https://menj.journals.ekb.eg
Print ISSN: 2735-3974
Online ISSN: 2735-3982
DOI:10.21608/menj.2024.411235

MNJ
Menoufia Nursing Journal
Faculty of Nursing
Menoufia University

Effect of Implementing Educational Intervention on Diet, and Exercise Awareness for Reducing Muscle Cramps among Hemodialysis Patients

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Abstract: **Background**: Chronic kidney disease is a progressive disease that cannot be reversed leads to end-stage renal disease if it is not detected and treated early. The application of educational intervention enables hemodialysis patients to overcome interdialytic weight gain, correct their behaviors, enhance their capabilities, knowledge, and awareness. **The purpose of the study** was to determine the effect of implementing educational intervention on diet, exercise awareness for reducing muscle cramps 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: It used to collect 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 educational intervention. III: The hemodialysis knowledge questionnaire: It was used to assess patient's level of knowledge regarding to heamodialsis, laboratory investigation,diet and exercises. **Results** there were a highly significant differences in pre and post third months' intervention regarding to knowledge about hemodialysis, laboratory investigation, diet and exercises where ($p<0.0001$). Also, all the studied patients had severe muscle cramp pre intervention while 70% of them had mild muscle cramps post third month. **Conclusions**: Educational intervention for three months led to improving patients' knowledge and increasing satisfactory level regarding hemodialysis, laboratory investigation, diet, exercises and decrease severity of muscle cramps. **Recommendation**: 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.

Keywords: *Educational Intervention, Hemodialysis Patients, Muscle Cramps.*

Introduction

The kidneys are one of the most hard-working organ systems in the human body. Their main role is to act as a purification system for the blood, filtering out and excreting waste products such as urea and excess sodium, and maintaining fluid and electrolyte balance. Urine, the waste product of this process, is then passed on to the bladder and ultimately disposed of. Kidneys also have other important functions in the body. They produce hormones that regulate red blood cell production (erythropoietin) and blood pressure; and activate vitamin D which plays a key role in bone health (Mehmood et al., 2019).

Chronic kidney disease is a progressive disease that cannot be reversed leads to end-stage renal disease (ESRD) if it is not detected and treated early. Globally, ESRD is the major health issue in various parts of the world and its problem affects both the personal and national levels. It refers to a permanent and irreversible renal impairment with necessitate renal replacement therapy (RRT) when glomerular filtration rate reduced to less than 15ml/min (Weir et al., 2020).

End-stage renal disease (ESRD) is the last stage (stage 5) of chronic kidney disease (CKD) in which the kidneys can no longer function properly. This can lead to a buildup of toxins and fluids in the body, which can be life-threatening. ESRD is also called kidney failure and can be seen developing insidiously when the treatment of CKD is either delayed or not treated at all. As the glomerular filtration rate (GFR) drops below 15 mL/min/1.73 m2, the kidney function progressively worsens. It is at this stage the nephrologist recommends renal replacement therapies such as dialysis or kidney transplantation to remove uremic toxins and maintain hemodynamic stability (Wyld et al., 2021).

Worldwide, the prevalence of ESRD is increasing at a stable number of about 20,000 cases per year. It being 1500 per million populations (pmp) in the United States and 800 pmp in the European Union. In developing countries, the prevalence may vary from less than 100 pmp in sub-Saharan to 400 pmp in Latin America (John 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).

Hemodialysis is an alternate kind of care for those with chronic renal failure and increases their chances of survival. Hemodialysis is a treatment that eliminates excess fluids and electrolytes while filtering waste. In hemodialysis, blood is drawn from the body and passed through an artificial kidney or dialyzer to be filtered before being returned to the body (Isarannar et al., 2017).

One of the acute complications during hemodialysis is muscle cramps. Muscle cramps are painful contractions that occur in one muscle or group of muscles in patients without myopathy or neuropathy. These cramps are usually confined to the calf muscles but can also involve other skeletal muscles. Furthermore, this symptom of muscle cramps is a complication of hemodialysis in the form of restless leg syndrome (desnita et al., 2022).

Muscle cramps are the most prevalent problems for patients undergoing HD, affecting around 33 percent to 86 percent of patients and resulting in pain, insufficient dialysis time, and premature HD termination. The early termination of dialysis session may also result in decreased fluid removal, insufficient waste product clearance, fluid overload, hypertension, and an increased risk of death, it may impact a patient's choice to discontinue dialysis therapy in extreme circumstances (Ghaleb& Sharaf, 2020).

Once the hemodialysis treatment is started, several changes occur in the patient's life. For example, dietary restrictions are the most important issue in these patients and lack of adherence to dietary restrictions among hemodialysis patients is common. Patients look for a way to change their knowledge and attitude when it comes to dietary changes in nutrition (Wang et al., 2018). Patient education is not only a critical mechanism through which patients can have their questions, concerns, and needs regarding kidney disease care addressed but it is also a crucial pathway to ensure that patients can be taught to engage in self-management (Dsouza et al., 2023).

The educational intervention is essential to enable hemodialysis patients and their caregivers to care for themselves in the following domains: vascular access care, diet, fluid intake, exercises, medications, management of complications and psychosocial problems management (Al-agamy et al., 2022).

Patient education is one of the most important roles for nurses in any health care setting. As nurses try to find the best way to educate patients, the public has become more assertive in seeking knowledge towards understanding health, within the health care system. Nurses provide patients with information needed for self-care to ensure continuity of care from the hospital to the home. Educational programs are essential to enable hemodialysis patients to care for themselves in the following domains such as vascular access care, diet, fluid intake, medications, management of complications and psychosocial problems management (Fadlalmola & Elkareem, 2020).

Nurses collaborate with dieticians' specialists to facilitate dietary and fluid prescription self-management using educational materials that include brochures, fact sheets, lists of foods to avoid, referral to internet sites, and ongoing counselling. It is important for nurses to develop a patient-specific method of dietary and fluid management to encourage compliance and improve the quality of

life of patients (Duzalan & Pakyuz, 2018).

Purpose of the study:

To determine the effect of implementing educational intervention on diet, exercise awareness for reducing muscle cramps among hemodialysis patients.

Hypotheses:

1) Patients' knowledge about diet and exercise will be improved after implementation of educational intervention than before among patients undergoing hemodialysis.
2) Muscle cramps will be reduced after implementation of educational intervention than before among patients undergoing hemodialysis.

Research Question:

Is there any correlation between total Knowledge about exercise and total leg cramps?

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. Then Cronbach alpha was calculated using SPSS computer package. It was 0.89 which indicates that the instrument is reliable to detect the objectives of the study.

Instrument two: The hemodialysis knowledge questionnaire:

The instrument was developed by the researcher to measure the knowledge about hemodialysis. It included information about (heamodialysis, laboratory investigation, diet and exercises).

Scoring system

These questionnaires' answers was three points Liker scale (0 – 1) as (0) for incorrect answer/don't know , (1) for correct answer. then total score divided as follows : ≤ 50% total score = 1 = unsatisfactory knowledge, and ≥ 50% of total score =2= satisfactory knowledge. The knowledge items were as follow; knowledge about hemodialysis (17 questions), laboratory investigations (4 questions), diet (14 questions), and Exercise (10 items). The patient' knowledge about hemodialysis was evaluated giving a score of 0-34. the total score of each patient was categorized into "unsatisfactory knowledge" when he/she achieved less than or equal ≤ 50% of the total score , and "satisfactory knowledge" was considered when he/she achieved more than > 50% of the total score . accordingly, the patient had from 0 - 16 points of the total score, was considered as "unsatisfactory knowledge", and those who had 17 - 34 points were considered as "satisfactory knowledge".

Regarding the patients' knowledge about Laboratory investigations, it was evaluated giving a score of 0-8. The total score of each patient was categorized into "unsatisfactory knowledge" when he/she achieved less than or equal ≤ 50% of the total score , and "satisfactory knowledge" was considered when he/she achieved more than > 50% of the total score . Accordingly, the patient had from 0 - 3 points of the total score, were considered as "unsatisfactory knowledge", and those who had 4 - 8 points were considered as "satisfactory knowledge". Regarding the patients' knowledge about diet , the patient' knowledge was evaluated as a score of 0- 28. If the patient had from 0-13 points of the total score, he/she was considered as "unsatisfactory knowledge", and if she had 14 – 28 points was considered as "satisfactory knowledge".

Concerning assessing the patients 'knowledge about exercise, the patient' knowledge was evaluated giving a score of 0- 20. Patients had from 0-9 points of the total score, were considered as "unsatisfactory knowledge", and those who had 10 - 20 points were considered as "satisfactory knowledge".

The grand total knowledge for each patient was assessed accordingly through 45 knowledge assessment items which were included in the questionnaire. The patient' grand total knowledge was evaluated giving

a score of 0- 90. The total score of each patient was categorized into "unsatisfactory knowledge" when the he/she achieved less than or equal ≤ 50% of the grand total score , and "satisfactory knowledge" was considered when he/she achieved more than > 50% of the grand total score. Accordingly, patients had from 0- 44 points of the grand total score, were considered as "unsatisfactory knowledge", and those who had 45 – 90 points were considered as "satisfactory knowledge". The scale was valid and reliabe.

The reliability of the second instrument was estimated then Cronbach alpha was calculated. It was 0.80 which indicates that the instrument is reliable to detect the objectives of the study.

Instrument three: 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 intradialytic stretching exercises. 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 third instrument was estimated then Cronbach alpha was calculated using SPSS computer package. It was 0.79 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:

- This study was approved by the Ethical Committee for Scientific Research Review, Faculty of Nursing, Menoufia University, Egypt conducted on 18-9-2021 with registered number (N: 898) of the Faculty of Nursing, Menoufia University, Egypt.
- An official letter was 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 was obtained from each participant of the study. The subjects who agreed to participate in the study was assured about confidentiality and anonymity of the study. They was informed about their right to withdraw from the study at any time without giving a reason. The purpose of the study was clarified for the participants by the researcher and any needed clarifications was 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.
- Each patient was personally interviewed and sometimes groups of patients (maximum six patients) in the hemodialysis unit.
- The educational intervention booklet was developed by the researcher after reviewing recent related literature and contain the following: kidney function, causes of chronic kidney failure, its symptoms, how to diagnose chronic kidney failure, definition of dialysis, types of dialysis, side effects during hemodialysis session, types of dialysis connections and how to care for them and definition of muscle cramps and how to reducing muscle cramps for dialysis

patients through exercieses and essential nutrition.

- The educational intervention was done to all patients in heamodialysis unit. It was in the first hour of starting hemodialysis session that lasted about seventh sessions (three months) after distributing educational booklet to the patients.
- Each session was taken 20- 30 minutes and used lecture and group discussion as methods of teaching and power point, picture and videos about exercises to facilitate teaching and learning. The intervention was given for small groups that composed from 2- 6 patients.
- The first session included introduction about kidney function, causes of chronic kidney failure and its symptoms.
- The second session included a summary about what had been discussed in the first session; then how to diagnose chronic kidney failure, definition of dialysis and types of dialysis were explained and discussed.
- The third session included the side effects during hemodialysis session.
- The fourth session included a summary about what had been discussed in the third session; then types of dialysis connections and how to care for them.
- The fifth session included a summary about what had been discussed in the fourth session; then the definition and causes of muscle cramps as well as the purpose, benefits, and steps of passive and active exercises using educational booklet.
- The six session included a summary about what had been discussed in the fifth session; then how to reducing muscle cramps through taking healthy diet was explained and discussed.
- The seven session included how to reducing muscle cramps through exercises was explained and discussed.
- By the end of the sessions, the patients were received an educational intervention booklet that contained all the previously mentioned information.
- 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.
- At the end of the interventions, post test was conducted for knowledge about diet, exercise and muscle cramps.
- 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). The level of significance was set as P value.

Results

Table 1 shows 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 smokers.

Table 2 demonstrates that all studied hemodialysis patients suffered from occurrence of muscle cramps, 90% of muscle cramps occurred in the dialysis days and 10% occurred in dialysis days and non-dialysis days. Also, most of the frequency of muscle cramps were three times per week (92.5%). Moreover, all patients suffered from occurrence of muscle cramps during hemodialysis session. Most of them (91.2%) had muscle cramps during hemodialysis session in the last hour, 95% of studied patient had both affected legs by muscle cramps and 91.2% of them had affected Calf muscle. by muscle cramps. Also, many studied patients (75%) had muscle cramps that restrict movement and 75% of them terminated hemodialysis session due to muscle cramps. In addition to, 92.5% of them received decrease filtration rate as a performed action for managing muscle cramps, 62.5% of studied patients had muscle cramps affected on daily activities. In addition to, 90% of them took nutritional supplements.

Table 3 represents that all studied patients had not knowledge pre intervention regarding to hemodialysis and complications of hemodialysis, while all studied patients had knowledge post three months' intervention regarding to hemodialysis and complications of hemodialysis. Also, there were a highly significant differences of studied patients' pre and post intervention knowledge about hemodialysis and hemodialysis complications where ($p<0.0001$). Moreover, the studied patients' mean total score of hemodialysis knowledge 32.3 ± 5.5 post three months' intervention was significantly increased compared to the studied patients' mean total score of hemodialysis knowledge 18.7 ± 3.1 in pre-intervention where ($p<0.0001$).

Table 4 illustrates that all studied patients had not knowledge pre-intervention regarding to laboratory investigations and diet, while all of them had knowledge post three months' intervention regarding to laboratory investigations and diet. Also, there were a highly significant differences of studied patients' pre and post intervention knowledge about laboratory investigations and diet

where (p<0.0001). Moreover, the studied patients' mean total hemodialysis knowledge about laboratory investigations and diet score (7.1 ± 2.2), (18.3 ± 2.2) post three months respectively were significantly increased compared to the studied patients' mean total hemodialysis knowledge about laboratory investigations and diet (4.2 ± 1.3), (6.1 ± 1.4) pre-intervention respectively where (p<0.0001). The findings of this table provide support to the first research hypothesis.

Table 5 shows that all studied patients had no knowledge pre-intervention about exercises 'benefits, while all of them had knowledge post three months' intervention about exercises 'benefits. Also, there were a highly significant differences of studied patients' pre and post intervention regarding to knowledge about exercises' benefits where (p<0.0001). Moreover, the studied patients' mean total hemodialysis knowledge' about exercises' benefits score 18.3 ± 2.2 post three months' post intervention was significantly increased compared to the studied patients' mean total hemodialysis knowledge about exercises' benefits 6.1 ± 1.4 pre-intervention where (p<0.0001). The findings of this table provide support to the first research hypothesis.

Table 6 represents all studied patient had unsatisfactory Knowledge pre intervention regarding to hemodialysis, diet and exercise while 62.5% of them had unsatisfactory knowledge regarding to laboratory investigation. Also, all studied patients had satisfactory Knowledge post third months' intervention regarding hemodialysis, laboratory investigation and diet while 28.7% of them had unsatisfactory knowledge regarding to exercises post third months' intervention. Moreover, there were a highly significant differences in pre and post third months' intervention regarding to knowledge about hemodialysis, laboratory investigation, diet and exercises where (p<0.0001). In addition to the studied patients' mean of grand total knowledge score (27.5± 1.9) post three months' intervention was significantly increased compared to the studied patients' mean of grand total knowledge score (8.6 ± 3.3) pre-intervention where (p<0.0001). The findings of this table provide support to the first research hypothesis.

Fig. 7 shows that all the studied patients had sever muscle cramp pre intervention while 95% of them had moderate muscle cramps post first month. Also 98.7% of them had moderate muscle cramps post second month and 70% of them had mild muscle cramps post third month. Moreover 30% of them had no muscle cramp post third month. In addition to there were high significant differences between pre, post one month, post two month and post three months where (p<0.0001). The findings of this table provide support to the second research hypothesis.

Table 8 demonstrates that there was a negative significant correlation was observed between total Knowledge about exercise as independent variable and total leg cramp as a dependent variable where (p<0.0001). This

means that when the total Knowledge about exercise increased, the total leg cramp decreased. The findings of this table provide an answer to the research question.

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

Socio demographic characteristics	No.	%
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 of cramps among the studied hemodialysis patients (N=80).

Patients' medical history of cramps:	**No.**	**%**
Occurrence of muscle cramps	80	100
Days of Muscle cramps: 1. Dialysis days 2.Both dialysis and non-dialysis days together.	 72 8	 90 10
Frequency of muscle cramps per week Three times Four times	 74 6	 92.5 7.5
The occurrence of muscle cramps during hemodialysis session	80	100
Time of occurrence muscle cramps during hemodialysis session: Middle hours Last hour	 7 73	 8.8 91.2
The affected leg by muscle cramps. Right leg Both legs	 4 76	 5 95
The affected part of the leg by muscle cramps. Calf muscle. Posterior thigh muscle Anterior thigh muscle	 73 5 2	 91.2 6.3 2.5
Muscle cramps restrict the movement Yes No	 60 20	 75 25
Muscle cramps terminate hemodialysis session Yes No	 60 20	 75 25
The performed action for managing muscle cramps: Decrease filtration rate Stop hemodialysis a head of time	 74 6	 92.5 7.5
Muscle cramps affect daily activities. No effect To some extent Alot	 20 50 10	 25 62.5 12.5
Taking nutritional supplements Vitamins Fe and Ca Folic Acid	 72 5 3	 90 6.2 3.8

Table 3: Distribution of the studied hemodialysis patients regarding their knowledge about hemodialysis pre and post three months' intervention

Hemodialysis patients' knowledge about hemodialysis	Pre - intervention			Post intervention			χ^2/ LR P
	0	1	2	0	1	2	
	%	%	%	%	%	%	
Healthy kidneys control the balance of fluids and minerals, in the body.	100	0	0	0	0	100	200.9, p<0.0001
When the kidneys fail, production of the hormone called erythropoietin stops	100	0	0	0	0	100	200.9, p<0.0001
Dry weight is what a person weighs without excess fluid accumulation.	0	0	100	0	0	100	200.9, p<0.0001
Reducing fluid intake between dialysis sessions helps make dialysis comfortable.	100	0	0	0	0	100	200.9, p<0.0001
During hemodialysis, blood waste and toxic substances pass through the filter responsible for dialysis.	100	0	0	0	0	100	200.9, p<0.0001
During dialysis, things that are beneficial to the body (such as medicines) are removed along with waste products and toxic substances.	100	0	0	0	0	100	200.9, p<0.0001
Adhering to the specified number of dialysis sessions is better because healthy kidneys work 24 hours a day.	100	0	0	0	0	100	200.9, p<0.0001
Knowledge about hemodialysis complications:							
One of the complications of dialysis is low blood pressure	100	0	0	0	0	100	200.9, p<0.0001
A complication of dialysis is low blood sugar	100	0	0	0	0	100	200.9, p<0.0001
One of the complications of dialysis is muscle cramp	100	0	0	0	0	100	200.9, p<0.0001
One of the complications of dialysis is a high temperature	100	0	0	0	0	100	200.9, p<0.0001
One of the complications of dialysis is high blood pressure	100	0	0	0	0	100	200.9, p<0.0001
When suffering from diabetes, it is necessary not take diabetes medications during the dialysis session	100	0	0	0	0	100	200.9, p<0.0001
From the care of the fistula, it is necessary to wash the hand with the fistula with soap and water before starting the dialysis session	100	0	0	0	0	100	200.9, p<0.0001
From the care of the fistula, it is necessary not to use the hand with the fistula to work and lift heavy objects	100	0	0	0	0	100	200.9, p<0.0001
From the care of the dialysis catheter, it is necessary not to put water on the dialysis catheter and expose it to contamination.	100	0	0	0	0	100	200.9, p<0.0001
Alarms of the device indicate that there is a problem.	100	0	0	0	0	100	200.9, p<0.0001
Mean total Hemodialysis knowledge score	**18.7 ± 3.1 (0-34)**			**32.3 ± 5.5 (0- 34)**			**t =25.7, p<0.0001**

0 = Don't know/ wrong answer 1= Incomplete correct answer 2= Complete correct answer
NS= not significant HS= High significant. t= Paired t test. χ^2= Chi Square test

Table 4: Distribution of the studied patients according to their knowledge about laboratory investigations and diet pre and post three months' intervention (N=80).

Hemodialysis patients' knowledge about hemodialysis' Laboratory Investigations, and diet	Pre - intervention			Post intervention third month			χ^2 P
	0	1	2	0	1	2	
	%	%	%	%	%	%	
Laboratory Investigations:							
Hemoglobin is used to detect anemia	100	0	0	0	0	100	200.9, p<0.0001
Creatinine is a laboratory test that measures kidney function	10	90	0	0	0	100	112, p<0.0001
The normal level of phosphorous in the blood for dialysis patients is 3.5 to 5.3	0	0	100	0	15	85	103.6, p<0.0001
The normal level of potassium in the blood for dialysis patients is 3.5 to 5	100	0	0	0	0	100	200.9, p<0.0001
Mean total Hemodialysis patients' knowledge regarding Laboratory investigation score	4.2 ± 1.3(range:0-8)			7.1 ± 2.2(range: 0-8)			t= 21.3, p<0.0001 HS
Diet :							
Foods rich in phosphorous such as milk, dairy products, legumes and seafood should be avoided.	100	0	0	0	0	100	200.9, p<0.0001
Potassium-rich foods such as potatoes, banana, avocados, oranges and beets should be avoided.	90	10	0	0	0	100	112.0, p<0.0001
Avoid foods that contain salt, such as canned goods, roomy cheese, and salty cheese	100	0	0	0	10	90	112, p<0.0001
Iron-rich foods such as molasses, eggplant, meat, liver and fruits such as pomegranate should be eaten to treat anemia.	85	10	5	0	0	100	112, p<0.0001
should eat foods rich in vitamin C such as lemon, berries, kiwi and guava	100	0	0	0	0	100	200.9, p<0.0001
Obesity is one of the causes of many diseases such as diabetes and high blood pressure	100	0	0	0	0	100	200.9, p<0.0001
Obesity affects kidney function	100	0	0	0	0	100	200.9, p<0.0001
It is best to follow a diet that contains little fat, starches and sugars.	100	0	0	0	0	100	200.9, p<0.0001
Excessive obesity affects the heart muscle and leading to heart problems.	100	0	0	0	0	100	200.9, p<0.0001
It is necessary not drink a lot of coffee and tea and avoid soft drinks.	100	0	0	0	0	100	200.9, p<0.0001
A low-protein diet is necessary during partial kidney failure.	100	0	0	0	0	100	200.9, p<0.0001
It is necessary to follow a diet rich in protein when chronic kidney failure occurs.	100	0	0	0	0	100	200.9, p<0.0001
Reducing potassium prevent heart problems in dialysis patients.	100	0	0	0	0	100	200.9, p<0.0001
To avoid excessive weight gain between sessions, salt should not be added to food.	100	0	0	0	0	100	200.9, p<00001
Mean total Hemodialysis patients' knowledge regarding Diet score	**6.1 ± 1.4 (0- 28)**			**18.3 ± 2.2 (0 -28)**			**t2=9.7, p<0.0001**

0 = Don't know/ wrong answer **1**= Incomplete correct answer **2**= Complete correct answer
NS= not significant **HS**= High significant. **t**= Paired t test. χ^2= Chi Square test

Table 5: Distribution of hemodialysis patients according to their knowledge about exercises 'benefits for them, pre and post three months' intervention (N=80).

knowledge about exercises' benefits among hemodialysis patients, pre and post three months intervention	Pre - intervention			Post three months intervention			χ^2 P
	0	1	2	0	1	2	
	%	%	%	%	%	%	
knowledge about exercises' benefits:							
Exercise helps with sleeping, strengthening bones, protecting against depression, and preventing heart disease.	100	0	0	0	0	100	200.9, p<0.0001
Some of the exercises such as walking, jogging, swimming and climbing stairs are suit for hemodialysis patients	10	90	0	0	0	100	112, p<0.0001
Exercise reduces complications of kidney disease.	0	0	100	0	15	85	103.6, p<0.0001
Walking for half an hour a day, three days a week, keeps the heart and lungs healthy.	100	0	0	0	0	100	200.9, p<0.0001
Exercise helps lowering bad cholesterol and triglycerides.	100	0	0	0	0	100	200.9, p<0.0001
Aerobic exercise improves muscle performance.	90	10	0	0	0	100	112.0, p<0.0001
When eating a big meal, it is necessary you should wait an hour before doing any exercise	100	0	0	0	10	90	112, p<0.0001
It is recommended to avoid exercising before bedtime, as it leads to the inability to sleep	85	10	5	0	0	100	112, p<0.0001
Exercise helps in improving immune system and strengthening physical ability	100	0	0	0	0	100	200.9, p<0.0001
Exercise helps in lowering blood pressure	100	0	0	0	0	100	200.9, p<0.0001
Mean total knowledge about exercises benefits among studied patients	**6.1 ± 1.4 (0- 20)**			**18.3 ± 2.2 (0 -20)**			**t2=9.7, p<0.0001**

0 = Don't know/ wrong answer **1**= Incomplete correct answer **2**= Complete correct answer
NS= not significant **HS**= High significant. **t**= Paired t test. χ^2= Chi Square test

Table 6: The effect of educational intervention on improving total knowledge levels about hemodialysis, laboratory investigations, diet and exercises benefits, as well as grand total knowledge. levels among studied hemodialysis patients pre and post three months' interventions (N=80).

Total Knowledge score about:	Pre intervention				Post three months intervention.				Test of sig. X2/ LR	P value
	Unsatisfactory Knowledge		Satisfactory Knowledge		Unsatisfactory Knowledge		Satisfactory Knowledge			
	No.	(%)	No.	(%)	No.	(%)	No.	(%)		
Hemodialysis	80	100	0	0	0	0	80	100	X^2=112	<0.0001 HS
Lab. Investigations	50	62.5	30	37.5	0	0	80	100	X^2=60.4	<0.0001 HS
Diet	80	100	0	0	0	0	80	100	X^2=112	<0.0001 HS
Exercises	80	100	0	0	23	28.7	57	71.3	X^2=52	<0.0001 HS
Grand total Kn.	80	100	0	0	0	0	8	100	X^2=112	<0.0001 HS
X± SD	8.6 ± 3.3(4 -15)				27.5± 1.9 (23 -30)				t= 64.2	<0.0001

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

Fig. 7: The effect of educational intervention on the severity of muscle cramps levels among the studied hemodialysis patients (N=80).

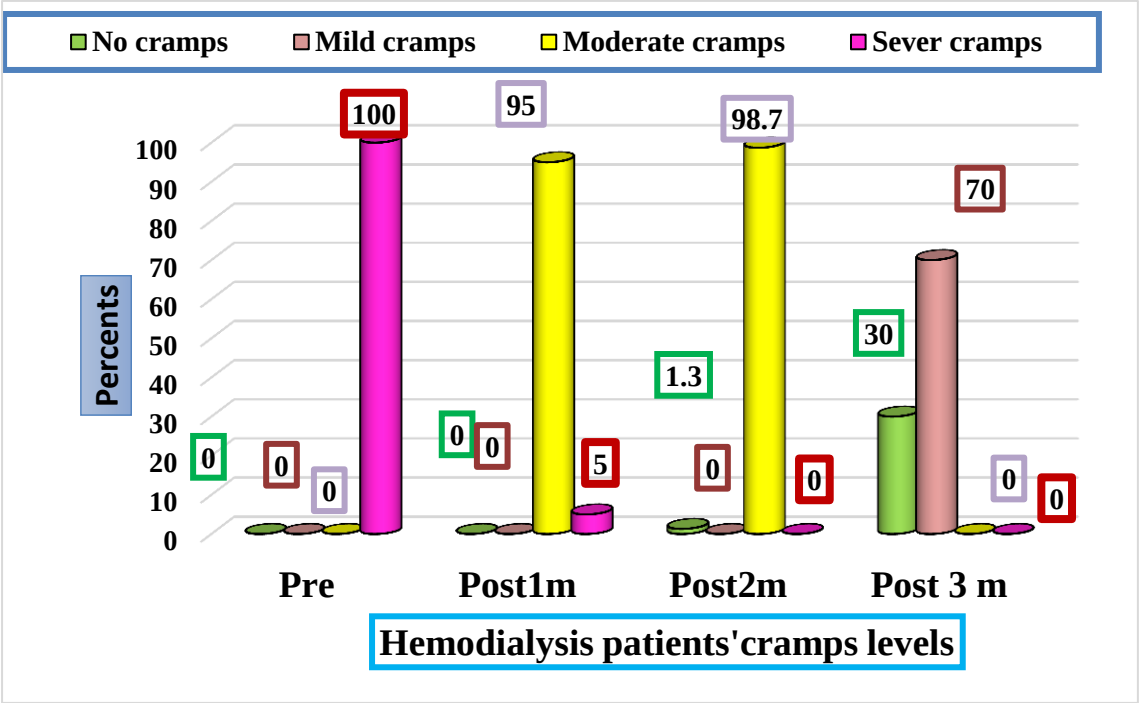

Table 8: Correlation between total knowledge about diet and exercise and total leg cramp

	Total Knowledge about diet		Total Knowledge about exercise		Total QoL	
	r	p	r	p	r	p
Total Leg cramp	0.98	<0.0001	- 0.87	<0.0001	0.96	<0.0001

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 implementing educational intervention on diet, exercise (Ghaleb & Sharaf, 2020). Therefore, the purpose of the present study aimed to determine the effect of implementing educational intervention on diet, exercise awareness for reducing muscle cramps among hemodialysis patients.

Regarding to the history of the muscle cramps which included; days of muscle cramp, frequency of muscle cramps per week, time of occurrence of muscle cramps during hemodialysis session, the affected leg by muscle cramps and the affected part of the leg by muscle cramps; the present study donated that all studied patient had muscle cramps during hemodialysis session, more than three quarters of studied patients had muscle cramps during hemodialysis session in last

hour, had both affected legs by muscle cramps in the calf muscle (table 2) .

The present study result was consistent with a study was conducted by Fatma et al (2021) who evaluated the effect of practice passive and active stretching exercises on controlling muscle cramps for patients on hemodialysis at Kafrelsheikh general hospital governorate, Egypt; the researchers reported that there was more than half of both groups had muscle cramps in the last hours of dialysis session and their lower limbs were affected by the muscle cramps pre practice stretching exercises.

Moreover, the current study results came in agreement with a study was conducted by Jasline & Elina (2022) who assessed the effectiveness of intradialytic stretching exercises on reduction of muscle cramps among Indian patients undergoing hemodialysis at SMI hospital Dehradun; the authors reported that all the patients undergoing hemodialysis experienced muscle cramps previously. Also, they reported that most of the study's participants experienced muscle cramps at the termination of hemodialysis and experienced cramps in calf muscles.

The first hypothesis assumed that patients' knowledge about diet and exercise will be improved after implementation of educational intervention than before among patients undergoing hemodialysis. The findings of this study provide acceptance of this hypothesis as shown from the present study's results which indicated that there were a highly significant differences in pre and post third months' intervention regarding to knowledge about hemodialysis, laboratory investigation, diet and exercises. Also, all studied patients had unsatisfactory knowledge pre intervention regarding to hemodialysis, diet and exercises; while all studied patients had satisfactory Knowledge post third months' intervention regarding to hemodialysis, laboratory investigation and diet (tables 3-6).

This finding agreed with Dsouza et al (2023); they studied the effect of educational intervention on knowledge and level of adherence among Iranian hemodialysis patients; they reported that there was a significant increase in the level of their patients' knowledge concerning diet restrictions after an educational intervention and an improvement in fluid and dietary adherence.

In addition, the present findings came on the same line with Saelim et al (2021); the researchers studied the effect of a health education on improving patients' behaviors, clinical and laboratory parameters, among chronic hemodialysis Indian patients at the hospital for tropical diseases; they reported that the health education program significantly improved the hemodialysis patients' knowledge about the disease and their dietary behavior and all patients had unsatisfactory level of knowledge before interventions which improved to satisfactory level one month after interventions. Also, there was a significant improvement in the mean total patients' knowledge one month after interventions.

Moreover, the present study results were consistent with a study was conducted by Abdel Monem et al., (2022), who examined the effect of a designed educational nursing intervention on knowledge and compliance to therapeutic regimen among Egyptians patients with hemodialysis. The researchers reported that there was a significant difference among the study group than control group one month and three months' post intervention regarding total and subtotal knowledge level. This might be due to after application of educational intervention about diet and exercises, the knowledge of patients about diet and exercises increased than before.

The second hypothesis assumed that frequency and severity of muscle cramps will be reduced after educational intervention 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 months, and post three months. Also, all the studied patients had severe muscle cramps pre-intervention while most of them had moderate muscle cramps post first month and post second month and two-thirds of them had mild muscle cramps post third month (tables 6-7).

These results were consistent with Ghaleb & Sharaf (2020); they studied the effects of nursing interventions on intradialytic muscle cramps among patients undergoing maintenance hemodialysis; they found that after three months of application of nursing intervention, there were a significant in reducing the level of muscle cramps among the studied patients.

Moreover, the current study results came in agreement with Chen et al., (2022); the researchers studied the effect of different nutritional education based on healthy eating index for hemodialysis patients on dietary quality and muscle mass; they found that after application of educational intervention about diet for hemodialysis patients, there was reduction of muscle mass and weight gain which led to decrease frequency and severity of muscle cramps. Also, there were statistical significance differences regarding severity and frequency of muscle cramps pre & post implementation of educational intervention.

Also, the present study results were consistent with a study was conducted by Desak (2021); who investigated the benefits of 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. This might be due to after application of educational intervention about diet and exercises which lead to decrease weight gain and muscle mass. Also, the severity and frequency of muscle cramps decreased than before.

Related to correlation between total knowledge about diet and exercise and total leg cramp; the present study revealed that, there were a negative significant correlation was observed between total knowledge about

exercise as independent variable and total leg cramp as a dependent variable (table 8). This finding agreed with Wayan (2021); who investigated the benefits of exercise programs, specifically on increase muscle strength and physical function among Indonesian patients; the researcher reported that exercise could reducing pain and fatigue through reduction of muscle stiffness, and improvement blood flow. Also, the effects of exercise on chronic kidney disease patients increase muscle strength and decrease muscle cramps for improving their physical function.

Moreover, the present study result was consistent with a study was conducted by Ghaleb & Sharaf (2020), who identified the effects of nursing interventions on muscle cramps among patients undergoing maintenance hemodialysis conducted in hemodialysis unit, Alexandria University; they found after applied nursing interventions have a remarkable effect on the level of patients' muscle cramps, as the majority of them had moderate cramps before applying the nursing interventions, while they had no to mild cramps respectively after interventions. This might be due to application of educational intervention which had an effective role in improving knowledge about exercises and diet leading to decrease frequency and severity of muscle cramps.

Conclusions

- Educational intervention for three months led to improving patients' knowledge and increasing satisfactory level regarding hemodialysis, laboratory investigation, diet and exercises. Moreover, there were highly significant differences in pre and post third months' intervention regarding knowledge about hemodialysis, laboratory investigation, diet and exercises. Also, all studied patients had unsatisfactory Knowledge pre intervention regarding to hemodialysis, diet and exercises, while all studied patients had satisfactory knowledge post third months' intervention regarding to hemodialysis laboratory investigation and diet.
- Application of educational intervention for three months had an effective role in improving knowledge about diet and exercise leading to decrease frequency and severity of muscle cramps among hemodialysis patients. Also, there was a negative significant correlation was observed between total knowledge about exercise and total leg cramp after application of intradialytic stretching exercises and educational intervention for three months.

Recommendations

1) 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.

2) Encourage the patients to note the frequency of muscle cramps in a diary after performing the exercises.

3) 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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