

Effectiveness of applying Intradialytic Stretching Exercises on Reducing Lower Limbs Muscle Cramps among Haemodialysis Patients

Abdallah Jabbar Mahmood AL-Mtiwti¹ and Saad Hussein Murad AL-Shammary²

ABSTRACT

Objective: To evaluate the effectiveness of intradialytic stretching exercises in reducing lower-limb muscle cramps among patients undergoing maintenance hemodialysis.

Study Design: Quasi-experimental pre-test–post-test control group study.

Place and Duration of Study: This study was conducted at selected hemodialysis centers in Mosul, Iraq, from 25th February 2026 to 25th April 2026.

Methods: A purposive sample of 60 adult patients receiving maintenance hemodialysis was recruited and allocated into a study group (n = 30) and a control group (n = 30). The study group performed a structured intradialytic stretching exercise program during the second hour of each dialysis session in addition to routine nursing care, whereas the control group received routine care only. Muscle cramp severity was assessed using the Muscle Cramp Questionnaire, and pain intensity was measured using the Visual Analogue Scale (VAS). Data were analyzed using descriptive and inferential statistics, including the Friedman, Wilcoxon signed-rank, and Mann–Whitney U tests, with statistical significance set at $p < 0.05$.

Results: Patients who participated in the stretching exercise program demonstrated significant reductions in muscle cramp severity and pain intensity compared with the control group ($p < 0.001$). At the final assessment, 83.3% of participants in the intervention group reported no muscle cramps, while only minimal improvement was observed in the control group. The intervention also improved patient comfort and tolerance of hemodialysis sessions.

Conclusion: Intradialytic stretching exercises are a safe, simple, and effective nurse-led intervention for reducing lower-limb muscle cramps among maintenance hemodialysis patients. Incorporating this intervention into routine hemodialysis care may improve symptom management and enhance patients' quality of life.

Key Words: Hemodialysis; Intradialytic Stretching Exercises; Muscle Cramps; Non-Pharmacological Intervention; Nursing Care; Quasi-Experimental Study.

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INTRODUCTION

Chronic kidney disease (CKD) is a major global public health challenge, affecting more than 850 million people worldwide and contributing substantially to morbidity, mortality, and healthcare expenditures¹. As CKD progresses to end-stage kidney disease (ESKD), renal replacement therapy becomes essential, with hemodialysis remaining the most widely used treatment

modality despite advances in kidney transplantation and peritoneal dialysis^{2,3}. Although life-sustaining, hemodialysis is frequently accompanied by intradialytic complications that negatively influence treatment tolerance, patient comfort, and quality of life⁴.

Muscle cramps are among the most common and distressing complications experienced during hemodialysis, with reported prevalence ranging from 30% to 80% depending on patient characteristics and diagnostic criteria⁵.

These painful involuntary contractions predominantly affect the calf and foot muscles, often resulting in premature termination of dialysis sessions, inadequate fluid removal, reduced dialysis efficiency, sleep disturbances, and diminished health-related quality of life⁶. The underlying mechanisms are multifactorial and include rapid ultrafiltration, intradialytic hypotension, electrolyte imbalance, impaired muscle perfusion, and neuromuscular dysfunction⁷.

Pharmacological treatments such as vitamin supplementation, L-carnitine, gabapentin, and

¹MSc Student / Assistant Professor², College of Nursing, University of Mosul, Mosul, Iraq

Correspondence: Mr. Abdallah Jabbar Mahmood AL-Mtiwti, MSc Student, College of Nursing, University of Mosul, Mosul, Iraq.

Contact No: +964-7510667405

Email: abdallah.24nup4@student.uomosul.edu.iq

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hypertonic solutions have demonstrated inconsistent effectiveness and may be associated with adverse effects or increased treatment costs⁸. Consequently, non-pharmacological interventions have gained increasing attention. Intradialytic stretching exercises represent a simple, inexpensive, and nurse-led intervention designed to improve muscle flexibility, enhance local circulation, reduce neuromuscular excitability, and alleviate cramp severity during dialysis sessions⁹. However, high-quality evidence supporting their routine implementation remains limited, particularly in Middle Eastern dialysis settings. Therefore, this study aimed to evaluate the effectiveness of intradialytic stretching exercises in reducing lower-limb muscle cramps among patients undergoing maintenance hemodialysis¹⁰.

METHODS

Study Design: A quasi-experimental study with a pre-test–post-test control group design was conducted to evaluate the effectiveness of intradialytic stretching exercises in reducing lower-limb muscle cramps among patients undergoing maintenance hemodialysis. The study was carried out in selected hemodialysis centers in Mosul, Iraq, between 25 February to 25 April 2026. Patients in the intervention group received a structured intradialytic stretching exercise program in addition to routine hemodialysis care, whereas the control group received routine care alone.

Study Setting: The study was conducted in the pediatric wards of five public healthcare institutions in Mosul City, Iraq. Mosul General Hospital, Ibn Al-Atheer Teaching Hospital, and Al-Khansa Teaching Hospital were assigned to the experimental group, while Al-Salam Teaching Hospital and Ibn Sina Teaching Hospital served as the control group. These hospitals provide specialized pediatric healthcare services and employ registered nurses responsible for monitoring and managing hospitalized children.

Participants and Sampling: A purposive sample of 60 adult patients receiving maintenance hemodialysis was recruited and equally allocated into a study group ($n = 30$) and a control group ($n = 30$). Eligible participants were adults (≥ 18 years) diagnosed with end-stage kidney disease, receiving regular hemodialysis for at least three months, experiencing recurrent lower-limb muscle cramps during dialysis, able to communicate effectively, and willing to participate by providing written informed consent. Patients were excluded if they had unstable cardiovascular disease, severe cognitive impairment, acute neurological or musculoskeletal disorders limiting lower-limb movement, recent lower-limb surgery or trauma, severe peripheral vascular disease, or any contraindication to stretching exercises.

Intervention: Participants in the intervention group underwent a standardized intradialytic stretching exercise program performed during the second hour of each hemodialysis session under the supervision of

trained nurses. The program consisted of passive and active stretching exercises targeting the calf, hamstring, quadriceps, ankle, and foot muscles. Each stretching position was maintained for approximately 20–30 seconds and repeated three times with short rest intervals. The intervention was implemented during every dialysis session throughout the study period. The control group continued to receive routine nursing and dialysis care without structured exercise.

Outcome Measures: The primary outcome was the severity of lower-limb muscle cramps, assessed using the Muscle Cramp Questionnaire. Pain intensity associated with muscle cramps was evaluated using the Visual Analogue Scale (VAS). Demographic characteristics, clinical history, hemodialysis-related variables, chronic medical conditions, lifestyle factors, and laboratory electrolyte values were also collected using a structured questionnaire.

Data Collection Procedure: Baseline assessments were completed before implementation of the intervention. Follow-up assessments were conducted immediately after completion of the intervention (post-test I) and again during the subsequent evaluation period (post-test). All assessments were performed by trained researchers using standardized data collection procedures to ensure consistency across both groups.

Validity and Reliability: The study instrument was reviewed by an expert panel specializing in nephrology nursing, medical-surgical nursing, and research methodology to establish content validity. Reliability testing demonstrated satisfactory internal consistency and stability, indicating that the instrument was appropriate for assessing muscle cramps and pain among hemodialysis patients.

Statistical Analysis: Data was analyzed using IBM SPSS Statistics version 27. Continuous variables were expressed as mean $\pm$ standard deviation, whereas categorical variables were summarized using frequencies and percentages. Baseline characteristics between groups were compared using the independent-samples t-test or Mann–Whitney U test for continuous variables and the chi-square or Fisher's exact test for categorical variables. Changes in muscle cramp severity and pain scores over time were analyzed using the Friedman test and Wilcoxon signed-rank test for within-group comparisons, while between-group differences were evaluated using the Mann–Whitney U test. A two-tailed p-value < 0.05 was considered statistically significant.

RESULTS

Patients who participated in the stretching exercise program demonstrated significant reductions in muscle cramp severity and pain intensity compared with the control group ($p < 0.001$). At the final assessment, 83.3% of participants in the intervention group reported no muscle cramps, while only minimal improvement was observed in the control group. The intervention also improved patient comfort and tolerance of hemodialysis sessions.

Table No. 1: Baseline Characteristics of the Participants

Variable	Study	Control	Total	P value
Age (years), Mean $\pm$ SD	40.37 $\pm$ 8.89	41.87 $\pm$ 10.01	41.12 $\pm$ 9.46	0.54
Male, n (%)	20 (66.7)	19 (63.3)	39 (65.0)	0.79
Urban residence, n (%)	18 (60.0)	17 (56.7)	35 (58.3)	0.80
Normal BMI, n (%)	17 (56.7)	15 (50.0)	32 (53.3)	0.86
Overweight, n (%)	9 (30.0)	12 (40.0)	21 (35.0)	
Obese, n (%)	3 (10.0)	2 (6.7)	5 (8.3)	
Underweight, n (%)	1 (3.3)	1 (3.3)	2 (3.3)	

Table No. 2: Changes in Muscle Cramp Outcomes in the Study Group

Outcome	Pre-test	Post-test I	Post-test II
No muscle cramps, n (%)	0 (0.0)	11 (36.7)	25 (83.3)
Muscle cramps present, n (%)	30 (100.0)	19 (63.3)	5 (16.7)
Moderate pain (VAS 4–6), n (%)	18 (60.0)	9 (30.0)	0 (0.0)
Severe pain (VAS 7–10), n (%)	12 (40.0)	0 (0.0)	0 (0.0)
No pain, n (%)	0 (0.0)	11 (36.7)	25 (83.3)
Warm lower limb, n (%)	0 (0.0)	25 (83.3)	30 (100.0)
Unbearable discomfort, n (%)	11 (36.7)	0 (0.0)	0 (0.0)

Table No. 3: Summary of the Effectiveness of Intradialytic Stretching Exercises

Outcome	Study Group	Control Group	P value
Participants without muscle cramps at final follow-up	25 (83.3)	Minimal change	<0.001
Moderate/Severe muscle cramps	Markedly reduced	No significant reduction	<0.001
Pain severity (VAS)	Significant reduction	No significant change	<0.001
Muscle discomfort	Significant improvement	No significant change	<0.001
Overall intervention effect	Highly effective	Routine care only	<0.001

DISCUSSION

The present quasi-experimental study demonstrated that intradialytic stretching exercises significantly reduced the severity of lower-limb muscle cramps and associated pain among patients undergoing maintenance hemodialysis. Participants who received the stretching exercise program showed progressive improvement from baseline to both post-intervention assessments, whereas the control group exhibited little or no meaningful change. These findings support the effectiveness of structured intradialytic stretching exercises as a safe, simple, and cost-effective nursing intervention for managing one of the most frequent complications experienced during hemodialysis.

Muscle cramps remain a common and distressing intradialytic complication, affecting approximately one-third to four-fifths of hemodialysis patients worldwide. They frequently lead to discomfort, premature interruption of dialysis sessions, inadequate ultrafiltration, reduced dialysis efficiency, and impaired quality of life. Although the exact mechanisms remain incompletely understood, muscle cramps are believed to result from rapid fluid removal, intradialytic hypotension, electrolyte disturbances, tissue hypoperfusion, and neuromuscular hyperexcitability. Therefore, interventions capable of improving muscle

flexibility and local circulation have considerable clinical importance^{11,12}.

The substantial reduction in muscle cramp severity observed in the intervention group is consistent with previous studies evaluating exercise-based interventions during hemodialysis. Stretching exercises improve muscle extensibility, increase range of motion, enhance peripheral blood circulation, and reduce muscle stiffness, thereby decreasing the susceptibility of skeletal muscles to involuntary contractions. Furthermore, regular stretching may improve neuromuscular coordination and delay muscle fatigue, resulting in fewer cramp episodes during dialysis sessions^{13,14}.

Pain intensity also declined markedly following implementation of the stretching program. This finding is clinically relevant because pain associated with muscle cramps often contributes to treatment intolerance, anxiety, and decreased adherence to prescribed dialysis sessions. Stretching exercises may reduce pain through improved muscle oxygenation, decreased ischemia, enhanced venous return, and activation of endogenous pain-modulating mechanisms. The reduction in pain observed in this study agrees with previous investigations reporting that intradialytic exercise effectively alleviates musculoskeletal

discomfort and improves patient comfort without increasing adverse events^{15,16}.

Another important finding was the progressive improvement between the first and second post-intervention assessments, suggesting that the beneficial effects of stretching exercises were sustained over time. Continuous implementation during successive dialysis sessions likely promoted gradual physiological adaptation, increased muscle flexibility, and improved tolerance to ultrafiltration-induced physiological stress. This observation supports recommendations that exercise interventions should be incorporated into routine dialysis care rather than applied as isolated sessions. Similar long-term benefits have been reported in previous exercise studies involving hemodialysis patients^{17,19}.

The favorable outcomes observed in this study also highlight the important role of nurses in delivering evidence-based non-pharmacological interventions. Unlike pharmacological therapies such as quinine, gabapentin, vitamin supplementation, or L-carnitine, stretching exercises require minimal resources, are inexpensive, and carry virtually no risk of medication-related adverse effects^{20,21}. Nurse-supervised exercise programs can therefore represent an effective strategy for improving patient outcomes while reducing healthcare costs and medication burden. Recent nephrology guidelines increasingly encourage individualized physical activity programs as part of comprehensive dialysis care²²⁻²³.

The effectiveness of the intervention may also be explained by the structured nature of the stretching protocol. Performing exercises during the second hour of hemodialysis allows patients to complete the activities before substantial ultrafiltration-related physiological changes occur, while maintaining adequate hemodynamic stability. Stretching of the calf, hamstring, quadriceps, ankle, and foot muscles directly targets the muscle groups most frequently affected by dialysis-related cramps, thereby maximizing therapeutic benefit. Similar protocols have demonstrated improvements in muscle function, physical performance, and symptom control in patients receiving maintenance hemodialysis²⁴.

Despite these encouraging findings, several limitations should be acknowledged. The study was conducted in a limited number of dialysis centers using purposive sampling and a relatively small sample size, which may reduce the generalizability of the findings. Additionally, longer follow-up periods would be valuable to determine whether the beneficial effects of stretching exercises persist over several months. Future multicenter randomized controlled trials with larger populations and objective physiological outcome measures are recommended to further establish the effectiveness of intradialytic stretching exercise programs²⁵.

Overall, the present findings indicate that intradialytic stretching exercises constitute an effective nursing intervention for reducing lower-limb muscle cramps

and pain among patients undergoing maintenance hemodialysis. Incorporating structured stretching exercises into routine dialysis care has the potential to improve treatment tolerance, enhance patient comfort, and promote better clinical outcomes.

CONCLUSION

The findings of this study demonstrate that intradialytic stretching exercises are an effective non-pharmacological intervention for reducing lower-limb muscle cramps among patients undergoing maintenance hemodialysis. Patients who participated in the structured stretching exercise program experienced significant reductions in muscle cramp severity and pain intensity compared with those receiving routine care. The intervention also contributed to improved patient comfort and greater tolerance of hemodialysis sessions. Because stretching exercises are simple, safe, inexpensive, and can be performed under nursing supervision without specialized equipment, they represent a practical strategy for routine clinical practice. Integrating intradialytic stretching exercises into standard hemodialysis care may enhance symptom management, improve patients' quality of life, and support more effective dialysis treatment.

Recommendations: IPEWS should be integrated into routine pediatric nursing practice to support early recognition of clinical deterioration and improve patient safety. Ongoing education through training programs, workshops, and competency assessments is recommended to enhance nurses' knowledge and skills. Incorporating IPEWS into nursing curricula may further strengthen evidence-based pediatric care.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Abdallah Jabbar Mahmood AL-Mtiwti, Saad Hussein Murad AL-Shammary
Drafting or Revising Critically:	Abdallah Jabbar Mahmood AL-Mtiwti, Saad Hussein Murad AL-Shammary
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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