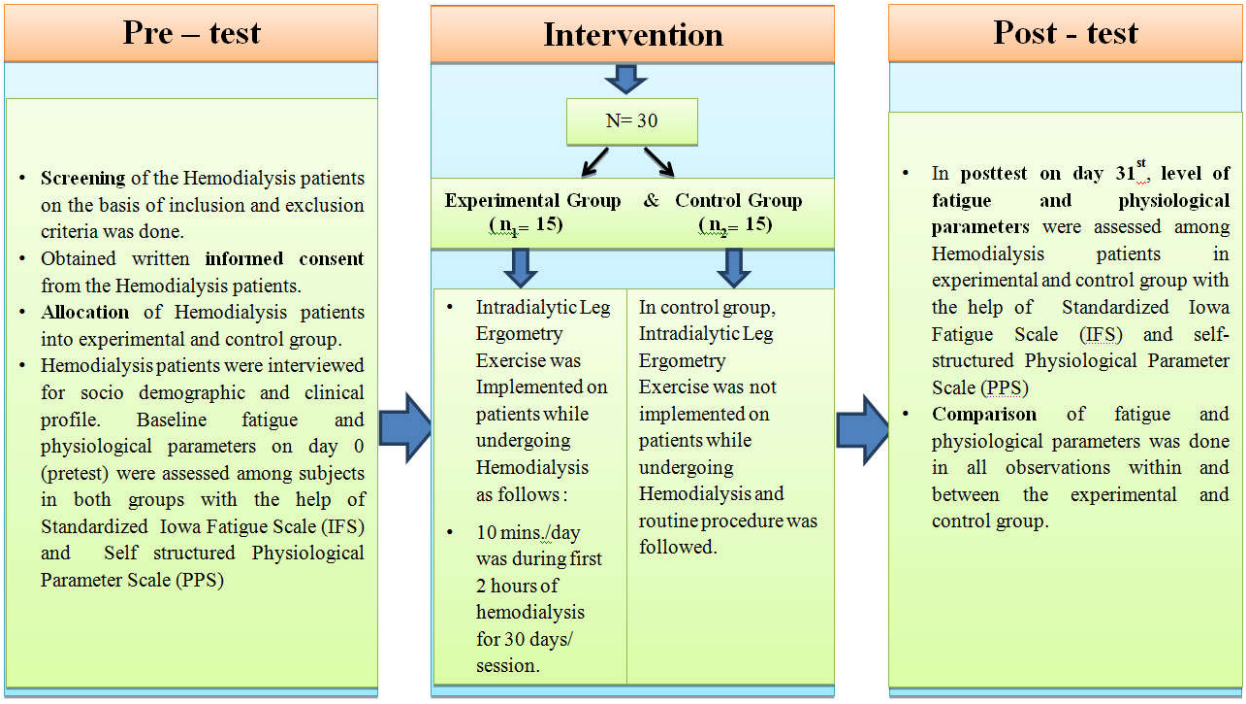

Fig. 1. Algorithm for data collection procedure & intervention

The exclusion criteria includes those who werehaving femoral access for hemodialysis, irregular for hemodialysis, critically ill (airway, breathing, circulation affected), diagnosed with cardiovascular diseases, not able to follow instructions for Leg Ergometry Exercise due to any physical (amputation/surgery) or mental problems (anxious patients) and un-cooperative. The study subjects i.e. 30 were drawn from the target population by using convenience sampling technique and then were allocated in experimental group (n_1=15) and control group (n_2=15).

Intradialytic Leg Ergometry Exercise was provided to the patients in experimental group. Intradialytic Leg Ergometry Exercise refers to the quadriceps, knee and gluteal strengthening exercise in which maintenance hemodialysis patients feet are placed on pedals and are moved around in circles as if pedaling a cycle for about 10 minutes during first 2 hours of hemodialysis for 30 days per session. Comparison of fatigue and physiological parameters was done in all observations (pretest & posttest) within and between the experimental

RESULTS

Out of 30 patients included in our study, 15 patients (Experimental group) had IntradialyticLeg Ergometry Exercise and the remainder of the 15 patients (Control group) were served with regular routine care.In the present study Mean age of experimental group was 52.73±10and of control group was 50.26±15.69 and majority were males.As per socio demographic profile(age, gender, habitat, educational status, religion, marital status, occupation, dietary habits and socio economic status)and clinical profile (dialysis vintage, cause of renal failure, frequency of dialysis per week, total hours of dialysis, comorbidities, pre dialysis complications, intra dialysis complications, post dialysis complications, medication and access type) of Hemodialysis patients, both the groups were found to be homogenous ($p>0.05$). Out of 30 patients, in 29 patients cause of renal failure was known Figure 2 and majority of patients had AV Fistula as an access for hemodialysis Figure 3.

Fatigue: As per level of fatigue, in experimental group majority of the subjects were falling in mild i.e. 8 (53.3%) and moderate i.e.7 (46.7) level of fatigue. After intervention majority of the subjects were lying in mild level of fatigue i.e. 14 (93.3%) where as in control group during pre-test most of the subjects i.e. 6 (40%), 7 (46.7%) were lying in mild and moderate level of fatigue as followed by post-test i.e. 7 (46.7%), 6 (40%) were falling in moderate and severe level of fatigue. Significant effect was seen in the level of fatigue within experimental group (t=7.70; p=0.00) and control group (t=6.91; p=0.00), but in experimental group fatigue level was decreased and in control group fatigue level was increased. Significant effect was also noticed between experimental & control group at posttest (t=6.44; p=0.00) Table 1 & Figure 4.

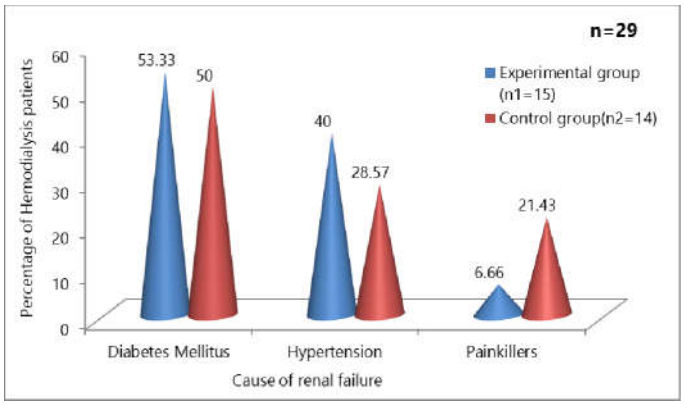

Fig. 2. Distributionof Hemodialysis patients according to their cause of renal failure

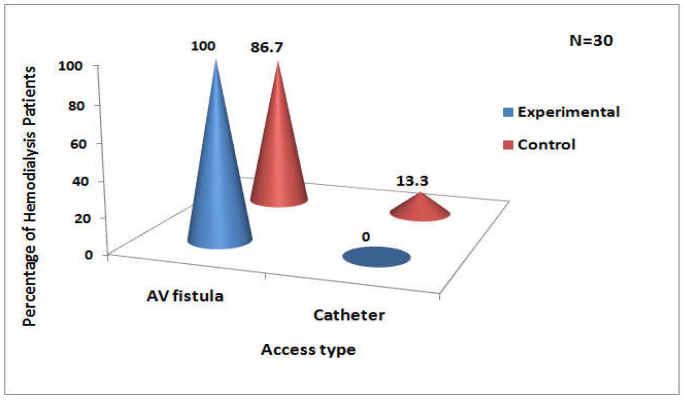

Fig. 3. Distribution of Hemodialysis patients according to their access type

Table 1. Comparison of fatigue of Hemodialysis patients among experimental and control group in pre-test and post-test within the groups and between the groups

N=30

Fatigue Score	Pre-test		Post-test		Paired t/p value
	Mean±SD	Mean %	Mean±SD	Mean %	
Experimental	30.33±4.73	55.14	24.06±3.23	43.74	t=7.70 df=14 p=0.00*
Control	32.46±7.53	59.01	37.46±7.32	68.10	t=6.91 df=14 p=0.00*
Unpaired t/p value	t=0.92 df=28 p=0.36NS		t=6.44 df=28 p=0.00*		

*Minimum score=11 *Significant*
Maximum score=55NS= Non – Significant
Null hypothesis is rejected

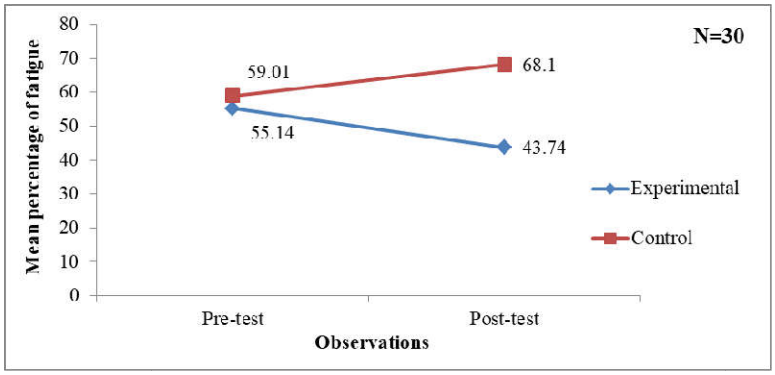

Fig. 4. Line diagram showing comparison of mean percentage of fatigue of Hemodialysis patients at pretest and posttest

Lab parameters: In experimental group mean of calcium in pretest was 7.66±1.58 mg/dl followed by posttest i.e. 8.54±0.92 mg/dl while in control group mean of calcium in pretest was 8.27±1.13mg/dl and posttest was 8.64±0.46 mg/dl. It concludes that the implementation of the Intradialytic Leg Ergometery exercise have significant effect on calcium (t=2.53; p=0.02) of hemodialysis patients.Whereas, there wasno significant difference in lab parameters like sodium, potassium, phosphorus, serum urea, serum creatinine and hemoglobin levels.

Intradialytic weight gain: IntradialyticLeg Ergometeryexercise had no significant effect (p=0.46, 0.45) on Intradialytic weight gain within experimental and control group and no significant effect (p=0.14) was seen between the experimental and control group.

Vital parameters

Blood Pressure: In experimental group significant effect was seen in Pretest-Posttest pre dialysis systolic BP (t=3.76; p=0.00); intra dialysis diastolic BP (t=2.70; p=0.01) and post dialysis diastolic BP (t=2.44; p=0.02). No significant effect was seen in control group.

Pulse: Between experimental and control group significant results were found at posttest in pre dialysis pulse (t=2.79; p=0.00) and post dialysis pulse (t=2.63; p=0.01).No significant effect was seen in control group.

Respiration: In experimental group significant effect was seen in Pretest-Posttest pre dialysis respiration (t=2.25; p=0.04). Between

experimental and control group significant results were found at posttest in pre dialysis respiration (t=4.49; p=0.00) and post dialysis respiration (t=4.03; p=0.00). No significant effect was seen in control group.

SpO_2: In experimental group significant effect was seen in Pretest-Posttest pre dialysis SpO_2 (t=2.70; p=0.01) and post dialysis SpO_2 (t=2.55; p=0.02). Between experimental and control group significant results were found at posttest in intra dialysis SpO_2 (t=2.74; p=0.01) and post dialysis SpO_2 (t=3.20; p=0.00). No significant effect was seen in control group.

DISCUSSIONS

Patients undergoing hemodialysis experiences a range of symptoms, with considerable change in the frequency of symptoms experienced and in the severity with which the symptoms affected the individuals. Symptoms are significantly associated with sleep problems, fatigue, poor physical functioning and variations in physiological parameters like serum electrolytes (sodium, potassium, calcium, phosphorus) hemoglobin, serum urea, serum creatinine and vitals (B.P, heart rate, respiratory rate, pulse,SpO_2) and Intradialytic weight gain. Fatigue is one of the most frequent complaint of dialysis patient and most commonly alterations in physiological parameters are seen that affects physical functioning of hemodialysis patients.[11]To overcome this, Intradialytic Leg Ergometry Exercise is a good approach to reduce fatigue and improving physiological parameters. The findings of the present study reveals that there is significant effect of Intradialytic Leg Ergometry Exercise on the level of fatigue (t=7.70; p=0.00) within experimental group and also between experimental & control group at posttest (t=6.44; p=0.00).Similar RCT was done by Jose S, Devi B, Victoria E (2014) on effectiveness of Intradialytic leg exercise (ILE) on fatigue and activities of daily living among patients undergoing hemodialysis.The study group patients had a significant change in the level of fatigue (p=0.00) when compared to that of the control group patients.[12] Another study was done by Chang Y, Cheng SY, Lin M,et al. (2010) to evaluate the effect of Intradialytic leg ergometry exercise for improving fatigue and daily physical activity levels among chronic kidney disease patients. This study concluded that experimental group had a significantly less fatigue as compared to control group.[13]

The findings of this study reveals that there was significant improvement in lab parameter (Calcium) within the experimental group (t=2.53; p=0.02) with implementation of Intradialytic Leg Ergometry Exercise. Whereas, there is no significant difference in lab parameters like sodium, potassium, phosphorus, serum urea, serum creatinine and hemoglobin levels.Similar RCT was conducted by Soliman MH. (2015) on effect of Intradialytic Leg Ergometry Exercise on electrolytes level. A significant reduction was seen in serum phosphate and potassium, calcium, urea, creatinine and a slightly increase in hemoglobin level.[1]Another study was done byRashedi ALS, Ghaleb AM. (2017) to determine the effectiveness of Intradialytic leg exercise on dialysis efficacy among patients undergoing hemodialysis. This study concluded a significant improvement in blood urea nitrogen in the study group. Also, there was a slight improvement in the hemoglobin level. Whereas, there was no significant difference in the creatinine, URR and the calcium levels.[14]Another RCT was done by Makhlough A, llali E, Mohseni R, Shahmohammadi S (2012) on the effect of intradialytic aerobic exercise on serum electrolytes levels in hemodialysis patients. The findings revealed significant improvements in serum phosphate levels and serum potassium level. However, serum calcium and hemoglobin levels did not change significantly in the exercise group.[8] The findings of present study revealed that implementation of Intradialytic exercise had no significant effect (p=0.46, 0.45) on Intradialytic weight gain within experimental and control group and no significant effect (p=0.14) was seen between the experimental and control group. Similar study was done by Rhee SY, Song JK, Hong CS, Choi JW, et. al (2017) in Korea to evaluate the effect of intradialytic exercise on physical functions, psychological functions laboratory values, dialysis-related effects of intradialytic exercise. Findings revealed no significant changes in dry weight ($p < 0.05$).[15] The findings of this study reveals that in experimental group significant effect was seen in Pretest-Posttest pre dialysis systolic BP (t=3.76; p=0.00); intra dialysis diastolic BP (t=2.70; p=0.01); post dialysis diastolic BP (t=2.44; p=0.02); pre dialysis respiration (t=2.25; p=0.04); pre dialysis SpO_2 (t=2.70; p=0.01) and post dialysis SpO_2 (t=2.55; p=0.02). Between experimental and control group significant results were found at posttest in pre dialysis pulse (t=2.79; p=0.00); post dialysis pulse (t=2.63; p=0.01); pre dialysis respiration (t=4.49; p=0.00); post dialysis respiration (t=4.03; p=0.00); intra dialysis SpO_2 (t=2.74; p=0.01) and post dialysis SpO_2 (t=3.20; p=0.00). Similar RCT was done by Soliman MH.(2015) in Egypt and significant improvement was seen in systolic and diastolic blood pressure in the exercise group ($p < 0.05$)[1.] Another similar study was conducted by Rhee SY, Song JK, Hong CS, Choi JW, et. al (2017) in Korea. A significant difference was observed in intradialytic hypotension ($p < 0.05$).[15]

CONCLUSION

Intradialytic Leg Ergometry Exercise during hemodialysisis significantly effective in decreasingthe level of fatigue and improving certain physiological parameters like serum calcium and vitals: B.P, Pulse, Respiration and SpO_2 among patients undergoinghemodialysis in experimental group as compared to control group.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their personal and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity.

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Conflicts of interest: There are no conflicts of interest.

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