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EFFECTIVENESS OF STRETCHING EXERCISES ON MUSCLE CRAMPS AND FATIGUE AMONG HEMODIALYSIS PATIENTS

Pushpa
NPCC student, SGT University, Haryana,
Amandeep Kaur
Associate Professor cum SLTO, National Reference Simulation Centre, SGT University, Gurgaon, Haryana.
*Corresponding Author – **Pushpa**

ABSTRACT
Background: Muscle cramps and fatigue are prevalent complications in patients undergoing hemodialysis, negatively impacting their quality of life. This study evaluated the effectiveness of stretching exercises in reducing muscle cramps and fatigue among hemodialysis patients at a selected hospital in Gurugram. **Aim-**The objectives were to assess the impact of stretching exercises on muscle cramps and fatigue, examine the correlation between these variables, and explore associations with selected demographic and clinical factors. **Method-**A quasi-experimental study was conducted with 50 hemodialysis patients, divided into control and experimental groups. The control group received standard care, while the experimental group performed stretching exercises. Muscle cramps were measured using a Cramp Questionnaire Chart and Visual Analogue Scale, and fatigue was assessed using the Fatigue Severity Scale. Data were collected at pre-test, post-test 1, and post-test 2, and analyzed using paired and unpaired t-tests, ANOVA, chi-square tests, and correlation analysis. **Results-**The control group showed no significant changes in muscle cramp or fatigue scores, while the experimental group demonstrated significant reductions in muscle cramp scores from 7.84 ± 2.5 to 0.48 ± 1.4 and fatigue scores from 56.80 ± 2.61 to 34.64 ± 8.13 ($p = 0.000$). No significant correlation between muscle cramps and fatigue was found, though some associations with demographic factors were noted. **Conclusion-** Stretching exercises significantly reduce muscle cramps and fatigue in hemodialysis patients, suggesting their potential to enhance patient quality of life.
Keywords: Hemodialysis, muscle cramps, fatigue, stretching exercises, quality of life.

INTRODUCTION
Chronic kidney disease (CKD) is a significant public health issue marked by the progressive loss of kidney function over time. If left untreated, CKD can lead to end-stage renal disease (ESRD), necessitating interventions like hemodialysis or kidney transplantation. Hemodialysis, a critical therapy for ESRD, often results in complications such as muscle cramps and fatigue, which negatively impact patients' quality of life. Stretching exercises during hemodialysis sessions have shown promise in alleviating these symptoms, providing an inexpensive and non-pharmacological approach to enhancing patient outcomes.Hemodialysis is a crucial therapy for end-stage renal disease (ESRD) that helps maintain fluid and electrolyte balance and remove waste products from the body. It is a complex process that generally takes about 3 to 5 hours daily, spread across 2 to 3 days each week. With adequate and effective hemodialysis, the patient's quality of life can be enhanced and the issues linked to kidney failure can be minimized **.**Muscle cramps and fatigue are common complications in patients undergoing hemodialysis, often causing premature termination

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of dialysis sessions and reduced treatment effectiveness. Muscle cramps, typically affecting the legs, are caused by factors such as fluid and electrolyte imbalances, low blood pressure, and inadequate oxygen supply to tissues. Fatigue, experienced by up to 97% of dialysis patients, leads to both physical and mental exhaustion, significantly affecting quality of life and daily functioning. While pharmacological treatments like iron sucrose help manage symptoms, non-pharmacological interventions, including stretching exercises, have demonstrated potential to reduce muscle cramps and fatigue.

NEED OF THE STUDY

Muscle cramps and fatigue are common challenges faced by hemodialysis (HD) patients, often leading to treatment discontinuation. One of the simplest and most cost-effective ways to manage these symptoms is through stretching exercises during dialysis. Research suggests that incorporating stretching exercises can prevent or reduce muscle cramps, enhance strength and endurance, and improve various physiological and psychosocial aspects of health. These exercises, such as quadriceps, knee, hamstring, and glute stretches, promote muscle protein synthesis and breakdown, which contribute to overall physical function.Stretching exercises offer numerous health benefits, including increased energy, reduced muscle soreness, improved flexibility, and enhanced focus. Importantly, there is little evidence of serious injuries associated with exercise during dialysis, making it a safe intervention. Physical activity also plays a crucial role in reducing CKD-related complications by improving kidney function and benefiting neurological, musculoskeletal, and cardiovascular health. Dialysis nurses play a vital role in encouraging and assisting patients in performing these exercises both during and after dialysis. Based on clinical observations at SGT Hospital, fatigue and muscle cramps are frequently reported among HD patients. With around 100 HD patients per month, this study aims to investigate the effectiveness of stretching exercises in reducing these symptoms. The findings could provide evidence-based strategies to improve patients' quality of life and prevent treatment discontinuation, ultimately enhancing overall patient care.

AIM OF THE STUDY

To assess the effectiveness of stretching exercises on the level of muscle cramps and level of fatigue among patients undergoing hemodialysis and the association of muscle cramps & fatigue with selected demographic and clinical variables.

THE OBJECTIVE OF THE STUDY: -

1. To assess the effectiveness of stretching exercises on the level of muscle cramps among patients undergoing hemodialysis
2. To assess the effectiveness of stretching exercises on the level of fatigue among patients undergoing hemodialysis
3. To determine the co-relation of muscle cramps and fatigue after administering stretching exercises in experimental and control group of patients undergoing hemodialysis.
4. To find out the association of muscle cramps & fatigue with selected demographic variables in both experimental and control group of patients undergoing hemodialysis.

METHODOLOGY

Research Design: - The research design selected for the present study was quasi experimental

non-equivalent control group pre-test post-test design.

Table 3.1: Representation of Research Design

The design adopted for the study can be represented as O1-X-O2-O3

O1 - Pre-test assessment of muscle cramps & fatigue using the Cramp questionnaire chart & visual analogue scale and Fatigue severity scale

X - Stretching exercise

O2 - Post-test assessment of muscle cramps & fatigue using the Cramp questionnaire chart and visual analogue scale and Fatigue severity scale after 2 weeks.

O3 - Post-test assessment of muscle cramps & fatigue using the Cramp questionnaire chart and visual analogue scale and Fatigue severity scale after 4 weeks.

VARIABLES OF THE STUDY

Independent Variable-The independent variable of this study was stretching exercises.

Dependent Variable: The dependent variable of this study was muscle cramps and fatigue.

Extraneous variable: Age, gender, education, religion, type of family, number of hemodialysis, duration of hemodialysis, hours of dialysis, and sitting of hemodialysis, number of blood transfusion during hemodialysis etc.

RESEARCH SETTING

This study was conducted in dialysis unit of SGT Hospital Gurugram. The hospital is a multispecialty hospital with bed strength of 810. The dialysis department of this hospital which has bed strength of 9. The total number of patients undergoing haemodialysis for each month is 120-130 and each day they have four Shifts with the population of patients. The dialysis department of this hospital has 1 in-charge dialysis technician, 3 experienced and qualified staff nurses, 4 technicians, and 2ward assistants.

Population of the study

i. **Target Population:** Patients undergoing hemodialysis.

ii. **Accessible population**: Patients undergoing hemodialysis at selected hospital in Gurugram.

Sample and Sampling Technique

The Sample of the study was patients undergoing haemodialysis at SGT Hospital during the study period and those who met the eligibility criteria.

The Sample size for this study was 50 patients with muscle cramps and fatigue undergoing hemodialysis.

SAMPLE SELECTION CRITERIA

A. Inclusion Criteria:

- Patients who had muscle cramps and fatigue during haemodialysis.
- Patients who were alert and cooperative.

B. Exclusion Criteria:

- Patients undergoing emergency and first haemodialysis
  Patients with any lower limb disability

Tools descriptions

Various literature was reviewed, including previous research, journals, articles, etc. and guidance was taken from the research guide.

Tool 1:

Section A: Demographic variable of patients undergoing hemodialysis.

Section B: Clinical Variables of patients undergoing hemodialysis

Tool 2: Cramp questionnaire chart and visual analogous scale

Tool 3: Fatigue severity scale (FSS)

Tool 1:

Section A: Demographic variable of patients undergoing hemodialysis containing.

This section contains of 11 items which includes Age, Gender, Religion, Education, Occupation, Marital Status, Type of Family, Family Monthly Income, Dietary Pattern, Area of residence, Lifestyle.

Section B: Clinical Variables of patients undergoing hemodialysis.

This section consists 25 items including Duration of renal failure, Duration of dialysis treatment, Frequency of hemodialysis treatment, duration of hemodialysis session, Any co-morbidity, Rate of Ultrafiltration, Rate of blood flow through dialyzer, Fatigue experience, When fatigue, Duration of fatigue, when Experience fatigue during hemodialysis, Fatigue restrict activity, Hb level before hemodialysis, Iron supplement, BT during hemodialysis, Feel muscle cramps, When feel muscle cramps, When feel muscle cramps during hemodialysis , Restrict activities & Movement, In which leg feel muscle cramps, In which muscle feel cramps, Calcium Supplement, Stretching exercise, Transplantation, Injection Erythropoietin.

Tool 2: Cramp questionnaire chart and visual analogous scale.

The cramp questionnaire chart was developed by (Basemath, 2014) It was designed to assess the level of muscle cramps during hemodialysis, before and after intervention. It contains various components of muscle cramps such as the frequency of muscle cramps, duration of muscle cramps, level of pain, temperature and discomfort which was comprehensively scored as level of muscle cramps ranging from (0-13).

Score Interpretation	
0	**No Cramps**
1-4	**Mild Cramps**
5-8	**Moderate Cramps**
9-13	**Severe Cramps**

Tool 3: Fatigue severity scale. (FSS) (Shahid et al., 2011): This tool was used to assess fatigue symptoms. It is a questionnaire containing nine statements that explore the severity of fatigue symptoms. The patient is asked to circle a number from 1 to 7, depending on how appropriate they felt the statement applied to them. As regard fatigue level a low value indicates strongly disagree and a high value indicates strongly agree. Total score was 63.

Total Fatigue severity scale	Scores
Mild fatigue	36 – 44
Moderate fatigue	45 - 53
Sever fatigue	54 -63
Total	**63**

VALIDITY AND RELIABILITY:

Content of tool was validated from total 6 experts in the fields of nursing, dialysis unit and physiotherapy. They reviewed the tool-1 for clarity, relevance and comprehensiveness and then the tools were designed in their final format after discussion will guide. Content validity was measured (SCVI/ Ave.=0.98) for tools 1st section (Demographic variables) and (SCVI/ Ave. = 0.99) for 2nd section (clinical variables).

Tool no 3rd (Cramp questionnaire chart and visual analogous scale) and Tool no 4th (Fatigue severity scale) is a standardized tool. The reliability of the tool was measured by Cronbach's alpha coefficient (r=0.72).

INTERVENTION

Stretching exercise is a form of physical exercise in which the calf, gastrocnemius, soleus, and hamstring muscles are flexed or stretched to improve the muscle's elasticity, muscle tone and reduce the cramps during hemodialysis at a frequency of thrice per session after first hour from starting session. Each session of this exercises program was for 15 minutes. It consisted of

- Ankle dorsiflexion
- Soleus stretching
- Gastrocnemius stretching
- Hamstring stretching

ETHICAL CONSIDERATION

For the present study, the researcher obtained ethical clearance from the ethical committee of University, Gurugram (letter no SGTU/FON/21/2024/196.) date 22.2.24. Written permission was obtained from the medical superintendent of SGT Hospital Gurugram. Both verbal and written consent was obtained from each participant by informing them of the intent of the study before the data collection.

PILOT STUDY

To determine the feasibility and practicality of the study, a pilot study was performed in Deepak dialysis centre at Madalasa hospital Gurugram for 1 week on 10 patients, 5 in experimental and 5 in control group suffering from muscle cramps and fatigue. The study was found to be feasible, and no modification was made after pilot study.

DATA COLLECTION PROCEDURE

Data collection period was in the month of Feb to Mar 2024 in the Dialysis unit at SGT Hospital Gurugram. The formal permission was obtained from the hospital and concerned authority to conduct the study. The investigator personally visited the selected hospital and introduced herself. Good report was established with samples after self -introduction. After taking informed consent, the researcher collected the data from both groups through structured tools in the form of pretest on day first.

Stretching exercises was provided to experimental group for 15 minutes for 3 times during dialysis in each visit in which researcher demonstrated and taught the exercise to the patient for 4 weeks. Patient was asked to perform these exercises 3 times a day and was reminded telephonically to perform these exercises at home. Post test was done using the tools after 2-weeks and 4-weeks interval from control and experimental group.

DATA ANALYSIS:

Both descriptive and inferential statistics was used to analyse data. The data will be collected, arranged and tabulated.

a. Descriptive Statistics.

Frequency and percentage distribution was used to analyse demographic variables and clinical variables.Mean and standard deviation to compare pre-test and post-test scores of muscle cramps and fatigue after administering stretching exercises among the patient's undergoing hemodialysis.

b. Inferential statistics.

- Student t' test was used to compare the pre-test & post-test level of muscle cramps & fatigue in control and experimental group of patients undergoing haemodialysis.
- Repeated measure ANOVA was used to compare the pre-test, post-test I and post-test II level of muscle cramps & fatigue in control and experimental group of patients undergoing haemodialysis.
- Pearson corelation coefficient was used to assess corelation between fatigue and muscle cramp.
- Chi-square test was used to find out the association of muscle cramps & fatigue with selected demographic variables in both experimental and control group of patients undergoing haemodialysis.

Summary:

This study used a quantitative, quasi-experimental non-equivalent control group pre-test post-test design to assess the effect of stretching exercises on muscle cramps and fatigue in patients undergoing hemodialysis at SGT Hospital, Gurugram. The sample included 50 patients, divided equally between an experimental group and a control group. The intervention involved stretching exercises targeting the calf, gastrocnemius, soleus, and hamstring muscles, performed thrice per session for 15 minutes over four weeks. Data were collected using a Cramp Questionnaire Chart, Visual Analogue Scale, and Fatigue Severity Scale, and analysed with both descriptive and inferential statistics. Ethical clearance and informed consent were obtained, and a pilot study confirmed the feasibility of the research.

RESULTS -

Table 1. Level of muscle cramps among control group & experimental of patients undergoing hemodialysis.

n=50

LEVEL OF MUSCLE SCORE						
SCORE LEVEL	PRE-CONTROL	PRE-EXPE-RIMENTAL	POST TEST I CONTROL	POST TEST I EXPERIMENTAL	POST TEST II CONTROL	POST TEST II EXPERIMENTAL
SEVERE CRAMPS (9-13)	4(16%)	12(48%)	4(16%)	0(0%)	4(16%)	0(0%)
MODERATE CRAMPS (5-8)	20(80%)	11(44%)	20(80%)	10(40%)	20(80%)	1(4%)
MILD CRAMPS (1-4)	1(4%)	1(4%)	1(4%)	13(52%)	1(4%)	2(8%)
No CRAMPS (0)	0(0%)	1(4%)	0(0%)	2 (8%)	0(0%)	22(88%)

Maximum=13 Minimum = 0

Table 2. Comparison of the mean fatigue scores of patients undergoing hemodialysis between control group & experimental group.

n=50

FATIGUE SCORE					
Group	PRE-TEST Mean ± SD	POST TEST 1 (After 2 Weeks EXP) Mean ± SD	POST TEST 2 (After 4 Weeks CON) Mean ± SD	F- Value	p-value
CONTROL n1-25	55.92± 3.86	55.92± 3.86	55.92± 3.86	0.000	1.000
EXPERIMENTAL n2-25	56.80± 2.61	48.96± 1.96	34.64± 8.13	123.34	0.000*
Unpaired T T-value	0.944	-8.030	-11.8		
p-value	0.35^{NS}	0.000001*	0.000001*		

* Significant @ P<0.05, ^{NS} Not Significant

Table 2. displays the mean fatigue scores of the control group, which remained unchanged throughout the study, staying steady at 55.92 ± 3.86 from pre-test to post-test 1 and 2. This consistency is supported by an Fvalue of 0.000 and a p-value of 1.000, suggesting there was no notable change. In experimental group ,a significant reduction in mean scores was noticed, decreasing from 56.80 ± 2.61 in pre-test to 48.96 ± 1.96 in post-test 1 and further to 34.64 ± 8.13 in post-test 2. This reduction was statistically significant, with an F-value of 123.34 and a p-value of 0.000. The unpaired t-test also revealed significant differences between the control and experimental groups post-intervention, Control group showed no significant change in muscle cramp scores over time, with mean scores consistently around 7.08 ± 1.6 from pre-test through post-test 2. The lack of change was confirmed by an F-value of 0.000 and a p-value of 1.000. Experimental group experienced a significant reduction in muscle cramps, with mean scores dropping from 7.84 ± 2.5 at pre-test to 4.04 ± 1.6 in post-test 1, and further to 0.48 ± 1.4 in post-test 2. These changes were statistically significant (F-value 92.172, p-value 0.000), highlighting the effectiveness of stretching exercise, with corresponding p-values of 0.000001, indicating the intervention effectively reduced fatigue in the experimental group while the control group saw no change.

DISCUSSION

The research undertaken was "A quasi-experimental study to determine the effectiveness of stretching exercises on muscle cramps & fatigue among the patients undergoing hemodialysis in selected hospital, Gurugram". The study aimed to evaluate the effectiveness of stretching exercises on muscle cramps and fatigue in

patients undergoing hemodialysis. The research involved 50 patients and used a quasi-experimental design. The objectives were to assess the effectiveness of stretching exercises on muscle cramps and fatigue, explore the correlation between these two conditions, and determine any associations with demographic and clinical variables.

In control group most patients had renal failure for 6 to 9 months, with 56% on dialysis for 9 months or more. All experienced fatigue, with 60% reporting muscle cramps during hemodialysis. In experimental group most had been on dialysis for 6 to 9 months. Fatigue was prevalent (100%), with 72% experiencing muscle cramps during hemodialysis. Except for blood transfusion during hemodialysis ($p = 0.004$), all other variables show no statistically significant differences at $p<0.05$, thus the group were homogenous in respect to all their clinical variables except blood transfusion.

Prolonged kidney disease results in a steady decrease in kidney function, frequently requiring hemodialysis (HD) for patients with end-stage renal failure (ESRD). While HD is essential for survival, it comes with its own set of issues such as muscle cramps and fatigue which can greatly affect the patients' daily life. Muscle cramps, affecting between 33% to 86% of HD patients, can interrupt treatment and are often due to imbalances in fluids and electrolytes. Fatigue which occurs in up to 97% of HD patients, worsens their situation. Both medication and non-medication approaches, like stretching exercises, can help manage these symptoms. This study seeks

to assess how effective stretching exercises are in reducing muscle cramps and fatigue in HD patients, with the objective of enhancing treatment results and the patients' general health.

CONCLUSION

The study successfully demonstrated the stretching exercises significantly reduce muscle cramps and fatigue in hemodialysis patients. While the control group showed no improvement, the experimental group exhibited considerable benefits, supporting the hypothesis that stretching exercises are an effective intervention. Future research should focus on validating these results across diverse settings and patient populations.

Stretching exercises are effective in reducing muscle cramps and fatigue in hemodialysis patients. These exercises could enhance the quality of life in these patients or population.

Future Research: Larger and longer-term studies are needed to confirm these findings and explore the long-term effects of stretching exercises.

Broader Implementation: Healthcare facilities should consider implementing stretching exercises as part of standard care for hemodialysis patients, with further training for staff on effective exercise routines.

Multi-: It can be done in multiple locations or environments rather than being limited to a single site. Which can provide a broader understanding of the research question and enhance the generalizability of the findings.

More sample size and randomization can be done (RCT): RCT in which larger sample size of patient's randomization are crucial elements that contribute to the study's reliability, validity, and generalizability.

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