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Effect of Implementing Intradialytic Stretching Exercise on Reducing Muscle Cramps for Improving Quality of Life among Hemodialysis Patients

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Abstract: **Background**: Chronic kidney disease has a great impact on health-related quality of life from initial stage of disease to its end stage due to effect of symptoms, restrictions and its treatment on daily life of these patients. Active and passive stretching exercises had a positive effect on reducing the intensity of muscle cramps among HD patients. **The purpose of the study** was to determine the effect of intradialytic stretching exercise on reducing muscle cramps for improving the QOL among hemodialysis patients. **Design:** A quasi-experimental design (pretest/posttest) was utilized. **Setting**: The study was conducted at hemodialysis unit in two different settings, which located in Tanta city, Gharbia Governorate, Egypt. **Sample**: A convenience sample of 80 patients who were registered in dialysis unit's files in Tanta Fever hospital and hemodialysis unit of Almunshawi Hospital. **Instruments** I: Structured interviewing questionnaire: that used to obtain personal and medical data about heamodialysis patients. II: Cramp questionnaire chart and visual analogue scale: It was used to assess patients' level of muscle cramps before and after application of intrdialytic stretching exercieses. III: Arabic Version of the Kidney Disease Quality of Life Short-Form. It was composed of 36 items. Results demonstrated post intervention in third month, revealed a highly significant improvement ($p<0.0001$) in the Physical QoL. The studied hemodialysis patients who suffered low physical QoL, was increased from zero % in pre intervention to 71.3% in third month post intervention and the difference was highly significant ($P<0.0001$). In addition, regarding mental QoL, of the studied hemodialysis patients who gained decrease in their negative mental responses, was increased from zero% in pre intervention to 100% in third month post intervention and the difference was highly significant ($P<0.0001$). **Conclusions**: Implementation of intradialytic stretching exercises for three months leading that the studied patients' mean total physical component subscale scores, total mental component subscale scores, burden of kidney diseases subscale and effects of kidney disease on daily life post three months' intervention were significantly increased compared to pre intervention. **Recommendation**: Intradialytic stretching exercises should be combined with routine nursing care for hemodialysis patients.

***Keywords**: Hemodialysis patients, intradialytic Stretching Exercise, Quality of Life.*

Introduction

The development of kidney Chronic disease (CKD) and its progression to terminal stage remains a significant source for reducing quality of life (QOL) and premature mortality. Once patients have been diagnosed with End-stage renal disease (ESRD), most of them will require dialysis or renal transplant. ESRD increases morbidity, mortality, adds additional costs to healthcare system and there is no cure from ESRD. Thus, the key to improve long-term outcomes is in preventing progression of this disease (Bikbov et al., 2018).

The worldwide incidence of chronic kidney illness is 34% in patients with diabetes mellitus, 29% in patients with hypertension, 14% in patients with glomerulonephritis, 1% in patients with drug induced nephropathy 1%, and in 7% of the patient's cause is not known. (Jayasrikannan et al., 2021).

The reported prevalence of ESRD in the Middle East where 5% of worldwide population live ranges between 52 pmp in Iraq and 818 pmp in Lebanon with the mean prevalence of 430 pmp in the whole Middle East (Beaumont et al., 2016). While in Egypt, the estimated annual incidence of ESRD is 74 pmp and the total prevalence of patients on dialysis is 264 pmp (Hassaballa et al., 2022). Also, other cross-sectional study was conducted in Menoufia showed that an Egyptian Governorate with 2.2 million populations and the prevalence of ESRD was 330 pmp (Abd et al., 2017).

Hemodialysis (HD) is a serum treatment that involves the use of a dialysis machine and a specific filter referred as an artificial kidney or dialyzer. Throughout the treatment, patients may encounter problems such as hypotension, muscle cramps, disequilibrium disorder, and vomiting. Hypotension, infection, muscle spasms, skin irritation, and other complications might occur because of hemodialysis (Kanbay et al., 2020).

Muscle cramps are one of the most common and frequent intradialytic complications (Khedhiri et al., 2022). They are a painful experience described by HD patients as rapid throbbing and spontaneous tightening of the muscle (Jayasrikannan et al., 2021). Patients on HD have prioritized muscle cramps as 1 of the top 3 physical symptoms during dialysis (Flythe et al., 2018). They occur in 33% to 78% of patients undergoing dialysis (Xu et al., 2022). Also, a study conducted by (Laxmipriya and Raddi, 2020).

Muscle cramps commonly occur on HD days, near the end of the dialysis session, and may persist for some time after dialysis (Chowdhury & Sharma, 2022). They usually last for a few minutes for most patients. Cramps developed essentially in the leg muscles (Divia Acha, 2016; Khedhiri et al., 2022). The most

affected leg muscles are the gastrocnemius (the calf muscles), the hamstrings (the muscles behind the thighs), the quadriceps (the muscles in front of the thighs) and toes (Lekha, 2016; Shraida et al., 2021). Everyone undergoing HD is susceptible to have leg muscle cramps, about 80% of the HD patients will experience leg cramping during or after HD session (Jancy & Parimala, 2020), regardless of their gender (Bordoni et al., 2018).

There are many pharmacological and non-pharmacological measures adopted to treat muscle cramps (Paul & Das, 2022). Most of patients complain of muscle cramps during dialysis routinely treated with normal saline and 25% dextrose in a hospital setting (Jayasrikannan et al., 2021). Administration of carnitine, but this is not effective in every patient (Takahashi, 2021).

The most used non-pharmacological therapy is stretching exercises. Stretching is effective in relieving leg muscle cramps during HD session (Isaac & Jacob, 2016). Intradialytic stretching exercise is a simple and efficient technique for reducing and preventing muscle cramps among patients undergoing HD (Shraida et al., 2021). It is a form of physical exercise in which a specific muscle or tendon (or muscle group) is deliberately flexed or stretched to improve the muscle's felt elasticity and achieve comfortable muscle tone. The result is a feeling of increased muscle control, flexibility and range of motion. Thus, it is used therapeutically to decrease cramps (Mathew, 2018).

A study carried out by Abouelala et al (2021) showed that active and passive stretching exercises had a positive effect on reducing the intensity of muscle cramps among HD patients and they were safe and inexpensive procedure. Even more, Jayasrikannan et al (2021) in their study observed that, the intradialytic exercises were highly effective in reducing muscle cramps and improving the quality of life among HD patients. Also, they encouraged incorporation of exercises into clinical practice.

Quality of life (QOL) is a multidisciplinary concept used to describe a set of variables including physical, psychological, social, and functional dimensions. According to World Health organization (WHO), Quality of life (QOL) is defined as individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns (World Health organization, 2020).

CKD has a great impact on health related QoL from initial stage of disease to its end stage due to effect of symptoms, restrictions and its treatment on daily life of these patients. Also, HD Patients have different physiological experiences as fatigue, limited physical activity, low blood pressure, muscle spasm, nausea and vomiting, limitations in

doing normal activities and interruption of everyday life. These problems affect the different aspects of QoL (Al-Rajhi& Al Salmi, 2020).

According to a study conducted in hemodialysis unit by Dembowska et al (2022) who assess the quality of life of hemodialysis patients in comparison with healthy subjects concluded that lower values of assessed quality-of-life parameters in hemodialysis patients compared to the control group, especially in the somatic domain; general diseases such as oral mycosis, osteoporosis, rheumatoid arthritis, and coronary-artery disease negatively impact perceived quality of life; numerous indications for the implementation of comprehensive psychological care of hemodialysis patients due to their poor psychosocial condition.

Nursing HD patients is a challenging process as it requires nurses' careful judgement in the situations where complex problems can occur. They are projected to provide patient centered care in a highly technical environment, which has a significant impact on improving patients' outcomes. Nurses should be skillful in HD techniques, including managing the procedure, maintaining vascular access, preventing infections, and administering treatment, along with possessing a general knowledge about kidney diseases (Shahdadi & Rahnama, 2018; Lee and Kim, 2022).

Purpose of the study:

To determine the effect of intradialytic stretching exercise on reducing muscle cramps for improving the QOL among hemodialysis patients.

Research hypotheses:

1) Muscle cramp will be reduced after intradialytic stretching exercises than before among patients undergoing hemodialysis.

2) Quality of life will be improved after intradialytic stretching exercises intervention than before among patients undergoing hemodialysis.

Methods

Design:

A quasi-experimental design (one group pretest/posttest design) was utilized.

Setting:

The study was conducted at hemodialysis unit in two different settings (the hemodialysis units of Tanta Fever hospital and hemodialysis unit of Almunshawi Hospital), which located in Tanta city, Gharbia Governorate, Egypt.

Study Sample:

A convenience sample of 80 patients who were registered in dialysis unit's files in Tanta Fever hospital and hemodialysis unit of Almunshawi Hospital with end stage renal disease and on regular hemodialysis.

Inclusion Criteria

- Both males and females.
- The Patients with chronic kidney disease and undergoing heamdialysis.
- Patients who had muscle cramps during hemodialysis.
- Patients who are alert and cooperative.

Exclusion Criteria

- Patients with any lower limb disability.
- Patients undergoing peritoneal dialysis.

Data collection instruments

Instrument one: Structured interviewing questionnaire:

This instrument was developed by the researcher after reviewing the related literature. It was used to obtain personal and medical data about heamodialysis patients. It included three parts:

- **Part 1**: Socio-demographic data of studied sample: including name, telephone number, age, sex, marital status, level of education, working condition, income, residence, and smoking
- **Part 2**: Medical history of patients: including presence of chronic diseases, duration of hemodialysis treatment (years), side effect of heamodialysis.

The reliability of the first instrument was estimated among 10 hemodialysis patients by using test-retest method with two weeks apart between them. Then Cronbach alpha was calculated between the two scores using SPSS computer package. It was 0.89 which indicates that the instrument is reliable to detect the objectives of the study.

Instrument two: Cramp questionnaire chart and visual analogue scale:

The instrument was developed by Basemath (2014) to assess the level of muscle cramps. 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' level of muscle cramps before and after application of intrdialytic stretching exercieses.This scale is composed of five features of muscle cramps: frequency, duration, level of pain, leg temperature and discomfort.

Scoring system

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

The reliability of the second instrument was estimated among 10 hemodialysis patients by using

test-retest method with two weeks apart between them. Then Cronbach alpha was calculated between the two scores using SPSS computer package. It was 0.79 which indicates that the instrument is reliable to detect the objectives of the study.

Instrument three: Arabic Version of the Kidney Disease Quality of Life Short-Form (KDQOLSF)

The instrment was developed by Sarra, et al (2019) and was adapted by the researcher. It was composed of 36 items. It was classified in to five subscales. First part: physical component subscale (PCS) : it included (items 1–6). Second part: mental component subscale (MCS): it includes (items 7–12). The third part: burden of kidney disease subscale, it included (items 13–16). The fourth part: symptoms and problem list subscale: it included (items 17–28). The fifth part: the effect of kidney disease subscale, it included (items 29–36). Likered points were different in different subscale. This instrument is valid and reliabe.

Scoring system

Grand total scores ranged from (0 - 131). Higher score reflects high QOL.

The reliability of the third instrument was estimated among 10 hemodialysis patients by using test-retest method with two weeks apart between them. Then Cronbach alpha was calculated between the two scores using SPSS computer package. It was 0.81 which indicates that the instrument is reliable to detect the objectives of the study.

Validity of the instruments:

The data collection instruments which were translated by the researcher and translated by English-Arabic language specialist. Then the instruments were tested for face and content validity by a jury of five experts in the specialties of Family and Community Health Nursing of Nursing Menoufia University. Who assessed the instruments and recommend some modifications that were taken into consideration. For example arrangement of some of questions about knowledge of diet and lab investigatins.

Pilot study:

A pilot study was carried out on 10% of the total sample (8 patients) to test the clarity, feasibility and applicability of the instruments.

Ethical Considerations:

An approval sheet was obtained from the Ethical Research Committee of the Faculty of Nursing, Menoufia University.

- An official letter will be obtained from the Dean of Faculty of Nursing Menoufia University directed to director of kidney dialysis unit at Tanta fever and Almunshawi Hospital to get their agreement, permission and support to conduct the study,to permit data collection and gain support. It was including the

purpose of the study and methods of data collection.

- Oral and written informed consent will be obtained from each participant of the study. The subjects who agreed to participate in the study will be assured about confidentiality and anonymity of the study. They will be informed about their right to withdraw from the study at any time without giving a reason. The purpose of the study will be clarified for the participants by the researcher and any needed clarifications will be done.

Data collection procedure:

- Period of Study: Data was collected in the period from the beginning of August, 2023 to the end of December, 2023.
- An official letter was obtained from Dean Faculty of Nursing Menoufia University directed to director of kidney dialysis unit at Tanta fever and Almunshawi Hospital to get their agreement, permission and support to conduct the study.
- Instruments of data collection and an educational booklet were developed after reviewing the relevant literature including books, magazines, articles, periodicals and websites. Also, the instruments were tested for validity and reliability.
- The researcher introduced herself to the patients and then explained the purpose and nature of the study to gain patients' cooperation.
- Oral and written informed consent had been obtained from each patient matched with the inclusion criteria, and they were assured of close confidentiality of data.
- Each patient was interviewed individually in the dialysis unit to collect essential data by using the study instruments (pretest). It took about 25-30 minutes.
- The researcher applied the stretching exercise intervention which included two type (acive and passive stretching exercises).
- Active stretching is a method of improving flexibility. It involves active contracting of one muscle (the agonist) as a way to stretch an opposing muscle (the antagonist), with no external force.
- Active stretching which means nonmoving because the end position of the stretch is held for a set amount of time , instead of holding stretch using a prop, such as a strap or band, simply holding the stretch with other muscles. This is why it's called static active stretching.
- One example of active stretching is lying on the back on the floor and lifting a straight leg to the ceiling until feel hamstring stretch.
- Passive stretching relies on the assistance of a prop, accessory, or partner to increase the stretch, which means that not actively contributing to increasing the range of motion.
- Passive stretches enhance flexibility while preventing the

muscle fatigue and soreness that often follow a workout. Use them to cool down after you exercise. Passive stretches are useful when recovering from an injury or cannot stretch on your own.

- The researcher conducted the intervention. Firstly, by explaining the definition and causes of muscle cramps as well as the purpose, benefits, and steps of passive and active stretching exercises using educational booklet. Then before starting the stretching exercises, the researcher informed the patient to take slow, deep breathing and exhale slowly during exercises and to stop exercises if they had any muscle or joint pain.
- The researcher started with passive exercises followed by active exercises performed by the patient. Stretching exercises consisted of ankle dorsiflexion, soleus stretching, gastrocnemius stretching, hamstring stretching, and quadriceps stretching.
- The exercises were provided on individual basis by demonstration and re-demonstration.
- The implemented intradialytic stretching exercise was conducted through twelve sessions for three months, the duration of each session was around 20 minutes, it was done at the second hour of heamodialysis session.
- Patient safety was maintained during the implementation of the exercises.
- Following the implementation of the exercise procedure, the patient was given a printed copy of the intradialytic stretching exercises booklet and was instructed to practice these exercises at least three times a week to improve muscle strength.
- The session was ended with a summary of its content and feedback from the patient.
- The researcher visited the hemodialysis units for 5 to 6 days a week and implemented the exercise procedure for 2 to 4 patients daily. And during the data collection period, each patient was observed by the researcher.
- Monthly post intradialytic stretching exercise intervention was conducted for three months for measuring the effect of intradialytic stretching exercises on muscle cramp of heamodialysis patients.
- At the end of the interventions, post test will be conducted for quality of life.
- Telephone number of the researcher was b given to the participants in the study to communicate and ask questions about their care at any time.

Statistical Analysis: -

Data was entered and analyzed by using SPSS (Statistical Package for Social Science) statistical package version 22. Graphics were done using Excel program

Quantitative data were presented by mean (X) and standard deviation (SD). It was analyzed using student t- test for comparison between two

means, and ANOVA (F) test for comparison between more than two means.

Qualitative data were presented in the form of frequency distribution tables, number and percentage. It was analyzed by chi-square ($\chi 2$) test. However, if an expected value of any cell in the table was less than 5, Fisher Exact test was used (if the table was 4 cells), or Likelihood Ratio (LR) test (if the table was more than 4 cells). Level of significance was set as P value

Results

Table 1 shown, 36.3% of the studied hemodialysis patients were in age ≥ 60 years with a mean age of 63.9 ± 5.1 years, with a range of 30 -68 years. Majority 86.3% were males, 87.6% married, 52.5% had basic education, and 90% were not working. All participants claimed that their monthly income is not enough. Most of them lived in rural areas 93.7%, and 73.8% of them were smoker.

Table 2 demonstrated 88.8% of studied hemodialysis patients suffered from hypertension, while 11.2% of them suffered from diabetes Mellitus, and all of them are taking corresponding medications. Regarding Patients' history with beginning of hemodialysis, 88.8% of them began hemodialysis since more than or equal to four years, while 3.8% of them started first time hemodialysis treatment since less than one year. All patients exposed to hemodialysis session three times per week, and all of them reported that duration of hemodialysis in a single session is four hours.

Table 3 shows that regarding frequency of cramp, all studied patients reported that cramps occurred more than three times per hour pre intervention while 75% of them reported that cramp did not occur post third month intervention. Regarding to duration of the cramps, all studied patients reported that cramps lasted for more than 5 minutes pre intervention while 60% of them reported that cramp did not occur post third month intervention. In addition to there was a highly significant differences between pre intervention, post one month, post two month and post three months regarding to level of pain (VAS), temperature of the leg and discomfort where ($p<0.0001$). Also, there were a high significant decrease in studied patients' mean total score of cramp questionnaire from 11.9±0.24 pre intervention to 7.4 ±0.57 post one month, to 5.2 ±0.74 post two month and to 1.2±0.23 post three months intervention where ($p<0.0001$). The findings of this table provide support to the first research hypothesis.

Table 4 demonstrates that regarding to quality-of-life physical component subscale (PCS), in pre intervention, 91.3% of studied patients pre intervention considered their health poor and only 8.8% of them considered their health to be fair, while in post three months intervention; 56.3% of them

considered their health very good. Also, in pre intervention, most studied patients (91.3%) considered their health limited a lot daily moderate activities, while in post three months intervention, 57.5% of them considered their health limited a little daily moderate activity. Moreover, in pre intervention, all studied patients facing a problem in work interfere of accomplishment work less than would like, while in post three months intervention, all of them did not face a problem in work interfere of accomplishment work less than would like. In addition to, the studied patients' mean total hemodialysis patients' physical component score of quality of life (12.0 ± 0.76) post three months intervention were significantly increased compared to the studied patients' mean total hemodialysis patients' physical component score of quality of life (2.0 ± 0.0) pre-intervention where ($p<0.0001$).

Table 5 illustrates that regarding quality-of-life mental component subscale (MCS), in pre intervention, all studied patients faced a problem at work due to emotional problem, while in post three months intervention, all of them did not face a problem at work due to emotional problem. Also, in pre intervention all studied patients felt a little of time calm, peaceful, downhearted and blue while 71.3% of them post three months intervention felt a bit of time calm, peaceful, downhearted and blue. Moreover, in pre intervention, all studied patients had a little of time physical health or emotional problems interfered with social activities, while in post three months intervention ,71.3% of them had a bit of time physical health or emotional problems interfered with social activities. In addition to, the studied patients' mean total hemodialysis patients' mental component score of quality of life (16.01 ± 1.42) post three months intervention were significantly increased compared to the studied patients' mean total hemodialysis patients' physical component score of quality of life (4.0 ± 0.0) pre-intervention where ($p<0.0001$).

Table 6 shows that all studied patients had low quality of life pre-intervention regarding physical subscale, while 71.2% of them had high quality of life post three months intervention regarding physical subscale. Also, all studied patients had low quality of life pre intervention regarding to mental, burden of kidney diseases and effect of kidney disease quality of life subscales, while all of them had high quality of life post three months regarding to mental, burden of kidney diseases and effect of kidney disease quality of life subscales. Moreover, all studied patients had low quality of life pre-intervention regarding grand total quality of life, while all of them had high quality of life post three months regarding to grand total quality of life. In addition to the studied patients' mean grand total

QoL in three months (104.3± 3.5) post intervention was significantly increased compared to the studied patients 'mean grand total QoL (33.0± 0.0) pre-intervention where (p<0.0001). The findings of this table provide support to the third research hypothesis.

Table 7 shows the studied patients' mean total physical component subscale scores, total mental component subscale scores, burden of kidney diseases subscale and effects of kidney disease on daily life (12.0 ± 0.76), (16.01± 1.42), (52.6± 4.2). (23.7± 1.04) post three months intervention respectively were significantly increased compared to the studied patients' mean total physical component subscale scores, total mental component subscale scores, burden of kidney diseases subscale and effects of kidney disease on daily life (2.0± 0.0), (4.0± 0.0), (17.0± 0.0), (10.0 ± 0.0) pre-intervention respectively where (p<0.0001). In addition to the studied patients' mean grand total quality of life in three months (104.3± 3.5) post intervention was significantly increased compared to the studied patients' mean grand total quality of life (33.0± 0.0) pre-intervention where (p<0.0001).

Table 8 demonstrates that there was significant association between muscle cramps and physical component quality of life post three months intervention where (P=0.95).

Table 1: Sociodemographic characteristics of the studied patients (N = 80)

Socio demographic characteristics	N0.	%
Age (Years):		
30 – <40 years	8	10
40 – <50 years	25	31.3
50 – <60 years	18	22.4
60 – 70 years	29	36.3
Mean ± SD	**63.8±5.1years (range: 30 – 68 Y)**	
Educational Level:		
Illiterate/Read & Write	12	15
Secondary Edu., or technical diploma	42	52.5
University	26	32.5
Gender:		
Male	69	86.3
Female	11	13.7
Marital status:		
Married	70	87.6
Divorced	5	6.2
Widow	5	6.2
Residence:		
Rural	75	93.7
Urban	5	6.3
Occupation:		
Work	8	10
Not work	72	90

Income:		
Enough	0	0
Not enough	80	100
Smoke:		
No	17	21.2
Yes	59	73.8
Previous smoker	4	5
Total	**80**	**100**

Table 2: Medical history among the studied hemodialysis patients (N=80).

Patients' Medical History:			**N**		**%**	
Suffering from a chronic disease			80		100	
Hypertension			71		88.8	
Diabetes Mellitus			9		11.2	
Taking medication			80		100	
Hypertension medication			71		88.8%	
Diabetes mellitus medication			9		11.2%	
Patient' medical history with beginning of hemodialysis sessions:						
First time of starting dialysis treatment: < 1 year			3		3.8	
1 - < 2 years.			2		2.4	
2 - < 4 years			4		5	
≥ 4 years			71		88.8	
Number of hemodialysis sessions per week: Three/ Weeks			80		100	
Duration of hemodialysis in a single session: 4 hours			80		100	
Side effects during Hemodialysis	**No**		**Sometimes**		**Yes**	
	N0.	**%**	**N0.**	**%**	**N0.**	**%**
Suffer from loss of appetite	0	0	77	96.2	3	3.8
Suffer from nausea and vomiting	77	96.2	0	0	3	3.8
Suffer from gastric pain	0	0	79	98.7	1	1.3
Suffer from constipation	0	0	77	96.2	3	3.8
Suffer from hypotension	80	100	0	0	0	0
Suffer from fatigue	0	0	0	0	80	100
Suffer from diarrhea	80	100	0	0	0	0
Suffer from itching	78	97.5	0	0	2	2.5
Suffer from swallowing problems	79	98.7	0	0	1	1.7

Table 3: The effect of intradialytic stretching exercise on reducing the frequency and severity of muscle cramps among the studied hemodialysis patients (N=80)

S.NO	Feature of muscle cramps	Scores	Pre intervention		Post 1st month		Post 2nd month		Post 3rd month		*Fried. test	P value
			N	%	N	%	N	%	N	%		
I	**Frequency of cramps**											
1	Does not occur	0	0	0	0	0	1	1.3	60	75	**= 460**	**<0.0001 HS**
2	Cramps occur less than 3 times /hour	1	0	0	67	83.8	79	98.7	20	25		
3	Cramps occur more than 3 times /hour	2	80	100	13	16.2	0	0	0	0		
II	**Duration of the cramps**											
1	Cramps does not occur	0	0	0	0	0	1	1.3	48	60	**= 474.3**	**<0.0001 HS**
2	Cramps lasts for less than 5 minutes	1	0	0	80	100	79	98.7	32	40		
3	Cramps lasts for more than 5 minutes	2	80	100	0	0	0	0	0	0		
III	**Level of pain (VAS)**											
1	No pain	0	0	0	0	0	1	1.3	68	85	**=668.5**	**<0.0001 HS**
2	Pain 1-3	1	0	0	0	0	60	75	12	15		
3	Pain 4-6	2	5	6.3	73	91.3	19	23.7	0	0		
4	Pain 7-10	3	75	93.7	7	8.8	0	0	0	0		
IV	**Temperature - Leg**											
1	Warm	0	0	0	0	0	1	1.3	80	100	**= 606.6**	**<0.0001 HS**
2	Cold	1	0	0	75	93.8	79	98.7	0	0		
3	Cold /clammy	2	80	100	5	6.2	0	0	0	0		
V	**Discomfort**											
1	No cramps	0	0	0	0	0	1	1.3	54	67.5	**= 772.5**	**<0.0001 HS**
2	Perceptible	1	0	0	0	0	79	98.7	26	32.5		
3	Sensitive	2	0	0	77	96.3	0	0	0	0		
4	Painful	3	80	100	3	3.7	0	0	0	0		
5	Unbearable	4	0	0	0	0	0	0	0	0		
	Total		80	100	80	100	80	100	80	100		
	Mean ± SD total cramp Questionnaire	10	11.9±**0.24** (11 – 12)		**7.4 ±0.57** (7 – 9)		**5.2 ±0.74** (0 – 7)		1.2±**0.23** (0 – 3)		F=310.8	<0.0001 HS

Fried. test = Friedman ANOVA test which is the nonparametric counterpart to the analysis of variance with repeated measures , **F** = Analysis of variances test , **LR** = Likelihood test, **HS** =High Significant

Table [4]: Distribution of the studied patients according to their quality-of-life Physical component subscale pre and post intervention (N=80).

Hemodialysis patients' Physical component of QoL	Pre Intervention		Post intervention		P value
	N	%	N	%	
In general, your health is:					
Poor	73	91.3	0	0	
Fair	7	8.8	0	0	LR= 221.8
V. good	0	0	45	56.3	, p<0.0001
Excellent	0	0	35	43.7	
Now the health limit daily moderate activities					LR =135.7
Yes, limited a lot	73	91.3	0	0	
Yes, limited a little	7	8.7	46	57.5	, p<0.0001
No, not limited at all	0	0	34	42.5	
Climbing several stairs leads to performing activities less than you would like.					LR=85.0
Yes	3	3.8	34	42.5	, p<0.0001
No	77	96.2	46	57.5	
In last 4 weeks had a problem at work, due to physical health					Fisher exact test: p<0.0001
Yes	80	100	0	0	
No	0	0	80	100	
The work problem interferes with accomplishment work less than you would like.					Fisher exact test: p<0.0001
Yes	80	100	0	0	
No	0	0	80	100	
In the last 4 weeks pain limited normal work.					
Yes, limited a lot	80	100	0	0	LR= 221.8
Yes, limited a little	0	0	80	100	p<0.0001
No, not limited at all	0	0	0	0	
Mean total Hemodialysis patients' regarding QoL (Physical component score)	2.0 ± 0.0 (11-13)		12.0 ± 0.76 (3-19)		t= 117.2, p<0.0001 HS

NS= not significant HS= High significant. t= Paired t test. χ^2= Chi Square test

Table [5]: Distribution of the studied patients according to their quality-of-life mental component subscale pre and post intervention (N=80).

Hemodialysis Patients' Mental Component subscale of QoL	Pre Intervention		Post intervention		P value
	N	%	N	%	
During last 4 weeks: problems facing patient at work due to emotional problems					
An accomplished work less than patient would like					χ^2= 160
Yes	80	100	0	0	, p<0.0001
No	0	0	80	100	
Patient didn't perform work in efficient way					χ^2= 160
Yes	80	100	0	0	, p<0.0001
No	0	0	80	100	
Patients' feeling during last 4 weeks:					
Patient felt calm and peaceful					χ^2= 160.0
A little of time	80	100	0	0	, p<0.0001
Bit of time	0	0	11	13.8	
Most of time	0	0	69	86.2	
Patient has a lot of angry					LR= 160.0
A little of time	80	100	0	0	p<0.0001
Bit of time	0	0	57	71.3	
Most of time	0	0	23	28.7	
Patient felt downhearted and blue					LR= 160.0
A little of time	80	100	0	0	p<0.0001
Bit of time	0	0	57	71.3	
Most of time	0	0	23	28.7	
During last 4 weeks, did physical health or emotional problems interfered with patients' social activities					LR= 160.0
A little of time	80	100	0	0	p<0.0001
Bit of time	0	0	57	71.3	
Most of time	0	0	23	28.7	
Mean total Hemodialysis patients' regarding QoL (Mental component score)	**4.0 ± 0.0 (14 – 18)**		**16.01 ± 1.42 (15 – 18)**		**t= 75.7, p<0.0001 HS**

NS= not significant **HS**= High significant. **t**= Paired t test. χ^2= Chi Square test

Table 6: Descriptive statistics of the studied hemodialysis patients according to their four quality of life total subscales scores, as well as Grand total quality of life **(N=80)**

Groups	Intervention	N	Mean ± SD	Range	t paired test	P value
Total physical component subscale scores	Pre	80	2.0 ± 0.0	2 – 2	t = 117.2	<0.0001 HS
	Post three months	80	12.0 ± 0.76	11 - 19		
Total mental component subscale scores	Pre	80	4.0 ± 0.0	4 – 4	t = 75.7	<0.0001 HS
	Post three months	80	16.01 ± 1.42	14 - 18		
Burden of Kid. Diseases subscale	Pre	80	17.0 ± 0.0	17 - 17	t = 74.9	<0.0001 HS
	Post three months	80	52.6 ± 4.2	47 - 59		
Effects of kid. Dis. On daily life.	Pre	80	10.0 ± 0.0	10 - 10	t = 117.2	<0.0001 HS
	Post three months	80	23.7 ± 1.04	12 - 32		
Grand total QoL	Pre	80	33.0 ± 0.0	33 - 33	t = 179.0	<0.0001 HS
	Post three months	80	104.3 ± 3.5	0 - 131		

t = Paired t test HS= High significant

Table [7]: The effect of intradialytic stretching exercise on improving total quality of life levels about physical, mental, kidney diseases burden, and effect of kidney diseases on daily life of patients, as well as grand total quality of life levels among studied hemodialysis patients pre and post three months interventions **(N=80).**

Total Quality of Life Subscales	Pre intervention						Post intervention3months.						Test of sig. X^2/ LR	P value
	Low QoL		Moderate QoL		High QoL		Low QoL		Moderate QoL		High QoL			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
Physical	80	100	0	0	0	0	0	0	23	28.8	57	71.2	X^2=160.0	<0.0001 HS
Mental	80	100	0	0	0	0	0	0	0	0	80	100	X^2=160	<0.0001 HS
Burden of kidney diseases	80	100	0	0	0	0	0	0	0	0	80	100	X^2=160	<0.0001 HS
Effect of kid. Dis.	80	100	0	0	0	0	0	0	0	0	80	100	X^2=160	<0.0001 HS
Grand total QoL	80	100	0	0	0	0	0	0	0	0	80	100	X^2=160	<0.0001 HS
X± SD Grand total QoL	33.0 ± 0.0 (range: 33 -33)						104.3 ± 3.5 (range: 0 - 131)						t= 64.2	<0.0001

X^2= Chi Square test. **LR** = Likelihood Ratio **HS**= High Significant **t** = Paired t test

Table [8]: Association between post three months intervention levels of physical component quality of life and muscle cramps among studied hemodialysis patients **(N=80).**

Total Physical QoL levels post three months intervention / Muscle Cramps levels		Post intervention three months Physical component QoL levels				
		Moderate QoL		High QoL		Test of significant
		N	%	N	%	X^2/ LR
Cramps levels	No cramps (n=24)	7	29.2	17	70.8	X^2=0.95, P=0.003
	Mild cramps (n=56)	16	28.6	40	71.4	
Total	N=80 (100%)	23	28.8	57	71.2	

DISCUSSION

Hemodialysis is one of the most widely used treatments for ESRD Patients (Lee & Son, 2021; Shraida et al., 2021). One of the most prevalent complications among dialysis patients is muscle cramps which frequently lead to the early termination of the HD session (Anbu & Rathiga, 2021). This can be prevented by application of stretching exercises (Jayasrikannan et al., 2021). Therefore, the purpose of the present study aimed to determine the effect of intradialytic stretching exercises on improving quality of life among hemodialysis patients.

The first hypothesis assumed that muscle cramps will be reduced after intradialytic stretching exercises than before among patients undergoing hemodialysis. The findings of this study provide support to this hypothesis as shown from the results that indicated there were significant difference between pre and post one month, post two month, and post three months regarding to frequency of cramp, duration of the cramps, level of pain (VAS), temperature of the leg and discomfort among the studied patients. Also, there were a high significant decrease in studied patients' mean total score of cramp questionnaire from pre intervention to post one month, to post two month and to post three months intervention (table 3).

These results were consistent with Jancy & Parimala (2020); they studied the effect of intradialytic stretching exercises to reduce leg muscle cramps among Indian patients undergoing hemodialysis in selected dialysis unit of Ernakulum district, Kerala; they found that in pretest; half of samples had severe to moderate muscle cramps while in posttest; half of samples had mild to no complaints of muscle cramps. Moreover, the present study results were supported by Vimala (2018); they studied the effectiveness of intradialytic stretching exercises on reduction of muscle cramps among Tricia patients undergoing hemodialysis at Sundaram hospital Tricky; the researcher reported that before intra dialytic stretching

exercise; majority of patients had severe cramps before and after intradialytic stretching exercise two fifths of patients had moderate cramps.

Moreover, the current study results came in agreement with Albadr et al., (2020); the researchers studied the effect of implementing intradialytic hemodialysis exercises program on fatigue and leg cramps in dialysis unit at Sohag university hospital; they found that after application of intradialytic stretching exercises, there was a statistical significance differences regarding cramps questionnaire chart & visual analogue scale pre & post implementation of intradialytic exercises. Also, the present study results were consistent with a study was conducted by Wayan (2021); who investigated the benefits of intradialytic exercise programs among Indonesian patients; the researchers reported that there was a highly significant reduction in the severity and frequency of muscle cramps after exercise and increase physical function.

Moreover, the present study results came in agreement with Paul & Das (2022); they studied the effect of intradialytic stretching exercises on muscle cramps among Bengali patients undergoing hemodialysis in a selected hospital, Kolkata, West Benga; the researchers found intradialytic stretching exercises were an effective method in reducing patients' level of muscle cramps. Also, the current study finding was similar with Shraida et al (2021); the authors studied the effectiveness of intradialytic stretching exercises on prevention and reduction of leg muscle cramps among Indian patients undergoing hemodialysis; they found that the study participants had moderate to severe muscle cramps during the HD procedure, while after application of exercise; there was a significant reduction in the severity of muscle cramps. This might be due to the application of intradialytic stretching exercises for three months which had many benefits such as reducing pain and fatigue, reduction of muscle stiffness, improvement blood flow and increased muscle strength. All those lead to reducing frequency and severity of muscle cramps.

The second hypothesis assumed that quality of life will be improved after intradialytic stretching exercises intervention than before among patients undergoing haemodialysis. The findings of this study provide acceptance of this hypothesis as shown from the present study results which illustrated that the studied patients' mean total physical component subscale scores, total mental component subscale scores, burden of kidney diseases subscale and effects of kidney disease on daily life post three months intervention were significantly increased compared to the mean the studied patients' mean total physical component subscale scores, total mental component subscale scores,

burden of kidney diseases subscale and effects of kidney disease on daily life pre-intervention (Table 6).

In addition to, the present study revealed that, all studied patients had low quality of life pre intervention regarding to physical subscale, mental, burden of kidney diseases and effect of kidney disease quality of life subscales, while all of them had high quality of life post three months regarding to mental, burden of kidney diseases and effect of kidney disease quality of life subscales (Tables 7).

The present study findings agreed with Baraz et al (2021), they studied the effect of two educational programs on the quality of life of hemodialysis patients in Iran; the authors reported that health related quality of life (HRQOL) in dialysis patients improved after educational interventions. Moreover, Fatehi et al (2020) showed that the education of coping strategies has a positive effect on hemodialysis patients QOL.

Also, the present study results were consistent with a study was conducted with Hammad & Eltayeb (2020) who studied the effectiveness of an educational program on the knowledge and quality of life among hemodialysis patients in Khartoum state, Sudan; they revealed that there was a significant improvement in all domains of quality of life.

Moreover, the current findings were consistent with Lazarus (2019) who evaluated the effectiveness of an education and exercise intervention on the quality of life of patients with end-stage renal disease (ESRD); the researcher reported that physical, mental domains had significantly influenced QOL. Also, physical health and functioning improved after education and exercise among patients with CKD. Moreover, physical, mental, social and emotional domains promote KDQOL among patients with CKD. In addition, QOL improved with interactive education and exercise among patients with CKD. Also, education and exercise were shown to be a positive predictor of physical and mental health for people on hemodialysis as they reported had fewer symptoms and confidence in their ability to manage those symptoms they do have. Also, they reported better subjective quality of life, including social and role functioning, and emotional well-being. In addition to the mean scores for the kidney disease and general QoL sub-scales among the intervention group were higher and statistically significant compared to the control group QOL. This might be due to after application of intradialytic stretching exercises and educational intervention for three months caused reducing severity and frequency of muscle cramps leading to improve quality of life among haemodialysis patients.

Related to association between post three months' intervention levels of physical component quality of life

and muscle cramps among studied hemodialysis patients; the present study revealed that, there was a significant association between muscle cramps and physical component quality of life post three months' intervention (Table 8). The present study result came in agreement with Jayasrikannan et al., (2021); the researchers evaluated the effectiveness of intradialytic stretching exercises on muscle cramps and quality of life among Indian patients undergoing hemodialysis; they reported that there was statistically significant correlation between muscle cramps and all domains of quality of life after application of intradialytic stretching exercises.

Moreover, the present study result was consistent with a study was conducted with Bhuvaneswari et al., (2022); they assessed the effectiveness of intradialytic stretching exercises on leg muscle cramps among Indian hemodialysis patients; they found after intradialytic stretching exercises; the muscle became healthy which led to increasing physical function and improving quality of life of hemodialysis patients.

Also, the present study result was consistent with a study was conducted with Nowicka et al (2022), they studied the association of physical performance, muscle strength and body composition with self-assessed quality of life in hemodialyzed patients; they found that both interdialytic and at home exercise regimens improve the mental and physical QoL of HD patients. Ultimately, considering the protective relationship of lean body mass and higher muscle strength on QoL, interventions aimed to increase muscle strength together with increasing lean tissue content. This might be due to post three months' application of intradialytic stretching exercises and educational intervention; there was association between levels of physical component quality of life and muscle cramps among studied hemodialysis patients.

Also, the present study results were consistent with a study was conducted by Silva & Pimenta (2023) who assessed the relationship between health literacy and quality of life in chronic kidney disease among American patients; they found an association between the medium score of literacy which led to increase knowledge and patients' quality of life for each additional point in health literacy, the quality-of-life score increased. This might be due to the application of stretching exercises and educational intervention which had an effective role in improving knowledge leading to improving quality of life among hemodialysis patients.

Conclusions:

- Application of intradialytic stretching exercises for three months reduced muscle cramps leading to improved quality of life among hemodialysis patients. Also, the studied

patients' mean total physical component subscale scores, total mental component subscale scores, burden of kidney diseases subscale and effects of kidney disease on daily life post three months' intervention were significantly increased compared to the mean the studied patients' mean total physical component subscale scores, total mental component subscale scores, burden of kidney diseases subscale and effects of kidney disease on daily life pre intervention.

- Application of intradialytic stretching exercises for three months had an effective role in improving quality of life among hemodialysis patients. Also, there were a significant association between muscle cramps and physical component quality of life post three months' intervention.

Recommendations

1) Intradialytic stretching exercises should be combined with routine nursing care for hemodialysis patients.

2) Develop instruction guidelines for hemodialysis patients before starting HD sessions to improve their self-care practices about care of vascular access, importance of exercise, medications, and its side effects.

3) Training can be provided to the staff nurses regarding passive intradialytic stretching exercises.

4) Future research includes replication of the present study on a large sample of HD patients to generalize the study's findings

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