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Muscle Cramps Severity, Features, and Pain Score After Intradialytic Stretching Exercises among Elderly Patients Undergoing Hemodialysis

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Abstract

Background: Muscle cramps are a common intradialytic complication among elderly patients, which can be prevented through the application of intradialytic stretching exercises. Purpose: Determine the effect of intradialytic stretching exercises on muscle cramps among elderly patients on maintenance hemodialysis. Design: A quasi-experimental research design was utilized (one group pre-test/ post-test design). Setting: The study was conducted at hemodialysis unit in Meet Khaqan Health Center. Methodology: Sample: A purposive sample of 50 elderly patients who were registered in dialysis unit's files with end stage renal disease. Instruments: 1) Structured interviewing questionnaire. 2) cramp questionnaire chart and visual analogue scale. Results: The mean age of the studied patients was 65.06 ± 4.96 years old, 60% of them were males and 88% had associated chronic diseases. There was a highly statistical significant difference in the muscle cramps level pre and post implementation of intradialytic stretching exercises ($p < 0.001$**). Conclusion: After practicing of the stretching exercise, a significant reduction in the level of muscle cramps had been observed. Therefore, intradialytic stretching exercises are an effective, simple, and safe procedure that could prevent or reduce the level of muscle cramps among elderly patients undergoing hemodialysis. Recommendation: Intradialytic stretching exercises should be incorporated into routine nursing care for HD patients.

Keywords: Intradialytic stretching exercises, Muscle Cramps Severity, Elderly patients.

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Introduction

The number of older persons is growing faster worldwide and now people are living longer **[1, 2]**. As people age, renal mass declines by ten percent per decade after the age of forty. The number of functional nephrons and renal cortical thickness also decrease, and the renal blood flow decreases along with a decline in the glomerular filtration rate **[3]**. Also, slow impairments of the kidney functions or constant kidney dysfunction is associated with an irreversible loss of kidney cells and nephrons, which in turn can lead to chronic kidney disease (CKD) **[4].**

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CKD is progressively diagnosed among the elderly group **[3]**. As, they had a long-term exposure to cardiovascular risk factors, diabetes mellitus and hypertension which adversely affect their kidneys **[5].** CKD is usually asymptomatic until the development of End Stage Renal Disease (ESRD) **[6].** Which occurs when the GFR falls below 15 mL/min per 173 m^2 and indicates that the kidney is not capable of supporting the life and the patient will require one of the following renal replacement therapies dialysis or kidney transplantation **[7, 5].**

Hemodialysis (HD) is the most used dialysis procedure for ESRD treatment in the world **[6]**, accounting about 89% of all dialysis treatments **[7,8]**. On average, each patient undergoes HD three times a week for three to four hours each session **[9].** The global percentage of patients on HD has increased, and the elderly population had the highest rate of growth **[10]**. HD therapy is associated with various complications such as muscle cramps, hypotension, nausea, fatigue, headaches, and body aches **[11,12 &13]**.

Muscle cramping is a frequent complication encountered by HD patients and are characterized by abrupt, painful and involuntarily contraction of a muscle, especially in the lower extremities **[14, 7]**). They occur suddenly during and in between HD sessions and may last from few seconds to several minutes **[15, 7]**. Cramps commonly affect the calf, feet, toes and thigh muscles **[16].** Most previous reports stated that, muscle cramps occurred in 33% to 86% of patients undergoing HD, usually at the end of the HD session. The causes of this cramps including hypotension caused by removing excess fluid during HD **[17].** Likewise, electrolyte imbalance, hypo-perfusion, carnitine depletion, tissue hypoxia, hyponatremia, hypomagnesaemia, alterations in plasma osmolality and increased serum leptin **[16, 15]**. Sometimes cramps are extremely severe that the patients stop their HD sessions early **[18])**. This problem is exacerbated in the elderly HD patients as both aging and uremic environment result in loss of muscle mass and function which expose these patients to frailty **[19]**.

Recently, numerous studies have indicated the importance of physical exercises to relieve muscles wasting among dialysis patients **[12]**. Intradialytic stretching exercise is one of the most common non-pharmacological treatments used to control muscular cramps **[18]**. It is an exercise training performed during the HD session to increase the patient's muscle strength, elasticity and endurance **[20].** According to the current literature, stretching a muscle can decrease and alleviate muscle cramps, as it reduces muscle protein loss and maintains muscle functions. Also, it reduces the circulation stasis, which promotes solute elimination, blood flow, and the strength of the muscle, as well as improving oxygen diffusion, which promotes aerobic capacity **[21].**

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Since pain relief is the basis of nursing care and muscle cramps are a common discomfort that cause severe pain among HD patients, so it becomes an important role of the nurses who are caring for HD elderly patients to take proper intervention to prevent occurrence of muscle cramps **[9, 15].**

Significance of the study

Muscle cramps are a frequent complication that occurs especially in the calf, feet, toes and thigh muscles **[16]**. Which resulting in pain, discomfort, shortened treatment times, and inadequate dialysis dose and thus less effective treatment **[22, 23].** Therefore, intervening with the muscle cramps and preventing their occurrence is very important **[16]**. Intradialytic stretching exercise is the most effective measure to prevent or decrease muscle cramps among elderly HD patients **[16]**. Stretching the affected muscle can relieve the cramp immediately **[15]** which consequently improves the adequacy of treatment **[7]**.

Purpose of the study:

To determine the effect of intradialytic stretching exercises on muscle cramps among elderly patients on maintenance hemodialysis

Research hypothesis:

There will be a significant reduction in the level of muscle cramps after application of intradialytic stretching exercises among elderly hemodialysis patients than before.

Subjects and Method

***Research Design*:**

A quasi-experimental research design (one group pre-test/ post-test design) was utilized.

Setting:

The study was conducted at hemodialysis unit in Meet Khaqan Health Center affiliated to Shebin El-Kom Fever Hospital, which located in Meet Khaqan village at Shebin El-kom city, Menoufia Governorate, Egypt. This setting was chosen as it was the largest HD center that serves a large number of HD patients, with a high percentage of HD elderly patients.

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Sample:

A purposive sample of 50 elderly patients who were registered in dialysis unit with end stage renal disease and on regular hemodialysis according to the following criteria: -

Inclusion criteria:

- Age 60 years old or more
- Both genders (male & female)
- Undergoing regular hemodialysis
- Patients who are conscious and cooperative.
- Patients who had muscle cramps during hemodialysis

Exclusion criteria:

- Irregular for hemodialysis
- Have femoral catheters .
- Have any lower limb pathology or musculoskeletal impairments.
- Patients undergoing emergency and first hemodialysis.

Data Collection Instruments:

Instrument I: Structured interviewing questionnaire. This instrument developed by the researcher after reviewing the related literature and discussion with dialysis specialists and experts to obtain personal and medical data about elderly patients. It included three parts: -

Part 1: Socio-demographic data of elderly patients: including name, telephone number, age, sex, marital status, level of education, working condition, income, residence, and smoking.

Part 2: Medical history of the patients: including presence of chronic diseases, duration of hemodialysis treatment (years), number of sessions per week, duration of each session (hours), cramp number per week, cramp days, time of intradialytic muscle cramp, site of cramp, muscle involved in cramp, movement restriction, interruption of dialysis session because of cramps, routine cramps treatment, other times of muscle cramp occurrence and effect of cramps on daily living activities.

Part 3: Anthropometric measurements: including height, weight and body mass index (BMI).

Instrument II: Cramp questionnaire chart and visual analogue scale. The instrument was developed by Morris (2014) **[24]** to assess muscle cramps level. It was translated into Arabic by the researcher and reviewed by an English-Arabic language specialist. It was used in the study to assess patients' muscle cramps

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level pre and post exercises application. This scale is composed of five features of muscle cramps: frequency, duration, pain level, leg temperature and discomfort.

Scoring system

The frequency of muscle cramps (score from zero to two), duration of muscle cramps (ranging score from 0 - 2), level of pain (score from 0 - 3), leg temperature (score from 0 - 2) and discomfort (score from 0 - 4). The total score of the scale ranged from 0 to13. Which were categorized as follows: (a 0 score) indicating no muscle cramps, (1 - 4 score) indicating mild muscle cramps, (5 - 8 score) indicating moderate muscle cramps, and (9 - 13 score) indicating severe muscle cramps.

Validity: The instruments were tested for face and content validity by a jury of five experts in the specialties of community health nursing and geriatric nursing faculties.

Reliability: The reliability of the instrument was done by using test-retest reliability method to measure the internal consistency, the result showed that reliability was r = 0,83. Also, the reliability of the instrument II established a high internal consistency with alpha coefficients of 0.93 **[25],** which consequently revealed high reliability. Hence the instrument was considered reliable, and it was used in the study.

Pilot study: A pilot study was performed on ten percent of the total sample (5 patients) to test the feasibility, clarity and applicability of the instruments. No modifications were done, so the pilot study sample wasn't excluded from this study.

Ethical Considerations

- An official letter was taken from the dean of the faculty of nursing and directed to the administrator of the study setting to permit data collection and gain support. It was including the aim of this study and methods of collecting data.
- Verbal informed consent was taken from each participant after they were being told about the procedure, advantages and nature of the study. They were also notified that participation in this study is fully voluntarily. Also they have the right to withdraw from the study at any time. They were assured of close confidentiality of data.

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Data collection procedure

- Data was collected in the period from the beginning of April, 2022 to the end of August, 2022.
- Instruments of data collection and an educational booklet were developed after reviewing the relevant literature including books, magazines, articles, periodicals and websites.
- The researcher introduced herself to the elderly patients and then explaining the purpose and the study nature to gain patients' cooperation. Verbal informed consent had been obtained from each participant.
- Each participant was interviewed individually in the dialysis unit to collect essential data by using the study instruments (pretest). It took about 25-30 minutes.
- After filling the study instruments, the researcher provided her intervention. The researcher started with passive exercises followed by active exercises performed by the patient. Stretching exercises consisted of soleus stretching, gastrocnemius stretching, hamstring stretching, quadriceps stretching and ankle dorsiflexion.
- Each participant received the exercise procedure for about 20 minutes. And at the end of the dialysis session, the patient was asked to re-demonstrate exercises with the help of the researcher for about 10 minutes. Patient safety was maintained during the implementation of the exercises.
- Following the implementation of the exercise program, the patient was given a printed copy of the intradialytic stretching exercises booklet and was instructed to practice this exercise program at least three times a week to improve muscle strength.
- The researcher visited the hemodialysis units for 3 to 4 days a week and implemented the exercise program for 2 to 4 patients daily. And during the data collection period, each patient was observed by the researcher.
- The post-test was taken from each participant one month after starting to practice the stretching exercises by using the study instruments to assess the exercises' effectiveness.

Statistical analysis

Data was entered and analyzed by using SPSS (Statistical Package for Social Science) statistical package version 22. The graphs were done using the Excel program. For qualitative data the number and percentage were calculated and represented in the form of frequency distribution tables. While, the quantitative

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data were represented by range, mean ($\bar{x}$) and standard deviation (SD). Level of significance was judged at P value <0.001 for all significant tests.

Schematic representation of the study

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Results

Table (1) represents socio-demographic characteristics of the studied patients. As shown, the mean age of the studied elderly was 65.06 ± 4.96 (ranged 60- 78 years) and 60% of them were males. Majority of the studied patients (80%) were married and 40% of them had a secondary education. As well, the majority of them (80%) were not work and 84% had enough income. Added to that, more than half of them were rural residents and non-smokers (60%, 62% respectively).

Table (2) clarifies medical data of the studied patients. Majority of the studied patients (88%) had associated diseases, with 84% of them suffered from hypertension and 24% suffered from diabetes mellitus. More than two-fifths (42%) of the participants underwent maintenance HD for more than 4 years and most of them (94%) had a 3 times dialysis session per week for 4 hours (96%). Also, more than two-fifths of the patients (42%) were obese.

Table (3) illustrates the distribution of the studied patients regarding their cramp variables. As represented, 46% of patients experienced muscle cramps twice a week, 70% of them experienced cramps on dialysis days, and most of the studied patients (92%) experienced muscle cramps during the last hour of their HD session. Regarding the site of muscle cramps, 84% of the patients experienced cramps at any of both legs and 98% of them reported cramps in the calf muscle. More than two-thirds of the patients (68%) reported restrictions in movements during HD, and sessions were sometimes interrupted because of the cramps. All of the elderly patients (100%) received medication (saline solution) and had fluid removal stopped temporarily or infused back as a first option of treatment.

Table (4) shows a significant improvement in muscle cramps features after application of intradialytic stretching exercises. As shown, pre-exercises application, the vast majority of the patients' cramps (96%) occurred less than 3 times per hour and lasted for less than 5 minutes. Nearly two-thirds of the elderly patients (64%) reported pain score of 7 to 10, 66% of the patients had cold legs and more than half of them (54%) experienced painful muscle cramps. While after exercises application, these percentages were reduced with more than half of the patients (56%) reported no cramps, which indicating a highly statistically significant differences between the pre and post-test.

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Table (5) reports that, there was a statistically significance difference in the level of muscle cramps throughout the two periods of measurements. As represented, there was a highly significant difference between the pre- and post-total mean score of muscle cramps. This reflects the effectiveness of intradialytic stretching exercises, and these findings provide support to the current research hypothesis.

Table (6) demonstrates the differences in cramp variables pre and post intervention. As shown, more than three quarters (70%) of the elderly patients experienced muscle cramps on dialysis days, most of them (92%) reported cramps during the last hour of the session, 84% of the patients experienced muscle cramps in two legs and 98% of them in the calf muscle. These percentages reduced to 42%, 44%, 20% and 38% respectively with more than half of them had no cramps during the posttest, indicating a highly statistically significant differences between the pre and post-test in relation selected cramp variables ($p < 0.001$**).

Fig.1 displays that, the mean pain score was 2.64 ± 0.49 during the pretest, which significantly reduced to 0.46 ± 0.54 after one month of practicing intradialytic stretching exercises.

Fig.2 shows the differences in muscle cramps severity pre and post implementation of intradialytic stretching exercises. As shown, in the pre-test, 70% of the patients had severe cramps and 30% of them had moderate cramps. While in the post-test, more than half of them (56%) had no cramps, 38% had mild cramps and only 6% of the patients experienced moderate muscle cramps.

Fig.3 illustrates that the studied patients who regularly performed intradialytic stretching exercises had the highest percentage of no and mild cramp occurrence during the posttest (52%, 30% respectively).

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Table (1): Distribution of socio-demographic characteristics of the studied patients (n=50)

Socio-demographic Characteristics	No.	%
Age (years)		
Min. – Max.	60.0 – 78.0	
Mean ± SD.	65.06 ± 4.96	
Gender		
Male	30	60.0
Female	20	40.0
Marital status		
Single	1	2.0
Married	40	80.0
Divorced	2	4.0
Widow	7	14.0
Education		
Illiterate	7	14.0
Primary education	10	20.0
Secondary education	20	40.0
High education	13	26.0
Working condition		
Still work	10	20.0
Not work	40	80.0
Income		
More enough	2	4.0
Enough	42	84.0
Not enough	6	12.0
Residence		
Rural	30	60.0
Urban	20	40.0
Smoking		
Yes	8	16.0
No	31	62.0
Past smoker	11	22.0

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Table (2): Distribution of the studied patients according to their medical data (n= 50)

Medical data	No.	%
Associated diseases*		
No	6	12.0
Yes	44	88.0
Hypertension	42	84.0
Diabetes Mellitus	12	24.0
Cardiovascular diseases	1	2.0
Polycystic kidney	4	8.0
Other diseases	5	10.0
Duration of Hemodialysis treatment (years)		
<1 year	3	6.0
1-2 years	13	26.0
>2- 4 years	13	26.0
> 4 years	21	42.0
Min. – Max.	1.0 – 10.0	
Mean ± SD.	4.04 ± 2.38	
Number of hemodialysis sessions per week		
Two	3	6.0
Three	47	94.0
Duration of session (hours)		
3 hours	2	4.0
4 hours	48	96.0
Body mass index (BMI)		
Under weight **(< 18.5)**	0	0.0
Normal l **(18.5-24.9)**	16	32.0
Overweight **(25-29.9)**	13	26.0
Obese **(≥ 30)**	21	42.0

***: Some patients choose more than one choice.**

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Table (3): Distribution of cramp variables among the studied patients (n= 50)

Cramp variables	No.	%
Cramp number per week		
Two	23	46.0
Three	16	32.0
Four	7	14.0
Five and more	4	8.0
Days of frequent muscle cramps occurrence		
Dialysis days	35	70.0
Non-dialysis days	0	0.0
All days	15	30.0
Time of intradialytic muscle cramps		
First hour	0	0.0
Middle hours	4	8.0
Last hour	46	92.0
Site of muscle cramps		
Right leg	6	12.0
Left leg	2	4.0
Any of two legs	42	84.0
Muscle involved in cramp*		
Calf	49	98.0
Thigh	4	8.0
Toes	18	36.0
Muscle cramps restrictions to movements during hemodialysis		
Yes	34	68.0
No	16	32.0
Interruption of dialysis sessions because of the cramps		
Yes	34	68.0
No	16	32.0
Treatment that is usually being done for dialysis cramps*		
Massage the extremities	11	22.0
Stop fluid removal temporarily/Infuse fluid back	50	100.0
Stop dialysis session prematurely	2	4.0
Taking medication	50	100.0

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Table (4): Muscle cramps features pre and post implementation of intradialytic stretching exercises among the studied patients (n=50)

No.	Feature of muscle cramps	Scores	Pre-exercise		Post-exercise		P.value
			N	%	N	%	
I	**Frequency of cramps**						
1	Does not occur	0	0	0.0	28	56.0	
2	Cramps occur less than 3 times /hour	1	48	96.0	22	44.0	
3	Cramps occur more than 3 times /hour	2	2	4.0	0	0.0	
	Mean ± SD.		1.04 ± 0.19		0.44 ± 0.50		P= < 0.001**
II	**Duration of the cramps**						
1	Cramps does not occur	0	0	0.0	28	56.0	
2	Cramps lasts for less than 5 minutes	1	42	84.0	22	44.0	
3	Cramps lasts for more than 5 minutes	2	8	16.0	0	0.0	
	Mean ± SD.		1.16 ± 0.37		0.44 ± 0.50		P= < 0.001**
III	**Level of pain (VAS)**						
1	No pain	0	0	0.0	28	56.0	
2	Mild pain 1-3	1	0	0.0	21	42.0	
3	Moderate pain 4-6	2	18	36.0	1	2.0	
4	Severe pain 7-10	3	32	64.0	0	0.0	
	Mean ± SD.		2.64 ± 0.49		0.46 ± 0.54		P= < 0.001**
IV	**Leg temperature**						
1	Warm	0	6	12.0	49	98.0	
2	Cold	1	33	66.0	1	2.0	
3	Cold /clammy	2	11	22.0	0	0.0	
	Mean ± SD.		1.10 ± 0.58		0.02 ± 0.14		P= < 0.001**
V	**Discomfort**						
1	No cramps	0	0	0.0	28	56.0	
2	Perceptible	1	0	0.0	19	38.0	
3	Sensitive	2	0	0.0	3	6.0	
4	Painful	3	27	54.0	0	0.0	
5	Unbearable	4	23	46.0	0	0.0	
	Mean ± SD.		3.46 ± 0.50		0.50 ± 0.61		P= < 0.001**

Wilcoxon Signed Ranks Test
****: Statistically significant at p ≤ 0.001**

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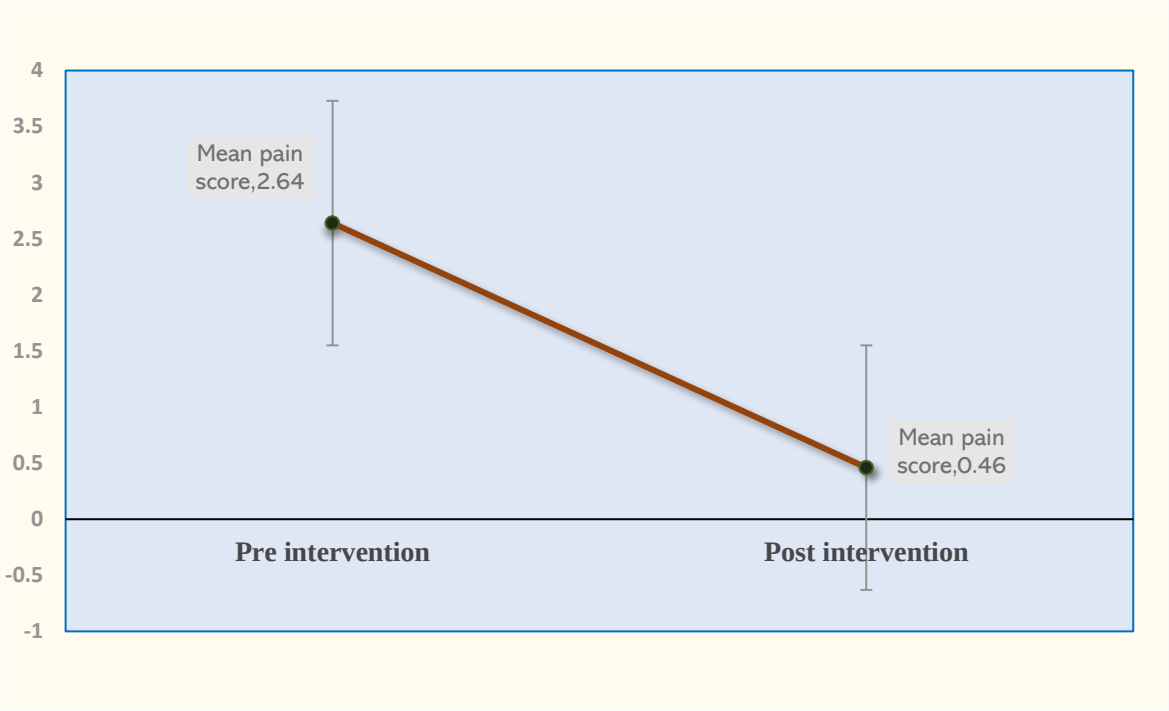

Figure (1): Mean pain score of muscle cramp pain during pre and post intervention (n=50)

Table (5): Differences in muscle cramp categories pre and post implementation of intradialytic stretching exercises among the studied

Scoring System	Pre-intervention		Post-intervention (1 month)		P.value
	No.	%	No.	%	
No cramps (0)	0	0.0	28	56.0	
Mild cramps (1-4)	0	0.0	19	38.0	
Moderate cramps (5-8)	15	30.0	3	6.0	
Severe cramps (9-13)	35	70.0	0	0.0	
Total score (Mean ± SD.)	9.40 ± 1.47		1.88 ± 2.20		**P < 0.001****

patients (n=50)

Wilcoxon Signed Ranks Test
****: Statistically significant at p ≤ 0.001**

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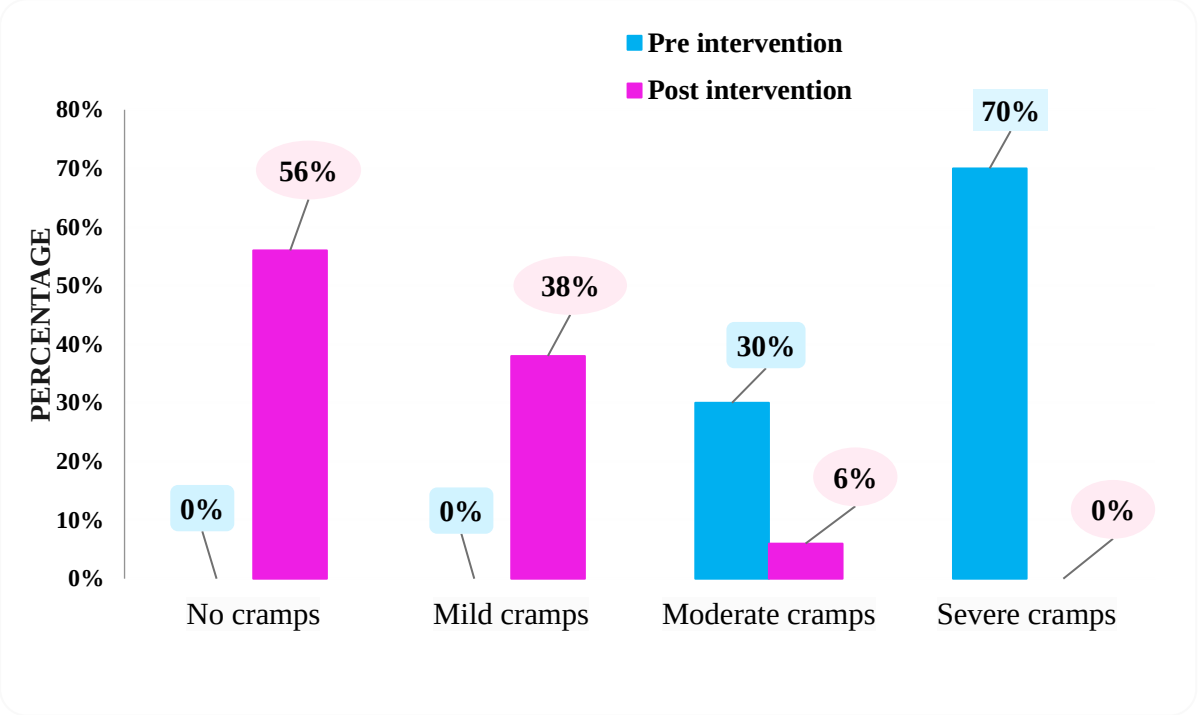

Figure (2): Effect of intradialytic stretching exercises on the level of muscle cramps among the studied patients (n=50)

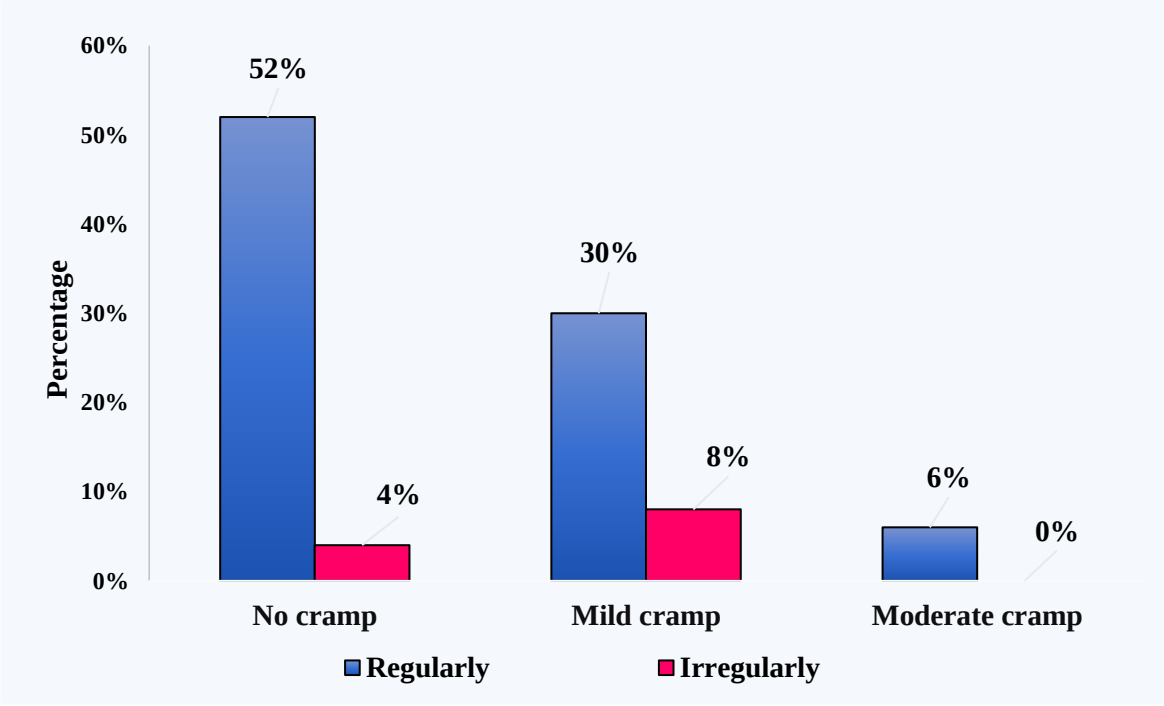

Figure (3): Relation between regularity of intradialytic stretching exercises performance and level of muscle cramps among the studied patients during the post-test (n=50)

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Table (6): Differences in selected cramp variables pre and post implementation of intradialytic stretching exercises among the studied patients (n=50)

Muscle cramp variables	Pre-intervention		Post-intervention		Sig.
	No.	%	No.	%	
Days of frequent muscle cramps occurrence					
None	0	0.0	28	56.0	P < 0.001**
Dialysis days	35	70.0	21	42.0	
Non-dialysis days	0	0.0	0	0.0	
Both days	15	30.0	1	2.0	
Time of intradialytic muscle cramps					
None	0	0.0	28	56.0	P < 0.001**
First hour	0	0.0	0	0.0	
Middle hours	4	8.0	0	0.0	
Last hour	46	92.0	22	44.0	
Site of muscle cramp					
None	0	0.0	28	56.0	P < 0.001**
Right leg	6	12.0	11	22.0	
Left leg	2	4.0	1	2.0	
Any of two legs	42	84.0	10	20.0	
Muscle involved in cramp					
None	0	0.0	28	56.0	P < 0.001**
calf	49	98.0	19	38.0	
Thigh	4	8.0	0	0.0	
Toes	18	36.0	5	10.0	

Independent sample t Test
One-way ANOVA
**: Statistically significant at p ≤ 0.001

Discussion

End-stage renal disease is a widespread health problem and its prevalence rising with age **[26].** Hemodialysis is the most widely used treatment methods for ESRD Patients **[27, 7].** It is a continual process where patients face various problems **[28]**. One of the most prevalent complication is muscle cramps which frequently lead to the early termination of the HD session **[15].** This can be avoided by application of preventive measures such as stretching exercises **[29].** Consequently, this study was conducted to determine the effect of intradialytic stretching exercises on muscle cramps among elderly hemodialysis patients.

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The findings of the current study revealed that, majority of the studied patients suffered from hypertension. This finding came in agreement with **[30],** they stated that the most common disease among the studied patients was hypertension. Also, **[26]** in their study reported that hypertension was the main cause of ESRD. On the contrary, **[31]** found that more than two-fifths of the patients had diabetes mellitus. This could be explained by the fact that the primary contributing factor to ESRD was hypertension and diabetes.

Regarding duration of hemodialysis treatment, the current study reported that more than two-fifths of the elderly patients underwent HD treatment for more than four years. This finding agreed with **[14]** who reported that around three quarters of the studied patients underwent HD treatment for more than four years. While, this study finding was inconsistent with **[32]** who found that more than two-fifths of patients were on HD treatment for less than five years.

Regarding duration of hemodialysis treatment, the present study results revealed that more than two-fifths of the elderly patients underwent HD treatment for more than four years, with a mean duration of 4.04 years. This finding congruent with **[26]** who stated that the mean duration of HD treatment of the studied patients was 4.80 years. While, this study finding was inconsistent with **[32]** they stated that more than two-fifths of patients were on HD treatment for less than five years. This result might be due to advances in health services and technology that help elderly HD patients to receive dialysis treatment for longer years than before.

Regarding number of HD sessions per week, the existing study demonstrated that most of the participants had three times dialysis sessions per week. This result was congruent with **[32, 31].** Both of the studies revealed that the vast majority of the studied patients underwent three HD sessions per week. On the other hand, this result was incongruent with **[33]** who found that the majority of patients were receiving two dialysis sessions per week. This could be explained by the fact that the number of sessions is determined according to the medical condition of each patient.

Considering duration of HD session, the recent study revealed that most of the studied patients receiving HD session for four hours. In the same line, **[30]** in their study reported that all the studied patients were receiving hemodialysis sessions for four hours. This result was incongruent with a study carried out by **[31]** they mentioned that more than half of the patients receiving HD session for three hours. This could be interpreted by that the duration of HD session follows the place policy, patient condition and intradialytic weight gain. Also, increasing the length of HD sessions led to better clearance of body waste.

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Regarding body weight, the current study finding found that more than two-fifths of the patients were obese. This result was in contradiction with **[7]** who reported that two-fifths of the participants had normal body weight. This might be related to different dietary habits, behaviors and culture of the studied patients.

Concerning number of muscle cramps per week, the recent study findings showed that nearly half of patients suffered from muscle cramps twice a week. This finding was matching with **[7]** they stated that more than half of the participants experienced muscle cramps twice weekly. This might be explained by the fact that muscle cramps are more prevalent and frequent side effect among HD elderly participants.

Regarding days of muscle cramps occurrence, the present study findings illustrated that about three quarters of patients experienced cramps on dialysis days. This finding was endorsed by **[34]** who indicated that more than fifty percent of patients experienced muscle cramps on dialysis days only. This might be related to that in dialysis days' patients exposed to removal of body fluid, being unable to move during the session and fatigue associated with these days.

Regarding time of intradialytic muscle cramps, the present study clarified that most of the studied patients reported cramps at the last hour of HD session. This result was consistent with **[28]** they mentioned that most of participants suffered from cramps during the last hour of the HD session. Moreover, similar results reported by **[35]** they reported that most of the subjects had muscle cramps at the end of HD session. This consistency might be related to over intradialytic fluid gain which led to rapid elimination of excess body fluid during the session, resulting in electrolyte disturbances and hypotension which in turn causes muscle cramps. This is directly proportional to the length of the session.

Relating to site of muscle cramps, the current study represented that most participants experienced muscle cramps at any of two legs and in the calf muscle. This present study results were reinforced by **[30]** who stated that majority of the subjects reported muscle cramps in two legs and in the calf muscle. On the other hand, the present study result was in contrast with **[15]** they indicated that half of patients reported muscle cramps in the right leg. This might be due to weak blood vessels and poor blood supply to lower extremities that especially associated with aging, chronicity of the disease and due to fluid shifts during the session.

Regarding restriction of movement during HD session as a result of muscle cramps, the present study reported that greater than two-thirds of the patients reported movement restrictions because of muscle cramps. This finding came in agreement with **[36]** as the results indicated that majority of the participants reported movement restrictions during the HD session because of cramps. This

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consistency might be as a result of severe pain from muscle cramps. Also, cramps made muscles appear distorted and twisted, which made it temporarily impossible to use the affected muscle.

Considering the interruption of the session because of the cramps, the recent study represented that more than two-thirds of the patients said that HD sessions sometimes being interrupted because of the cramps. This result was in a same line with **[34]** they found that more than three quarters of participants reported session interruption because of the cramps. In addition, the result of the present study was supported by **[37]**. The study implied that muscle cramps led to termination of HD session before the appointed time. This study finding could be due to un-affordable muscle cramp pain experienced by patients which result in stopping fluid removal and sometimes stopping the session before the scheduled time.

Concerning the hospital routine of muscle cramp treatment, the present study findings revealed that all the participants received medication (saline solution) and had fluid removal stopped temporarily or infused back as a first treatment option. This present study result was congruent with **[34]** they stated that dialysis cramps were usually treated by decreasing fluid removal and reinfusing fluid back. Furthermore, the current study finding came in agreement with **[38]** who mentioned that majority of patients' cramp were controlled with administration of medication. This consistency could be illustrated by administration of medication, decrease fluid removal and infuse fluid back assisted to improve the body fluid volume and enhance circulation which all helped to control muscle cramps.

In relation to muscle cramps frequency, the present study results showed that most of subjects reported that intradialytic muscle cramps occurred less than three times per hour, while after application of stretching exercises there was a significant decline in the frequency of cramp, and above half of patients experienced no cramps occurrence. This result came in agreement with **[28]** they explained that majority of patient's cramps occurred less than three times per hour, while after practicing exercises about half of patients reported no cramps. Also, this result was matching with **[14]** who observed that more than fifty percent of patients did not develop muscle cramps after implementation of stretching exercise. In addition, this result was supported by **[30]** they reported that there was significant difference in muscle cramps' frequency before and after intervention. Moreover, these finding was consistent with **[38]** who found that exercises made a notable reduction in muscle cramps' frequency between their patients.

Regarding duration of muscle cramps, the current study findings represented a significant reduction in cramps duration during post-test. Majority

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of patients' cramps duration lasted for less than five minutes' pre-exercises, while post exercises application more than half of them had no cramps. This result was concurrent with **[39]** where the study results indicated that stretching exercises were found to be effective in reducing the duration of muscle cramps among the study participants. Also, similar results were reported by **[28, 30],** both studies revealed that, there was a highly significant difference in cramp duration pre and post intervention.

Concerning muscle pain level, the present study findings showed that after performing the exercises, the level of pain was significantly reduced, nearly two-thirds of patients reported sever pain before exercises application, while after practicing the exercises more than half of them had no pain. This result was consistent with **[30]**. They illustrated that more than half of the patients in the study experienced severe pain prior to intervention, but more than half of them experienced no pain following intervention, and these differences were statistically significant. Also, this finding was supported by **[21]**. The finding showed that intradialytic stretching exercises reduced the muscle pain by easing muscle stiffness and increasing blood flow. In addition, **[12]** in their study reported that severity of leg cramps pain had been reduced after practicing the exercises. Moreover, similar results were reported by **[16]**. The study finding revealed that after application of intradialytic stretching exercises there was a significant reduction in pain level among the studied patients.

Regarding leg temperature, the present study findings demonstrated that there was a statistically significant difference in leg temperature between the study subjects' pre- and post-exercise performance. Two-thirds of the studied patients had cold legs prior implementation of the exercises, while post exercises most of them had warm legs. This result was in agreement with **[28]** they found that majority of patients' legs were cold before intradialytic stretching exercises, while after exercises application more than three quarters of patients' legs were warm. Also, this study result was supported by **[14]** who stated that there was a significant improvement in patients' leg temperature and most of them had warm leg after implementation of intradialytic stretching exercises. This result might be due to exercise during dialysis increasing blood flow to the muscles, which in turn improves leg temperature.

Regarding discomfort, the existing study findings revealed that there was a substantial improvement in patients' discomfort after implementation of exercise program. Above half of subjects suffered painful cramps and nearly half of them had unbearable muscle cramps pre-exercises, while after practicing exercises more than half of patients had no cramps. This result was in a line with **[14]** who reported that nearly half of patients experienced unbearable muscle cramps prior exercises application, but after exercises performance nearly two-

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thirds of patients reported no discomfort. Also, this study finding was concurrent with **[16]** who found that study participants felt more comfortable after performing exercises.

Regarding overall muscle cramps level, the present study indicated that more than two-thirds of patients had severe muscle cramps pre-exercises, while post exercise more than half of them had no cramps. Thus, these results reflect effectiveness of intradialytic stretching exercises on reducing muscle cramp level and these findings provide support to the current research hypothesis. So, the research hypothesis was accepted. This study result was in the same line with **[15]** who in their study illustrated that the stretching exercises was an effective measure which could be used as a preventive way in the muscle cramps treatment and to reduce the level of muscle cramps among HD patients. Moreover, **[40]** added that intradialytic stretching exercise was highly effective in eliminating leg cramps. Furthermore, the present study result came in agreement with **[33]** who proven the effect of stretching exercises on lessening of muscle cramps during HD. Similarly, this study result was supported by **[12]** they found that intradialytic stretching exercises was one of the most common important exercises to ease leg cramps during HD. This consistency is due to the effect of intradialytic stretching exercises on reducing muscle cramps by improving muscle strength and flexibility, as well as increasing blood flow and enhancing circulation.

Regarding the relation between regularity of practicing these exercises and the level of muscle cramps, the present study results clarified that the studied patients who regularly practice the exercises had the highest percentage of no and mild cramps occurrence during the post-test. This study result was supported by **[15]** they reported that regular practice of the stretching exercises led to reduction in the level of muscle cramps. Also, **[14]** found that regular performance of these exercises during HD limit and prevent occurrence of muscle cramps. This consistency could be attributed to the fact that constancy in exercises performance led to better and rapid improvement of muscle strength as well as reduction in muscle cramp severity and pain.

Conclusion

After application of an intradialytic stretching exercise program during the current study, a significant reduction in the muscle cramps level had been observed. Therefore, intradialytic stretching exercises were an effective, simple, and safe for preventing or reducing the severity of muscle cramps in elderly HD patients.

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Recommendation

- Intradialytic stretching exercises should be incorporated into routine nursing care for HD patients.
- Dialysis nurses should be trained to implement intradialytic stretching exercises during HD to help reduce severity of muscle cramp.
- Also, the current study can be replicated for elderly HD patients with a larger sample size from different geographical areas for good generalization.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

Permission was obtained from the Research Ethical Committee (REC) in the Faculty of Nursing, Menoufia University, Egypt (approval reference 824) on 16/3/2022.

Participants were notified that participation in the current research study was voluntary and that they might stop at any time without experiencing any adverse effects. The collected data was kept private and anonymous, and the respondents

Consent for publication

All authors fulfil the criteria for authorship and have read and approved the final version of this manuscript.

Authors' contributions

- **Magda M. Mohsen;** searched the databases, sharing the design of the study, writing original draft, drafted the manuscript, supervised whole research and editing the manuscript.

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- **Tawheda M. El-Saidy;** Created the study's concept and designed the present study, analyze the data and interpretation of data and validation of results, prepared the tables.
- **Amira E. Elsedawy;** sharing the study's concept and designed the present study, writing, review & performed the interviews, coordinated the data collection for the study.
- **Hanady S. Shehata:** Writing review, wrote the methodology, coordinated the data collection for the study, sharing in writing original draft of the manuscript,
- Authors read and approved the final manuscript**.**

Declaration of Competing Interest

The authors declare that they have no competing interests.

References

1. World Health Organization. (2020). Decade of healthy ageing: baseline report.
2. Gu, D., Andreev, K., & Dupre, M. E. (2021). Major trends in population growth around the world. *China CDC weekly*, *3*(28), 604.
3. Chou, Y. H., & Chen, Y. M. (2021). Aging and renal disease: old questions for new challenges. *Aging and disease*, *12*(2), 515.
4. Kellum, J. A., Romagnani, P., Ashuntantang, G., Ronco, C., Zarbock, A., & Anders, H. J. (2021). Acute kidney injury. *Nature reviews Disease primers*, *7*(1), 1-17.
5. Vaidya SR, Aeddula NR. Chronic Renal Failure. [Updated 2022 Aug 10]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan- Available from: https://www.ncbi.nlm.nih.gov/books/NBK535404/
6. Gerogianni, G., & Babatsikou, F. (2019). Chronic Kidney Disease and hemodialysis: Epidemiological characteristics and psychological disorders. *Perioperative Nursing-Quarterly scientific, online official journal of GORNA*, *8*(2 April-June 2019), 111-117.
7. Shraida, A. A., Abd-Ali, D. K., & Mohammad, H. Q. (2021). Effectiveness of Intradialytic Stretching Exercises on Prevention and Reduction of Leg Muscle Cramps among Patients undergoing Hemodialysis: Randomized Controlled Trial. *Indian Journal of Forensic Medicine & Toxicology*, *15*(3), 5133.
8. Bello, A. K., Okpechi, I. G., Osman, M. A., Cho, Y., Htay, H., Jha, V., Wainstein, M., & Johnson, D. W. (2022). Epidemiology of haemodialysis outcomes. *Nature Reviews Nephrology*, *18*(6), 378–395.
9. Poornazari, M., Roshanzadeh, M., Mohammadi, S., Tajabadi, A., Dehghani, K., & Parsa, S. (2019). Effect of Isotonic Exercise on the Frequency of Muscle Cramps in Hemodialysis Patients: A Clinical Trial. *Medical-Surgical Nursing Journal*, *8*(1).
10. Chou, A., Li, K. C., & Brown, M. A. (2022). Survival of Older Patients with Advanced CKD Managed Without Dialysis: A Narrative Review. *Kidney medicine*, 100447.
11. Gite ST. (2020). A study to assess the effect of selected nursing interventions on leg cramps for patients undergoing hemodialysis in selected hospitals. *Int J Health Sci Res*., 10(7):70-74.

Print ISSN 2636-3224
Online ISSN 2636-3232

12. Jancy, P. O., & Parimala, S. (2020). Assess the Effect of Intradialytic Stretching Exercises to Reduce Leg Muscle Cramps among Patients Undergoing Hemodialysis in Selected Dialysis Unit of Ernakulum District. *International Journal of Nephrology and Kidney Failure*, 6(3), 1–6.
13. Paul, G., & Das, K. (2022). Effect of The Intradialytic Stretching Exercises on Muscle Cramps Among Patients Undergoing Hemodialysis in A Selected Hospital, Kolkata, West Bengal. *Int J Recent Sci Res*. 13(09), pp. 2326-2332.
14. Lekha, J. (2016). Effectiveness of intradialytic stretching exercises on prevention and reduction of muscle cramps among patients undergoing Haemodialysis at PSG Hospitals, Coimbatore (Doctoral dissertation, PSG College of Nursing, Coimbatore).
15. Anbu, K., & Rathiga, A. (2021). Effectiveness of Intradialytic Stretching Exercises on Muscle Cramps among Patients Undergoing Haemodialysis in a Selected Tertiary Care Hospital Kancheepuram District, Tamil Nadu, India.
16. Bagchi, I. (2020). Effectiveness of Intradialytic Stretching Exercise on Pain due to Muscle Cramps among Patients Undergoing Haemodialysis at a Selected Tertiary Care Hospital Bhubaneswar, Odisha. *Nursing Journal of India*, *111*(2), 85-90.
17. Takahashi A. (2021). The pathophysiology of leg cramping during dialysis and the use of carnitine in its treatment. *Physiological reports*, *9*(21), e15114.
18. Dhudum, B., & Bhore, N. R. (2020). Intradialytic Stretching Exercises on Muscle Cramps: A Systematic Review. *Journal of Critical Reviews*, *7*(15), 4390-8
19. Chan, K. N., Chen, Y., Lit, Y., Massaband, P., Kiratli, J., Rabkin, R., & Myers, J. N. (2019). A randomized controlled trial of exercise to prevent muscle mass and functional loss in elderly hemodialysis patients: Rationale, study design, and baseline sample. *Contemporary clinical trials communications*, *15*, 100365.
20. Salhab, N., Karavetian, M., Kooman, J., Fiaccadori, E., & El Khoury, C. F. (2019). Effects of intradialytic aerobic exercise on hemodialysis patients: a systematic review and meta-analysis. *Journal of nephrology*, *32*(4), 549-566.
21. Wayan, D. (2021). Benefits of Intradialytic Exercise to Increase Muscle Strength, Prevent Muscle Mass Loss on Chronic Renal Failure Patients on Hemodialysis. *Jurnal keperawatan cikini, 2(1).*
22. Varghese, A., Lacson, E., Sontrop, J. M., Acedillo, R. R., Al-Jaishi, A. A., Anderson, S., Bagga, A., Bain, K. L., Bennett, L. L., Bohm, C., Brown, P. A., Chan, C. T., Cote, B., Dev, V., Field, B., Harris, C., Kalatharan, S., Kiaii, M., Molnar, A. O., … Garg, A. X. (2020). A Higher Concentration of Dialysate Magnesium to Reduce the Frequency of Muscle Cramps: A Narrative Review. *Canadian Journal of Kidney Health and Disease*, *7*.
23. Chowdhury, R., & Sharma, Y. (2022). Muscles Cramp and Sleep Disturbances Among Hemodialysis Patients. *Journal of Pharmaceutical Negative Results*, 2958-2962
24. Morris, B. (2014). Effect of intradialytic stretching exercise on muscle cramps among patients undergoing Hemodialysis. *Tamil Nadu Nurses and Midwives Council Journal of Medical and Surgical Nursing*, *2*, 8-11.
25. Vimala, A. (2018). Effectiveness of Intradialytic Stretching Exercises on Reduction of Muscle Cramps among patients undergoing Haemodialysis at Sundaram Hospital, Trichy (Doctoral dissertation, Indira College of Nursing, Tiruchirappalli).
26. El-Ballat, M. A. F., El-Sayed, M. A., & Emam, H. K. (2019). Epidemiology of end stage renal disease patients on regular hemodialysis in El-Beheira governorate, Egypt. *The Egyptian Journal of Hospital Medicine*, *76*(3), 3618-3625.
27. Lee, H. J., & Son, Y. J. (2021). Prevalence and associated factors of frailty and mortality in patients with end-stage renal disease undergoing hemodialysis: A systematic review and

Print ISSN 2636-3224
Online ISSN 2636-3232

meta-analysis. *International Journal of Environmental Research and Public Health*, *18*(7), 3471.
28. Albadry, A., Azer, S., Abd Elhamed, N., & Mostafa, N. (2020). Effect of Intradialytic Hemodialysis Exercises on Fatigue and Leg cramps. *Assiut Scientific Nursing Journal*, *8*(20), 131–140.
29. Jayasrikannan, M., Kanniammal, C., & Sheebjebakani, M. (2021). A Study to Assess the Effectiveness of Intradialytic Stretching Exercises on Muscle Cramps and Quality of Life in Patients Undergoing Hemodialysis at SRM General Hospital, Kattankulathur. *RGUHS Journal of Nursing Sciences*, *1*(1).
30. Ghaleb, M. A., & Sharaf, A. Y. (2020). The Effects of Nursing Interventions on Intradialytic Muscle Cramps among Patients Undergoing Maintenance Hemodialysis. *Int J Sci Res*, 8-21.
31. Abouelala, F. M., abdelftah Mohamed, N., & Khalil, N. H. K. (2021). Effect of Passive and Active Stretching Exercises on Controlling Leg Cramps for Patients undergoing Hemodialysis. *Egyptian Journal of Health Care*, *12*(1), 1549-1562.
32. Elsayed, E. B. M., Radwan, E. H. M., Elashri, N. I. E. A., & El-Gilany, A. H. (2019). The effect of Benson's relaxation technique on anxiety, depression and sleep quality of elderly patients undergoing hemodialysis. *International journal of nursing didactics*, *9*(02), 23-31.
33. Laxmipriya, D., & Raddi, SA (2020). Intradialytic Stretching Exercise for Muscle Cramps. *IJRAR-International Journal of Research and Analytical Reviews (IJRAR), E-ISSN*, 2348-1269.
34. Punj, S., Enaam, A., Marquez, A., Atkinson Jr, A. J., & Batlle, D. (2020). A Survey on Dialysis-Related Muscle Cramping and a Hypothesis of Angiotensin II on Its Pathophysiology. *Kidney International Reports*, *5*(6), 924.
35. Chavda, A., & Singh, S. (2018). Intradialytic stretching exercise: a conservative way to reduce muscle cramps. *Int J Nur Med Inv*, *3*(2), 35-8.
36. Mathew, T. (2018). A study to assess the effectiveness of intradialytic muscle stretching exercises on the level of pain during muscle cramps among patients undergoing hemodialysis in a selected hospital at Kerala (Doctoral dissertation, Annai Meenakshi College of Nursing, Coimbatore)
37. Moledina, D., & Wilson, F. (2015). Pharmacologic treatment of common symptoms in dialysis patients: a narrative review. *In Seminars in dialysis* (Vol. 28, No. 4, pp. 377-383).
38. Panchiri, M., Joshi, S. G., & Dumbre, D. (2017). Reduction of Muscle Cramps among Patients Undergoing Hemodialysis: The Effectiveness of Intradialytic Stretching Exercises. *International Journal of Nursing Education*, *9*(4), 64.
39. Divia Acha, J. (2016). A study to assess the effectiveness of intradialytic stretching exercise on muscle cramps among patients undergoing hemodialysis in selected hospital at Coimbatore (Doctoral dissertation, Sree Abirami College of Nursing, Coimbatore).
40. Vati, J. (2021). Effectiveness of Intradialytic Leg Stretching Exercises to Reduce Muscle Cramps among Patients Undergoing Hemodialysis. *Journal on Nursing*, *11*(4).

Print ISSN 2636-3224
Online ISSN 2636-3232