- *Basic Research*

Effect of Intradialytic Leg Exercise on Functional Status among Patients on Hemodialysis: Explanatory Randomized Control Study

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Abstract

Background: Hemodialysis is the most widely used treatment modality worldwide, it is associated with high rates of functional impairment, morbidity, hospitalization and mortality. Therefore, increasing physical activity through regular exercise, especially intradialytic leg exercise, might be an effective way to improve their functional status which includes physical, mental, and social life's aspects. **Aim of the current study:** it was to evaluate the effectiveness of intradialytic leg exercise on functional status among patients on hemodialysis. **Design:** Explanatory randomized control study design was utilized to accomplish the study purpose. **Research hypotheses:** H1: Study group who received the intradialytic leg exercise will have a significant higher mean functional score that includes (physical, psychological and social functioning) than the control group who received the routine hospital treatment only. **Sample:** A sample of 114 adult male and female patients (57 patients in each group (study or control group) who met the inclusion criteria was involved in the analysis. **Results:** there was a statistical significant difference between both study and control groups after applying intradialytic leg exercises in relation to basic physical and social role functions after 3 and 6 weeks consequently. Moreover, there was a statistical significant difference between both study and control groups after applying intradialytic leg exercises in relation to intermediate physical and psychological functions and social activities after 6 weeks; But there was no statistical significant difference regarding social interaction. **Conclusion:** intradialytic leg exercise was effective to improve many aspects of functional status among patients on hemodialysis. **Recommendation:** The application of intradialytic leg exercise is recommended to be endorsed as a nursing practice for patients who are scheduled on hemodialysis.

Key words: intradialytic leg exercise, functional status, & hemodialysis

Introduction:

Chronic kidney disease (CKD) is a major public health hazard, imposing a significant burden on healthcare systems. With increasing life expectancy and a higher burden of lifestyle-related disorders, the prevalence of CKD is showing a rising trend (Viswanath, Kumar, Haridasan, Parameswaran, & Priyamvada, 2019). Nearly 90% of patients with chronic renal failure require regular hemodialysis (HD) as renal replacement therapy for maintaining survival (Saran et al., 2020). Apparently; the goal of hemodialysis is to remove excess fluid and waste products (uremic toxins) from the blood through the dialyzer and to return a clear and filtered blood back to the patient (Zhang et al., 2022). Hemodialysis process is considered a vital management for patients with end-stage renal disease. However, complications may occur to those patients who undergo hemodialysis, which will influence their functional status. Actually; functional status reflects the ability to perform daily activities, including; doing a job, self-care, and taking care of family or social roles, as well as personal function in various fields, like physical, intellectual, social and emotional health (Rothpletz-Puglia et al., 2022). Also Elezi, Rumano, Abazaj & Topi (2023) determined in their study that it is essential to support patients on HD in several aspects as improving their lifestyle, emotional and mental health.

Physical inactivity is one of the factors that increase the mortality rate of hemodialysis patients. Symptoms related to kidney disease and underlying comorbidities, including nausea, fatigue, shortness of breath, muscle weakness, cramps, and sleeping disorders, often prevent patients from doing even the slightest activity. The dialysis procedure itself requires patients to remain in a lying or sitting position for 4 to 5 hours, 2 to 3 times per week, which renders the patients immobile for approximately 40 to 48 hours per week may result in muscle disuse, muscle atrophy, myopathy, and deterioration of physical ability or physical capacity (Suhardjono, Umami, Tedjasukmana & Setiati, 2019).

There were several studies reported that lack of daily physical activities is associated with an increased risk of mortality and deprived life features among patients with hemodialysis. It has been shown that exercise training improves physical function, physical performance, nutritional status and cardiovascular function (Harris-Love, Hernandez & Obamwonyi, 2018; Rhee et al., 2019; Bharti & Chavda, 2020; Lin et al.,2021). Moreover, exercise revealed strong positive correlations with dialysis efficacy, high-sensitivity C-reactive protein, blood pressure. Unfortunately, reports of the low level of physical activity that perform among patients with hemodialysis remain numerous; despite evidence of the gained benefits of regular exercise for those patients. Regrettably, the encouragement of patients to exercise by physicians and nurses has not yet become a norm in hemodialysis departments (Ali, Eltokhy, Hassan &El-Nahas, 2020).

Intradialytic leg exercise, is an exercise performed only during the hemodialysis treatment, that considers one of the promising choices for those patients, as it can be conducted in a setting with close monitoring. It does not involve additional time or travel, and may alleviate a patient's fear of musculoskeletal injury, which may improve adherence and supervision relative to exercise on non-dialysis days. Intradialytic leg exercise was prescribed for 15 to 25 min/day, three times per week, during the first two hours of each heamodialysis session. It includes stretches exercises for hips, legs and waist followed by hip flexion then knee flexion for both legs, hip abduction and finally perform glute bridge (Kato et al., 2021).

Nurses have a crucial role in patients' rehabilitation and they are able to enhance patients with HD' ability to perform physical exercise that have reflection on their daily activities and reduce their social, mental, and economic problems as well. Recently, planned exercise activities that consider the patient's conditions and abilities have attracted the attention of rehabilitation specialists. Implementing supervised exercise programs by well-trained nurses in hospitals can increase patients' participation and commitment (Hatef et al., 2020). Therefore, the purpose of this study was to assess the effectiveness of intradialytic leg exercise on the functional status among patients on hemodialysis.

Significance of the study:

Increasing number of patients with chronic renal disease is growing worldwide. According to National Kidney Foundation, around 10% of the population worldwide is affected by chronic kidney disease (CKD). Around 4.35 million people worldwide currently receive treatment with dialysis or kidney transplant (Global Dialysis Market, 2020). Also it is unfortunately expected that the market will reach US$ 148.8 Billion by 2028 (Global Dialysis Market, 2023) Additionally; on of the latest regional report from the Egyptian Society of Nephrology Transplantation (2019) reported that; 3770 patients are at the End Stage Renal Disease (ESRD) and on hemodialysis all over Egypt. While 169 patients of them are at Kasr Al Ainy Kidney Center which is one of the Educational Hospital. Unfortunately, in Egypt the primary underlying cause is unknown; whereas hypertension is the secondary most common cause of ESRD, followed by diabetes mellitus. (Egyptian Renal Data System, 2019). Those patients obviously suffer from fatigue and limitation of their functional activity.

Indeed, during hemodialysis sessions, patients spend 3 to 4 hours connected to dialysis machine without doing any activity. And by knowing that, Intradialytic leg exercise includes two application forms; the first one is by using (ergometer) but it is high cost and causing high cardiac effort while the other form is the Intradialytic leg exercise that, the researcher intended to apply it in the current study and considers much accessible for different patients with HD conditions on physical and financial levels, in addition to that it

is safe, easy and might show changes in their physical and psychological and social conditions.

Tremendous patients with HD scheduled to HD sessions up to 3 times a week; thinking only of the length of the procedure and how bored they will be. Also, they think of the complications and the effect of dialysis; especially the deterioration of their functional status that takes place day after day. So, incorporating accessible, safe exercise during the HD sessions expected to not only show physical improvement; but also might have a positive psychological and social effect and guarantee commitment and close observation during performing the exercise. The current study hopefully enables the patients on HD to perform intradialytic leg exercises properly. Moreover, it would objectively quantify the effect of intradialytic leg exercises on functional health status among patients on hemodialysis. Also, it was hoped that findings might help in improving the functional status of those patients and establish evidence-based data that could promote nursing practice and research.

Theoretical framework:

Care is a universal aspect of the human experience, yet despite its centrality, there are wide variations in how care is conceptualized, researched, and practiced. Care is a broad concept, which is not restricted to, but often epitomized by nursing. Nursing care essentially respects and focuses on patients' needs to ensure their physical and psychosocial wellbeing (Feo et al., 2018). Therefore, *Lydia E. Hall's* ' "Core, Care, and Cure Model" (1964) was used as the theoretical framework for the current study. Lydia is considered a core philosophy of nursing that enables nurses to lay the foundation for patient care. Lydia E. Hall as a nursing theorist is unique in that her belief in nursing has been expressed in practice.

In the current model, core, care and cure represent the patient, intimate bodily care and aspect of nursing behavior such as nursing intervention and teaching. Hall presented a visual conceptual model of nursing by depicting three interlocking dimensions: core, care and cure. The three dimensions are linked and influence each other. Nursing plays an important role in these three interrelated aspects of (core, care and cure) (Sheeba, 2015; Umara , 2018).

Core aspect of patient care is based on the concept of patients observing their current state of health and possible changes and exploring their feelings. Umara (2018) added in the "core" aspect, the nurse provides explanations and treatment goals to facilitate the process of increasing self-awareness of patient health needs. A patient who has self-awareness will be able to control him/herself. Therefore, in this aspect, the patient needs less medical treatment and requires professional care to achieve the maximum goal. The "core" of this study is about patients who had renal failure and were treated by hemodialysis and

suffering from loss of functional status caused by the disease itself and related treatment complications that may delay the patient's convalescence and also affect their health-related functional status.

Care aspect represents the caring element. i.e., the concept of mothering (care and comfort of patients), through care aspect, the patients can control their own feelings, motives, goals and ultimately exert their self-potentials to the greatest extent by applying appropriate nursing intervention (Prabha, 2016). In the current study "care" aspect represent by implementing intradialytic leg exercises to improve functional status of those patients.

Cure aspect of patient care addresses the evaluation of pathological and therapeutic sciences applied by members of the medical team or deals with the responses of care provided for the patients by the medical team, especially nurses. (Sheeba, 2015). In relation to "cure" aspect in the current study, the researchers assess the effectiveness of intradialytic leg exercise on the functional status of patients on hemodialysis.

Methods

Aim of the study:

The aim of the current study was to evaluate effectiveness of intradialytic leg exercise on functional status among patients on hemodialysis.: Explanatory Randomized Control Study.

Research Hypotheses:

H1: Study group who received the intradialytic leg exercise will have a significant higher mean functional score than the control group who received the hospital routine treatment only.

H1-1: Study group who received the intradialytic leg exercise will have a significant higher physical mean score than the control group who received the hospital routine treatment only.

H1-2: Study group who received the intradialytic leg exercise will have a significant higher psychological function mean score than the control group who received the hospital routine treatment only.

H1-3: Study group who received the intradialytic leg exercise will have a significant higher social function mean score than the control group who received the hospital routine treatment only.

Research design:

Randomized Control Trial (RCT) is considered one of the highest levels of evidence in clinical practice. In which the randomization procedure gives the randomized controlled trial its strength as random allocation means that all participants have the same chance of being assigned to each of the study groups. In addition to randomization, the researchers can incorporate other methodologic strategies to reduce the risk of other biases that according to the level of blinding. So following the RCT steps is a must; which as follows; 1-Gathering

the Research Team (In the current study that all researchers were involved in each step), 2-Determining the Research PICOT (Patients; (patients with HD), Intervention; (applying the intradialytic Leg Exercise), Control, Outcome, Timing; was by (maintaining homogenous sample, measured the outcome by standardized, valid and reliable tool, specify timing of exercise and timing interval were based on evidence). 3-Defining Inclusion and Exclusion Criteria; (as stated in the methodology section). 4-Rondamization; (was maintained as it is illustrated at figure -1-) 5-Determining and Delivering the Intervention; (which was the intradialytic Leg Exercise). 6-Selecting the Control; (achieved by the homogenous control group). Determining and Measuring Outcomes; (using personal and medical data tool and Functional Status Tool along the study and the control groups). 7-Blinding Participants and/or investigators, (all patients with HD has an equal chance to be involved in the current study). 8-Ethical consideration, was maintained by having the approval from the IRB; which covered at (Protection of Human Rights) section. 9-Collecting the Data; (was achieved). 10-Determining Sample Size and Analyzing the Data; by using the sample size equation then analyzed the data at the results' section. 11-Disseminating and Reporting Results; (achieved at discussion section and by publishing the current study result). All referenced design's steps were supported by (Houle, 2015 & Jedad, 1998).

Parallel Explanatory Single Blind Randomized Control Trial (RCT) was utilized in the current study. As in Parallel RCT each group of patients is exposed to only one of the study interventions with strict patients' characteristics in order to address whether or not the current intervention works. While blind (RCT) the patients in which one group of individuals involved in the trial does not know the identity of the intervention that is given to each patient. Also a fixed size trial the researchers was achieved, through establishing deductively the number of patients (by using sample size calculation).

Setting:

The study was conducted at the hemodialysis units at one of Educational Hospital; Egypt.

Subjects:

Based on using G. Power sample size calculation was 114 adult male and female patients (57 patients in each group (study or control group) a power of 95% with confidence level at alpha error 0.05, receiving hemodialysis was enrolled in the study sample. Following equation was used:

$$\textit{Sample Size } n = N * [Z2 * p * (1-p)/e2] / [N - 1 + (Z2 * p * (1-p)/e2]$$

Inclusion Criteria: male and female adult patients their age was above 18 to 60 years, able to communicate, receiving hemodialysis treatment.

Exclusion criteria: Patients with/or had COVID-19, on chemotherapy, receiving genetic therapy, with previous failed kidney transplantation, autoimmune diseases, patients with

cardiac diseases or physical disability or orthopedic problems, current stroke was excluded from the study.

Tools

In order to achieve the purpose of the current study, two tools was used to collect data relevant to the study variables as follows:

Tool (1): Personal and Medical background information form; it consisted of two parts; the first part; includes patient's code, age, gender, education…etc; while the second part includes the duration of kidney disease, duration of hemodialysis per years, vital signs…etc.

Tool (2): Functional Status questionnaire (FSQ): It was established for easy administering that takes around 15 minutes; It provides information on patient's dimensions of physical, psychological, social/role functions. This questionnaire can be used both to screen initially for problems and to monitor the patient over time as well. Apparently it consists of three main parts, first part focuses on measuring the **Physical function**; that includes Activity of Daily Living (ADL) that divided on ***a)*** *Basic, ADL (BADL)*; that includes 4 questions and ***b-*** *Intermediate ADL (IADL)*; that includes 6 questions. ADL, scored from 0 to 4 per each question. 4=usually did with no difficult and 0=usually did not do for other reason. Also **Psychological function (Mental Health):** contains 5 questions; ranged from 1 to 6 as questions, 1,2 & 5 scored as 1= all of the time and 6 = none of the time. And question 3 & 4 scored as; 6= all of the time and 1 = none of the time. Whereas; **social/role function** that divided into ***a)*** *employment activity*; that consists of 6 questions; as 2, 5 & 6 scored from 1 to 4, as 1=all of the time and 4=none of the time. While; questions 1, 2 & 4 ranged from 4 to 1 that 4=all of the time and 1=none of the time. And ***b-*** *Social activity*; that includes 3 questions scored from 0 to 4 per each question. 4=usually did with no difficult and 0=usually did not do for other reason. And ***c-*** *Quality of social interaction;* that consists of 5 questions; as 1,3 & 4 scored from 1 to 6, as 1=all of the time and 6=none of the time. While; questions 2 & 5 ranged from 6 to 1 that 6=all of the time and 1=none of the time. (Jette & Cleary, 1986).

Tool score calculation as follow; (SUM of response scores for each grouping)/ (number of questions with valid information)) - 1) * (100 / ((maximum valid response score) - (minimum valid response score) = (Score) Interpretation is as follows; basic ADL, intermediate ADL, Psychological/mental health, work performance, social activities, quality of interactions as; 0 to 87, 0 to 77, 0 to 70, 0 to 78, 0 to 78 & 0 to 69 considers as Warning zone respectively. While; 88 to 100, 78 to 100, 71 to 100, 79 to 100, 79 to 100 & 70 to 100 considers Good respectively. (Jette & Cleary, 1986).

Reliability of FSQ; by using coefficient α was as follows; BADL section >0.75, IADL section >0.80, the work performance. Mental health of 0.74. While Social activities

had internal consistency of >0.65. Also content and construct validity was established. (Cleary & Jette, 2001).

Total Reliability score of the Arabic version of FSQ; was tested by the current researchers; by using coefficient α is (0.90) and classified as the following; ADL section was 0.94, Mental health is 0.80, Social activities is 0.91. While social interaction was 0.81.

Intradialytic leg exercise:

Intradialytic leg exercise includes the following steps: 1-stretches exercises for legs, hips and the waist legs (1 set), 2- Hip flexion for both legs (3 sets of 10 repetition), 3- knee flexion for both legs (3 sets of 10 repetition), 4-hip abduction for both legs (3 sets of 10 repetition), 5- Glute bridge (3 sets of 10 repetition), 6-stretches exercises for legs, hips and the waist, (1 set). (Kato et al., 2021). Its application takes between (15 to 25) minutes/three times weekly during the first 2 hours of hemodialysis session with patients on supine position to avoid intradialytic hypotension (Tamilmozhi, Valarmathi, Tamilselvi & Mekala, 2021). All patients in the study group was observed during the intradialytic exercise, the researchers were stop immediately the exercise when any patient complains from the following problems during exercise: headache, dizziness, nausea, exhaustion, palpitations or any other vital problem.

Protection of Human Rights:

Ethical approval was obtained from Research Ethics Committee-Faculty of Nursing Cairo University **(IRB 0006883)** Before the study commenced, each patient was informed about the nature, possible benefits, and purpose of the study. Both verbal and written consents was obtained from all patients within the study and the control groups; using separate informed consent depending on the RCT process either the patients were in the study or in the control group. The collected data was kept confidential. Assurance was given that they can withdraw from the study at any time and also privacy of information was maintained throughout the study. Emphasizing that the participation in the current study was entirely voluntary; anonymity and confidentiality were assured though coding the data.

Procedure:

Once permission of the study was obtained; the researchers was proceeding in the study process by firstly the eligible subjects, the researchers were explained to them the nature and the aim of the current study and official consent was obtained. **The preparatory phase:** Data collection was conducted for a period of 6 consecutive weeks. Based on the inclusion criteria patients were selected by using Parallel randomized control technique steps to enroll patients in the whole study. Then by using simple random sample (coin as tail) to decide out of which would be enrolled in either study or control groups.

demographic and medical data sheet using tool (1) was collected in addition to FSQ as initial reading/baseline/first reading before the application of the intradialytic leg exercise.

The implementation phase: The researchers explained the steps of intradialytic leg exercise for each patient individually at the study group before starting the hemodialysis session. Those patients would practice the intradialytic exercise once their hemodialysis session was started; with close observation by the researchers through 3 sessions/week over six consecutive weeks; its total practice time/session; approximately 25 minutes; that would take a place within the first two hours of the dialysis session. Regarding the control group, the researchers have been followed that; those patients were undertaking their routine treatment which is the hemodialysis session.

Evaluation phase: second measure would be repeated in the middle of the 6 weeks, in other words after 3 weeks for both (study and control) groups using FSQ using tool (2). While, the third and last measurement have been collected for (study and control) groups using FQS using tool (2). after an additional 3 weeks which was after 6 weeks from the beginning of the current study).

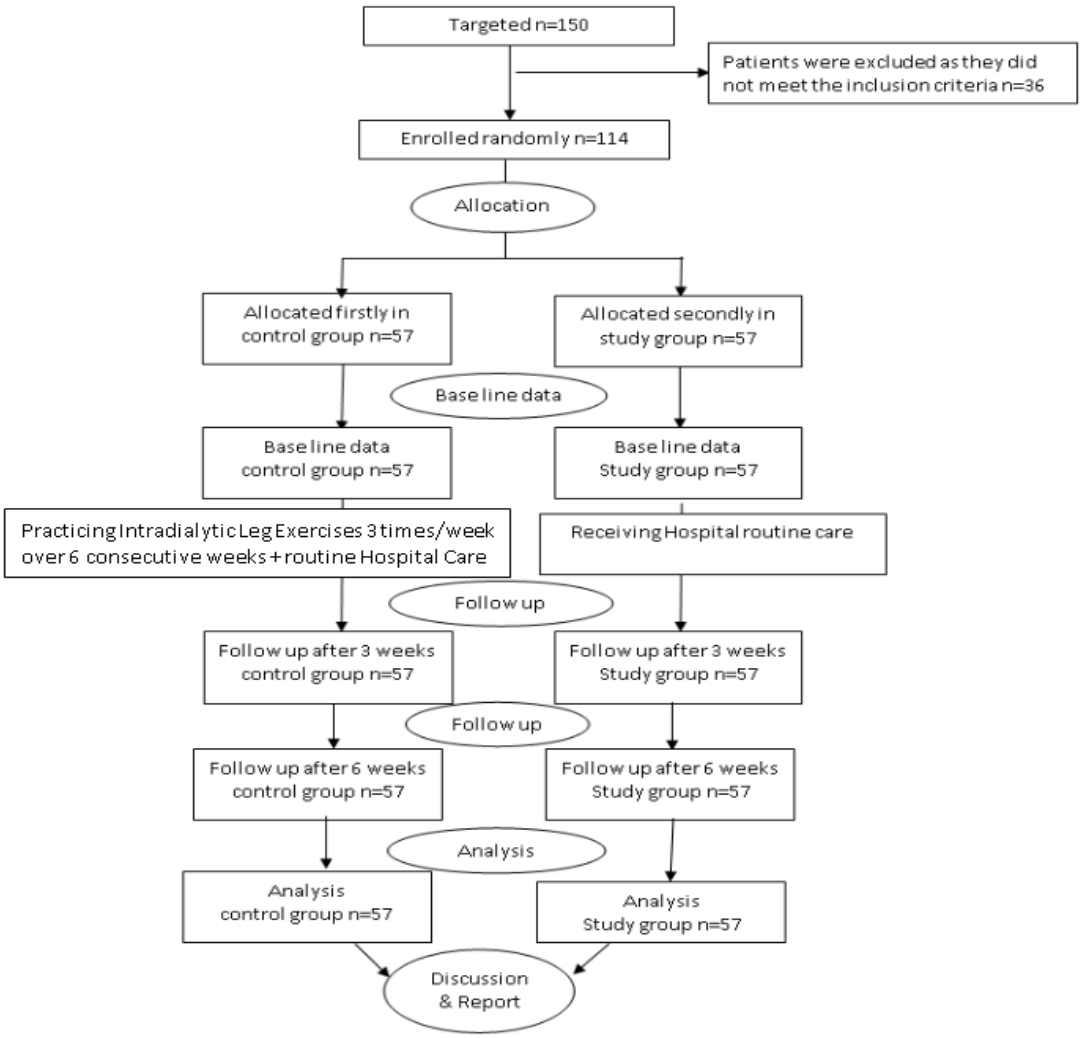
Operational Definition:

Functional Status: It aims to measure patient's different dimensions of physical, psychological, social and role functions related to the effectiveness of the giving clinical practice during the hemodialysis by using tool of FSQ (Jette & Cleary, 1986).

Intradialytic exercise: It is a simple exercise derived from the intradialytic ergometer; but regarding the intradialytic exercise; patients on hemodialysis will tend to train their lower body part's joints (hip, knees & waist), through simple movement during supine position three times/weekly (Kato et al., 2021). Each time ranged from (15 to 25) minutes during the first 2 hours of hemodialysis session (Tamilmozhi, Valarmathi, Tamilselvi & Mekala, 2021).

Statistical analysis:

The data was coded and tabulated using a personal computer. Statistical Package for Social Science (SPSS) version 20. (IBM, 2011). was used. Data is presented by using descriptive statistics in the form of frequencies and percentage…etc. Inferential tests is utilized as t-test, correlation tests,…etc, in relation to research variables. Statistical significance is considered at P-value ≤ 0.05.



Consort Diagram among patients on hemodialysis: RCT
Figure-1

Results

Statistical findings of the study are presented in three main sections as follows: **Section 1:** illustrates personal demographic characteristics and medical data of both study and control groups (Tables 1 and 2-1., 2-2). **Section 2:** Delineates hypothesis testing for being supported or not (Tables from 3 to 9). **Section 3:** Clarifying other additional findings such as the correlation between selected demographic characteristics and medical data with the functional status zone scores among study and control groups (Table 10).

Section 1:

Table (1) clarifies that (64.9%) and (56.1%) of the study and control groups' ages ranged between 50 to less than 60 years with mean of age (48.58 ± 10.427) for the study group, and (48.75±7.742) for the control group. Male gender represents (54.4 %, and 66.7 % correspondingly) of both study and control groups. In relation to marital status (89.5%, and 98.2% respectively) of both study and control groups were married. According to education level (40.4%, and 59.6% respectively) of both study and control groups can read and write. As regard to place of residence (63.2%, 61.4 % respectively) of both study and control groups had lived in rural region respectively. With reference to occupation, (43.9%, and 42.1% respectively) of both study and control groups had casual work. In addition, (93.0%, and 96.5% respectively) of both study and control groups were non-smokers. Moreover, (91.2%, and 82.5% respectively) of both study and control groups had no family history of renal failure. There were no statistical significant differences between study and control groups in relation to personal demographic characteristics.

Table (2-1) presents that (98.2%,100% respectively) of both study and control groups allocated between normal temperature's range. (94.7%, 100% respectively) of both study and control groups had normal range of pulse rate. (68.4%, 80.7% respectively) of both study and control groups had normal respiratory rate (61.4%, 73.7% respectively) of both study and control groups within normal range of blood pressure. In relation to laboratory investigations, (66.7%, 54.4% respectively) of both study and control groups had below normal range of Hb. (56.1%, 42.1% respectively) of both study and control groups had hyperkalemia. While (100%) of both groups had hypocalcemia and high level of urea and creatinine. In addition, there was no statistically significant difference between both groups regarding selected medical data.

Table (2-2) Also shows that (89.5%, 96.5% consequently) of both study and control groups had normal level of random blood sugar. (57.9%, 66.7% respectively) of study and control groups had normal BMI. (49.2%, 57.9% respectively) of both study and control groups had renal disease and receive hemodialysis treatment from 3 years to 6 years. In relation to duration of hemodialysis sessions, (100%) of both groups had hemodialysis session for more than 3 to less than 6 hours/session. (42.1%) of the study group had hypertension and diabetes mellitus. While, (31.6 %) of the control group had hypertension and Diabetes Mellitus diseases. Morever, there were no statistical significant difference between both groups regarding selected medical data.

Section 2:

Table (3): In relation to the basic ADL; there was a highly statistical significant difference among study and control groups (ANOVA test: 134.035, p-value: 0.000) along the study period. Also, there was a statistical significant difference between study and control groups in relation to post 1 and post 2 of interventions regarding basic activity of

daily living; with highly statistical significant difference after post 2 as t=2.801 at p=0.006. In addition, before intervention, there was no statistical significant difference between study and control groups (t-1.063 at p=0.290).

Table (4): Represented a highly statistical significant mean of difference among study and control groups in relation to the intermediate ADL, (ANOVA test: 37.339, p-value: 0.000) along the study period. Likewise, there was a statistical significant difference between study and control groups in relation to post 1 and post 2 interventions regarding intermediate ADL; as t=2.085 at p=0.039. In addition, there was no statistical significant difference between study and control groups before intervention.

Table (5) indicated that, there was a highly statistical significant difference among study and control groups regarding the psychological function; (ANOVA test: 57.074, p-value: 0.000) along the study period. Whereas, there was a highly statistical significant difference between study and control groups in the post 2 interventions regarding mental health, as t=2.505 at p=0.014. Furthermore; there was no statistical significant difference between study and control groups before intervention.

Table (6) indicates that, there was a highly statistical significant difference among study and control groups (ANOVA test: 3.393, p-value: 0.035) along the study period. While, there was a statistical significant difference between study group when compared to control group in the post 1 and post 2 interventions regarding employment activity; noticing that the highest statistical significant difference was at post 2 as t=1.978 at p=0.050. In addition, before intervention, there was no statistical significant difference between study and control groups.

Table (7) clarified that, there was a highly statistical significant difference among study and control groups (ANOVA test: 18.227, p-value: 0.000) along the study period. While, there was a statistical significant difference between study group when comparing with control group in the post 1 and post 2 interventions regarding social activities; observing that the highest statistical significant difference was at post 2 as t=2.056 at p=0.042. In addition, there was no statistical significant difference between study and control groups before intervention.

Table (8) elucidated that, there was no statistical significant difference among study and control group (ANOVA test: 2.595, p-value: 0.087) along the study period. In addition, there was no statistical significant difference between study and control groups before intervention or even in the post 1 and post 2 interventions regarding social interaction.

Table (9-1) clarified that, there was a statistical significant difference between both study and control groups after applying intradialytic leg exercises in relation to basic physical functional status zone after 3 and after 6 weeks as χ^2 = 5.36, p=0.021, 5.24, p-0.022 consequently and in relation to Intermediate physical function status zone after 6 weeks; as

χ^2 =5.68, p=0.017. Also regarding psychological function status zone, there was a statistically significant difference after 6 weeks as χ^2 =5.06, p=0.024.

Table (9-2) Illustrated that, there was a statistical significant difference between both study and control groups after applying intradialytic leg exercises regarding social role function status zone-: that related to employment after 3 weeks and 6 weeks but higher after 6 weeks as χ^2 = 4.24, p=0.039, and related to social activity after 6 weeks; as χ^2 =5.93, p=0.015. But there was no statistical significant difference regarding the social interaction part.

Section 3:

Table (10) illuminated that, there was negative correlations between age and basic ADL & intermediate ADL, mental health, social function and social activities; noticing the highest correlation was with intermediate ADL as it was strong; r= -0.684 with p=0.000. Also there was negative week correlations between BMI and basic ADL & intermediate ADL, mental health, social function and social activities; detecting the highest weak correlation was with mental health as r=- 0.251 with p=0.007.

Table (1): Personal demographic characteristics of study and control groups (n= 114).

Variables	Study group (57)		Control group (57)		χ^2	P- value
	No.	%	No.	%		
Age / Yrs:						
1. 20 < 30	5	8.8%	1	1.8%		
2. 30 < 40	4	7.0%	5	8.8%	5.273	0.153
3. 40 < 50	11	19.3%	19	33.3%		
4. 50 ≤ 60	37	64.9%	32	56.1%		
Mean ± SD	48.58±10.427		48.75±7.742			
Gender:					1.799	0.180
1. Male	31	54.4%	38	66.7%		
2. Female	26	45.6%	19	33.3%		
Marital status					4.234	0.237
1. Married	51	89.5%	56	98.2%		
2. Divorced	1	1.8%	0	0.0%		
3. Single	3	5.3%	1	1.8%		
4. Widow	2	3.4%	0	0.0%		
Education Level:					9.496	0.091
1. Cannot read or write	8	14.0%	2	3.4%		
2. Can read and write	23	40.4%	34	59.7%		
3. Primary School	1	1.8%	3	5.3%		
4. Preparatory	2	3.4%	0	0.0%		
5. Secondary	18	31.6%	15	26.3%		
6. University	5	8.8%	3	5.3%		
Place of Residence:					0.037	0.847
1.Urban	21	36.8%	22	38.6%		
2.Rural	36	63.2%	35	61.4%		
Occupation:					1.642	0.650
1. Does not work	8	14.0%	13	22.8%		
2. Employee	3	5.3%	2	3.5%		
3. Casual Work	25	43.9%	24	42.1%		
4. House wife	21	36.8%	18	31.6%		
Smoking:					0.704	0.402
1. Yes	4	7.0%	2	3.5%		
2. No	53	93.0%	55	96.5%		
Renal failure Family history						
1. Yes	5	8.8%	10	17.5%	1.919	0.166
2. No	52	91.2%	47	82.5%		

**** Significant ≤ 0.05 (2 – tailed).***

Table (2-1): Medical data of both study and control group (n= 114).

Variables	Study group (57)		Control group (57)		χ^2	P- value
	No.	%	No.	%		
Temperature:					1.009	0.315
1. Normal	56	98.2%	57	100%		
2. Fever	1	1.8%	0	0.0%		
Pulse rate:					3.081	0.079
1. Normal	54	94.7%	57	100%		
2. Tachycardia	3	5.3%	0	0.0%		
Respiration:					2.266	0.132
1. Normal	39	68.4%	46	80.7%		
2. Tachypnea	18	31.6%	11	19.3%		
Blood pressure:					2.036	0.361
1. Normal	35	61.4%	42	73.7%		
2. Hypotension	1	1.8%	1	1.8%		
3. Hypertension	21	36.8%	14	24.5%		
Laboratory investigations:						
1- Hb						
- Normal	19	33.3%	26	45.6%	1.799	0.180
- Below	38	66.7%	31	54.4%		
2- K						
- Normal	25	43.9%	33	57.9%	2.246	0.134
- Hyper	32	56.1%	24	42.1%		
3- Ca						
- Normal	0	0.0%	0	0.0%		
- Hypo	57	100%	57	100%		
4- Urea						
- Normal	0	0.0%	0	0.0%		
- Hyper	57	100%	57	100%		
5- Creatinine						
- Normal	0	0.0%	0	0.0%		
- Hyper	57	100%	57	100%		
6- Random blood sugar						
- Normal	51	89.5%	55	96.6%	2.151	0.142
Hyper	6	10.5%	2	3.4%		
BMI:						
- Normal BMI = 18.5–24.9	33	57.9%	38	66.7%	3.452	0.178
- Underweight = <18.5	3	5.3%	0	0.0%		
Overweight/ Obesity = ≥25	21	36.8%	19	33.3%		
Mean ± SD	24.14 ± 3.003		24.07± 2.426			

**** Significant ≤ 0.05 (2 – tailed***

Table (2-2): Medical data of both study and control group (n= 114) *(cont.).*

Variables	Study group (57)		Control group (57)		χ^2	P- value
	No.	%	No.	%		
Duration of kidney disease					7.313	0.063
- 5 months - ≤ one year	4	7.0%	8	14.0%		
- More than1 year <3 years	17	29.8%	15	26.3%		
- 3 years ≤ 6 years	28	49.2%	33	57.9%		
- > 6 years	8	14.0%	1	1.8%		
Mean ± SD	3.65 ±1.737		3.25± 1.467			
Duration of hemodialysis per years					7.313	0.063
-5 months - ≤one year	4	7.0%	8	14.0%		
-More than 1 year <3 years	17	29.8%	15	26.3%		
-3 years ≤ 6 years	28	49.2%	33	57.9%		
-> 6 years	8	14.0%	1	1.8%		
Mean ± SD	3.42 ±1.620		3.25 ±1.467			
Duration of hemodialysis session \ hour						
- 1 hour - < 3hours	0	0.0%	0	0.0%		
- 3 hours <6 hours	57	100%	57	100%		
Comorbid disease:					5.785	0.216
- Neurological disease	1	1.8%	0	0.0%		
- Hypertension and Diabetes Mellitus	24	42.1%	18	31.5%		
- Hypertension and cardiac disease	19	33.3%	15	26.3%		
- Hypotension	1	1.8%	1	1.8%		
- No	12	21.0%	23	40.4%		

- Reference of BMI: National Institute of Health.(2023).Calculate Body Mass Index. Available at https://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmicalc.htm.

**** Significant ≤ 0.05 (2 – tailed)***

Section 2:

Table (3): Comparison of mean scores of basic activity of daily living before and after intervention of intradialytic leg exercises among study and control groups (n=114)

Items	Study group (57) Mean ± SD	Control group (57) Mean ± SD	t-test	p-value
Pre intervention	7.58 ± 1.133	7.37± 0.975	1.063	0.290
Post intervention (1)	8.04 ± 1.792	7.39± 1.161	2.295	0.024**
Post intervention (2)	9.82± 1.692	8.95± 1.652	2.801	0.006**
ANOVA test P- value	134.035 0.000**			

*** Significant ≤ 0.05 (2 – tailed)**

Table (4): Comparison of mean scores of intermediate ADL before and after intervention of intradialytic leg exercises among study and control groups (n=114)

Items	Study group (57) Mean ± SD	Control group (57) Mean ± SD	t-test	p-value
Pre intervention	9.32 ± 3.929	8.65 ± 3.254	0.987	0.326
Post intervention (1)	12.04 ± 3.896	10.84 ± 3.040	1.823	0.071
Post intervention (2)	14.58 ±3.364	13.46 ± 2.284	2.085	0.039*
ANOVA test P- value	37.339 0.000**			

*** Significant ≤ 0.05 (2 – tailed)**

Table (5): Comparison of mean scores of psychological function (Mental Health) before and after intervention of intradialytic leg exercises among study and control groups (n=114)

Items	Study group (57) Mean ± SD	Control group (57) Mean ± SD	t-test	p-value
Pre intervention	11.05± 3.176	10.30± 2.891	1.326	0.187
Post intervention (1)	12.75 ± 2.378	12.40± 2.186	0.820	0.414
Post intervention (2)	16.84± 2.852	15.70± 1.918	2.505	.014**
ANOVA test P- value	57.074 0.000**			

*** Significant ≤ 0.05 (2 – tailed)**

Table (6) Comparison of mean scores of employment activities before and after intervention of intradialytic leg exercises among study and control groups (n=114)

Items	Study group (57) Mean ± SD	Control group (57) Mean ± SD	t-test	p-value
Pre intervention	14.07 ± 2.441	13.46 ± 2.122	1.433	0.155
Post intervention (1)	2.368±15.54	14.72 ± 1.934	2.036	.044*
Post intervention (2)	15.54 ±2.346	14.75 ± 1.892	1.978	.050*
ANOVA test P- value	3.393 0.035**			

***** Significant ≤ 0.05 (2 –tailed)***

Table (7): Comparison of mean scores of social activity before and after intervention of intradialytic exercises among study and control groups (n=114)

Items	Study group (57) Mean ± SD	Control group(57) Mean ± SD	t-test	p-value
Pre intervention	7.19 ± 1.846	7.18 ± 1.605	0.054	0.957
Post intervention (1)	7.74± 1.932	6.91± 1.618	2.470	0.015*
Post intervention (2)	8.39± 2.210	7.56± 2.070	2.056	0.042*
ANOVA test P- value	18.227 0.000**			

*** Significant ≤ 0.05 (2 – tailed)**

Table (8): Comparison of mean scores of social interaction before and after intervention of intradialytic exercises among study and control groups (n=114)

Items	Study group (57) Mean ± SD	Control group (57) Mean ± SD	t-test	p-value
Pre intervention	18.74 ± 3.930	18.81 ± 4.046	0.094	0.925
Post intervention (1)	18.88 ± 3.737	18.61 ± 4.178	0.354	0.724
Post intervention (2)	18.88 ±3.794	18.56 ± 4.205	0.421	0.675
ANOVA test P- value	2.595 0.087			

**** Significant ≤ 0.05 (2 – tailed).***

Table (9-1) Percentage distribution of Functional status zone among study and control groups (n=114)

Functional status zone	Study group (57)		Control group (57)		χ^2	P-value
	No.	%	No.	%		
Physical Function:						
A:						
Basic activity of daily living *before* intervention:						
▪ Warning zone	43	75.4%	47	82.5%	0.844	0.358
▪ Good zone	14	24.6%	10	17.5%		
Basic activity of daily living *after 3 weeks* of intervention:						
▪ Warning zone	36	63.2%	47	82.5%	5.361	0.021*
▪ Good zone	21	36.8%	10	17.5%		
***Basic activity of daily living after 6 weeks* of intervention:**						
▪ Warning zone	28	49.1%	40	70.2%	5.248	0.022*
▪ Good zone	29	50.9%	17	29.8%		
B:						
Intermediate ADL *before* intervention:						
▪ Warning zone	32	56.1%	36	63.2%	0.583	0.445
▪ Good zone	25	43.9%	21	36.8%		
Intermediate ADL *after 3 weeks* of intervention:						
▪ Warning zone	35	61.4%	43	75.4%	2.598	0.107
▪ Good zone	22	38.6%	14	24.6%		
Intermediate ADL *after 6 weeks* of intervention:						
▪ Warning zone	32	56.1%	44	77.2%	5.684	0.017*
▪ Good zone	25	43.9%	13	22.8%		
Psychological Function (Mental Health):						
Psychological Function *before* intervention:						
▪ Warning zone	32	56.1%	40	70.2%	2.413	0.120
▪ Good zone	25	43.9%	17	29.8%		
Psychological Function *after 3 weeks* of intervention:						
▪ Warning zone	32	56.1%	36	63.2%	0.583	0.445
▪ Good zone	25	43.9%	21	36.8%		
Psychological Function *after 6 weeks* of intervention:						
▪ Warning zone	24	42.1%	36	63.2%	5.067	0.024*
▪ Good zone	33	57.9%	21	36.8%		

*** Significant ≤ 0.05 (2 – tailed)**

Table (9-2) Percentage distribution of Functional status zone among study and control groups (n=114) *(cont.).*

Functional status zone	Study group (57)		Control group (57)		χ^2	P-value
	No.	%	No.	%		
Social\ Role Function:						
A:						
Employment activity before intervention:						
▪ Warning zone	29	50.9%	36	63.2%	1.754	0.185
▪ Good zone	28	49.1%	21	36.8%		
Employment activity after 3 weeks of intervention:						
▪ Warning zone	24	42.1%	35	61.4%	4.251	0.039*
▪ Good zone	33	57.9%	22	38.6%		
Employment activity after 6 weeks of intervention:						
▪ Warning zone	23	40.4%	34	59.6%	4.246	0.039*
▪ Good zone	34	59.6%	23	40.4%		
B:						
Social activity before intervention:						
▪ Warning zone	30	52.6%	36	63.2%	1.295	0.255
▪ Good zone	27	47.4%	21	36.8%		
Social activity after 3 weeks of intervention:						
▪ Warning zone	23	40.4%	36	63.2%	5.937	0.015*
▪ Good zone	34	59.6%	21	36.8%		
Social activity after 6 weeks of intervention:						
▪ Warning zone	22	38.6%	35	61.4%	5.930	0.015*
▪ Good zone	35	61.4%	22	38.6%		
C:						
Social interaction before intervention:						
▪ Warning zone	29	50.9%	35	61.4%	1.283	0.257
▪ Good zone	28	49.1%	22	38.6%		
Social interaction after 3 weeks of intervention:						
▪ Warning zone	28	49.1%	34	59.6%	1.273	0.259
▪ Good zone	29	50.9%	23	40.4%		
Social interaction after 6 weeks of intervention:						
▪ Warning zone	29	50.9%	34	59.6%	0.887	0.346
▪ Good zone	28	49.1%	23	40.4%		

*** Significant ≤ 0.05 (2 – tailed)**

Section 3:

Table (10): Correlation between Functional status zone score and selected items of demographic and medical data (n=114)

Selected demographic and medical data	Basic ADL	Intermediate ADL	Mental Health	Social Function	Social Activities	Social Interaction
Age	r: -0.622 P:0.000**	r: -0.684 P: 0.000**	r: -0.520 P: 0.000**	r: -0.361 P: 0.000**	r: -0.583 P: 0.000**	r: 0.139 P: 0.142
BMI	r: -0.190 P: 0.043**	r: -0.235 P: 0.012**	r: -0.251 P: 0.007**	r: -0.192 P: 0.041**	r: -0.227 P: 0.015**	r: -0.007 P: 0.943
Duration of Kidney disease	r: 0.025 P: 0.791	r: 0.039 P: 0.677	r: 0.113 P: 0.233	r: 0.015 P: 0.878	r: 0.062 P: 0.509	r: -0.076 P: 0.491
Duration of hemodialysis	r: 0.014 P: 0.886	r: 0.034 P: 0.716	r: 0.088 P: 0.350	r: -0.022 P: 0.812	r: 0.060 P: 0.526	r: -0.045 P: 0.638
HB	r: - 0.056 P: 0.554	r: - 0.049 P: 0.603	r: 0.009 P: 0.926	r: 0.013 P: 0.894	r: -0.080 P: 0.400	r: 0.000 P: 0.999
Urea	r: -0.036 P: 0.704	r: 0.049 P: 0.602	r: 0.077 P: 0.417	r: -0.062 P: 0.511	r: .076 P: 0.424	r: .078 P: 0.411
Creatinine	r: -0.081 P: 0.393	r: -0.083 P: 0.381	r: -0.036 P: 0.704	r: -0.058 P: 0.537	r: -0.075 P: 0.430	r: 0 .114 P: 0.228
Potassium	r: -0.058 P: 0.543	r: -0.061 P: 0.518	r: -0.130 P: 0.167	r: -0.046 P: 0.627	r: -0.059 P: 0.530	r: 0.073 P: 0.437

*** Significant ≤ 0.05 (2 – tailed)**

Discussion

The following discussion was pivoted by the theoretical framework of Core, Care and Cure Model which has been elaborated earlier at the framework section, also based on the result of the current study the researchers answered the proposed hypothesis in three main sections, *firstly*, demographic and medical section debate, *secondly*, first hypothesis argument with its sub-hypothesis, *thirdly* presented the last section that was for the additional finding discussion.

First section:

A committed start; there was no statistical significant difference between both study and control groups regarding the demographic data result; which reflected sample homogeneity. Merely two third of the study and control groups were males their age allocated between fifty to less than sixty years; that might reflect that gender must be taken in consideration regarding renal failure in any future study; particularly males spend several hours' outdoors for working as the current study found that more than one third of the studied sample had casual work which means that they occupied several hours under sun and has insensible loss than indoors occupation and probably they had to eat unhealthy food that might put them on the edge of chronic diseases as hypertension…etc; which might play a role on renal disease susceptibly. Furthermore, the most of them are married and was observed that more than two thirds of study and control groups were living in rural area; also less than half of the study group and merely half of the control group just can read and write without any mandatory education; all of these findings of having family burden; living at remote area in addition to insufficient educational level might play roles with those patients of reaching the chronicity of renal failure. However, it is a surprised finding that the most of the studied sample neither smoker nor with renal failure family history.

It goes without say that demographic data affect the kidney disease specially patients on hemodialysis as it is a well noted factor at various countries; as in a recent study that; conducted by Farag and El-Sayed (2022) was congruent by the same findings as they reported that patients undergoing dialysis in Egypt in 2020 was men with (59%), while 50% of them of age ≥55 years. Gaipove et al., (2020) were supported the current finding as they testified that 56% of their 5000 of studied hemodialysis sample was females. Also; Erickson, Zhao and Ho (2018) reported that; their examination of employment among patients on hemodialysis was changed regarding employment even in the 6 months of preceding dialysis initiation.

Apparently there was no statistical significant difference between both groups regarding selected medical data; that proved the homogeneity between study and control groups. Regarding the current study and control groups the most of them had normal pulse and temperature. Also more than two thirds of them had regular respiration and blood

pressure. However, regarding laboratory investigations, more than two thirds and more than half respectively of both study and control groups had anemia. Nerveless more than half of the study group and merely half of the control group had hyperkalemia. While all sample of both groups had hypocalcemia, hyper-uremia and hyper-creatinemia. In deed these results were expected as mostly those patients with renal failure are commonly to suffer from anemia and some sort of electrolyte imbalance that needs closed observation. Sitompul and Muzasti; (2023) supported the current finding as the majority of their studied patients who were under hemodialysis treatment suffered from low transferrin with (55.4%), and their average Hemoglobin (Hb) level in their study was 8.9 gr/dl.

A positive finding to report that the current study findings has been shown normal blood sugar among the most of the both groups. Merely half of the study group and merely two thirds of the control group had renal disease and were under hemodialysis treatment from 3 years up to 6 years. And all of the entire sample had hemodialysis sessions for more than 3 to less than 6 hours/session Moreover; merely two thirds of both study and control groups had normal body mass index (BMI). While, more than one third among study and control groups suffered from equally hypertension and Diabetes Mellitus diseases. Controversy finding was by Adler, Husain, Xiang, Rodrigue, and Waikar. Study at (2022) that Obesity among patients on hemodialysis was merely half of them was (≥ 30). While the same study was congruent with the current study as reported that around one third of their studied sample had hypertension; but diabetes mellitus was up to the half of their whole sample. In deed all of these finding reflected that patients on hemodialysis who had comorbid diseases; particularly hypertension, diabetes mellitus and obesity; might put them on the risk edge line of further complication.

Second Section:

Regarding the functional status related domains among study and control groups; it was crucial to discuss thoroughly; the indorsed factors of physical, psychological and social factors which related to the functional zone/status.

Apparently; when comparing both study and control groups; it pronounces; that both groups had some difficulties regarding performing the basic activity of daily living before applying intradialytic leg exercises; that proves study and control groups homogeneity, but after applying the intradialytic exercises by the study group; there was a highly statistical significant difference between study and control groups; that was observed after three weeks/post 1 and six weeks/post 2, correspondingly; while the highest significant result was after the first three weeks. On the other hand, and related to the intermediate activity of daily living, both groups had much difficulties regarding performing intermediate activity of daily living before applying intradialytic leg exercises; however, there was a statistical significant difference between both study and control groups after six weeks of applying intradialytic leg exercises through the study group.

Essentially; the researchers explained that finding as the application of intradialytic leg exercises play a role in enhancing the blood circulation that promotes musculature body function over the day; which took a part of patients' basic activity of daily living as (taking care of him/herself, eating, dressing or bathing, moving in or out of a bed or chair…etc) and there was reason effect on the intermediate activity of daily living as (walking several blocks, Walking one block or climbing, Doing work around the house……..etc). A systematic study was performed by Zhang et al., (2019) on exercise during hemodialysis; was agreed with the current study as they shown that physical performance is improved by exercises and they added its improvement occurred regardless of exercise frequency, intensity or time. Also they added that patients must adhere to the exercise intervention to preserve this leading effect. Thus; the finding supported the sub-hypothesis that hypothesized that there is a physical significant difference among patients with renal failure after practicing intradialytic leg exercise

Regarding the psychological function both study and control groups was homogenous as there was no statistical significant difference between both groups prior leg exercise practicing by the study group. Furthermore, the researchers claimed that there was a highly statistical significant difference along the research between study and control groups. Whereas, there was a highly statistical significant difference was well observed after six weeks/post 2 of the interventions regarding mental health. The researchers referred that finding as the leg exercise might enhance the blood circulation not only through muscles but also through brain that had a mental function improvement; which had been proved through patients' reports of improving their (nervousness status, enhancing their happiness condition along the current study …etc). A study by Rhee et al., (2019) was agreed with the current finding as they reported based on their study which conducted on patients on hemodialysis and was practicing exercise that there was a statistical significance after exercise training, as intradialytic exercise is beneficial for those patients' psychological health status. So the finding supported the sub-hypothesis that related to present of psychological significant difference among patients with renal failure after practicing intradialytic leg exercise.

Concerning social/role function it made up of (employment, activity & interaction) initially; there was no statistical significant difference between study and control groups before intervention which proof groups homogeneity. In the current research; related to employment activity as frequent rest, working regular hrs…etc; there was a highly statistical significant difference among study and control groups along the study period. Also, there was a statistical significant difference between study and control groups after three weeks/post 1 and after six weeks/post 2 interventions; observing that the highest statistical significant difference was at post 2. The researchers explained that finding as their physical activity probably took a role in their work performance which considers the other coin side of the employment activity; so their works achieved better than before. Additionally, related to social activities as visiting with relatives, participating in community activities,….etc;

there was a highly statistical significant difference between study and control groups Also, there was a statistical significant difference between study and control groups after three weeks/post 1 and after six weeks/post 2 interventions; detecting that the highest statistical significant difference was at post 2. The researchers claimed this finding as the patients after practicing the intradialytic exercises might become more energetic which reflected on their social activity to join community services.

Unfortunately; regarding social interaction; there was no statistical significant difference between study and control groups before intervention or even in the post 1 and post 2 interventions. Actually the researchers find this results reasonable; as those patients might need more time of practicing more exercise to have positive reflection on their social interaction specially that interaction refers to affectionate toward others; unreasonable demands on family…etc, Also; such interaction needs more tolerance and readiness from patients' sides; that they might need it. In deed Gallot., Reith and Ganea (2019) found similar result that partially congruent with the current study as part of their conducted study was related to the testing of the social interaction and social support but they reported that there was no significant noticed improvement for those patients. Accordingly, the finding supported partially the sub-hypothesis of the current study; as there was a significant difference among patients with renal failure after practicing intradialytic leg exercise regarding the employment, social activities.; however, there was no difference among the social interaction.

Furthermore; the functional status zone result as an integrated whole dimensions' parts of physical, psychological/mental and social/role function; the current study proved; that, there was a statistical significant difference between both study and control groups after applying intradialytic leg exercises in relation to basic physical functional status after three weeks and after six weeks and in relation to Intermediate physical function status after six weeks and in relation to the psychological function, after six weeks. Besides, the present study revealed that there was a statistical significant difference between both study and control groups after applying intradialytic leg exercises regarding social role function status-: that related only to employment after three weeks and after six weeks but was mostly higher after six weeks and also related to the social activity after six weeks. But there was not any statistical significant difference regarding the social interaction part.

The researchers explained that finding as the physical improvement considered the first aspect that got a positive effect as mainly the intradialytic led exercise is focusing on stretching the leg muscles; consequently, there was a psychological/mental improvement as it is well known that there was a strong bound between physical enhancement and psychological boosting. Also social/role function related to both employment and activity was enriched as a positive effect; But may be the social interaction need more time to take its place to be a noticed outcome.

Apparently; Rhee et al., (2019) supported the current finding as they performed exercise training through dialysis and they reported it was effective on both physical wellbeing and psychological/mental health. However; there was no sufficient related evidence related to the social function.

Third Section:

This section focused on the additional finding that might shed a light on the correlation between related variables and the sub-related functional status zone of physical, psychological/mental and social/role function.

The researchers found negative correlations between age and basic ADL & intermediate ADL, mental health, social function and social activities; noticing the strong correlation was with intermediate ADL. In deed the researchers interpreted this finding as in term of age usually has a significant value that play a role on body function that related to physical; psychological/mental and social/role function; that proved by the current findings as there was a negative correlation; in other word as long as the age increase the body function is gradually weaken. Actually there was no sufficient recent researches digging down the correlation between patients on hemodialysis and their age in relation to functional status (ADL); but a relevant study by Shah, Leonardo and Thakar (2018) reported a bound between those patients age and the improvement of functional status.

Likewise; there was a negative week correlations between BMI and basic ADL & intermediate ADL, mental health, social function and social activities; detecting the highest correlation was with mental health. The researchers inferred this finding as a significant reason finding; by means of the increasing of the BMI; the physical activity might face obstacles in term of declining in the ADL. Also the increasing of BMI might cause some sort of lessening in mental energy and consequently the BMI might affect the patients social function.

Conclusion

By applying the “Core, Care, and Cure Model” (1964) as a theoretical framework for the current study; as the Core: was targeted patients on HD, Care: patients in study group were practicing intradialytic leg exercises and finally Cure: to some extent was met as the researchers found a statistical significant difference regarding the functional status when likening the study groups result receiving intradialytic leg exercises comparing to the control group, sub-hypothesis of physical psychological/mental were accepted but social/role function was partially accepted as there was no statistical significant difference regarding to the social interaction elements.

Recommendations

1. The application of intradialytic leg exercises is recommended to be endorsed as a nursing practice for patients who are scheduled on hemodialysis.
2. Further studies are required to explicate the effectiveness of intradialytic leg exercises on functional status among patients on hemodialysis.
3. The study can be replicated including larger sample size to build the evidence base.
4. Further studies can be conducted on patients on peritoneal dialysis.

Implications:

1-Nursing practice:

Nurses are the health staff members who interact with patients on hemodialysis along the session time. Patients on hemodialysis suffer from serious complications such as physical inactivity or functional limitations. Therefore, nurses should act as an active member in supporting these patients by enabling them to perform leg exercises during dialysis to improve their functional status. Considering nursing implications for practice, endorsement of intradialytic leg exercise may contribute on the long term of practicing the improvement of the daily activity efficiency for those patients.

2-Nursing education:

As for nursing education implications, the application of intradialytic leg exercise would be a reference framework that would be taught in basic and continuing education programs as a nursing practice for health professionals. Additionally, this study may serve as a practice framework for the future development of further evidence-based nursing practice. Finally, the application of intradialytic leg exercise is safe, reasonable, and can be performed independently anywhere and at any time, which enhances its applicability.

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الملخص العربي

تأثير تمرين الساق أثناء الغسيل الكلوي على الحالة الوظيفية بين مرضى غسيل الكلى الدموى: دراسة تفسيريه عشوائيه منضبطة.

المقدمة: الغسيل الكلوي هو طريقة العلاج الأكثر استخدامًا على نطاق واسع في جميع أنحاء العالم ، يهدف إلى إزالة الفضلات من الدم، عندما تعجز الكليتان عن القيام بوظيفتهما على نحو سليم ويُعد الإستصفاء الدموي إحدى طرق علاج الفشل الكلوي المتطور، ويساعد في ممارسة حياة المريض على نحو طبيعي لكن قد يسبب بعض من المضاعفات منها انخفاض ضغط الدم، أو ارتفاعه، الغثيان، تشنج العضلات خصوصًا عضلات البطن والساقين، وحكة بالجسم، وغيرها مما يؤثر علي الحاله الوظيفية للمرضي فيزيد من حدوث الأمراض وأحيانا الوفيات. لذلك، فإن زيادة النشاط البدني من خلال ممارسة التمارين الرياضية بانتظام، وخاصة تمرين تمدد الساق ، قد يكون وسيلة فعالة لتحسين حالتهم الوظيفية التي تشمل جوانب الحياة الجسمانية والنفسية والذهنية وأيضا الإجتماعية. **الهدف من الدراسة الحالية:** هو تقييم فعالية تمرين الساق أثناء الغسيل الكلوي على الحالة الوظيفية بين مرضى غسيل الكلى الدموى. **تصميم البحث:** تم استخدام تصميم دراسة تفسيريه عشوائيه منضبطة لتحقيق غرض الدراسة. **فرضيات البحث:** مجموعة الدراسة التي تلقت تمرين الساق سيكون لديها متوسط درجات وظيفية (الحالة الجسمانية والنفسيه والاجتماعيه) أعلى من المجموعة الضابطة التي تلقت العلاج الروتيني في المستشفى فقط. **عينة البحث:** مكونة من 114 مريضًا بالغًا من الذكور والإناث الذين استوفوا معايير الاشتمال في التحليل. **النتائج:** كان هناك فرق ذو دلالة إحصائية بين كل من مجموعتي الدراسة و الضابطة في بعض الأسابيع بعد تطبيق تمارين الساق فيما يتعلق بوظائف الحالة الجسمانية و النفسية والأنشطة الاجتماعية ولكن لم يكن هناك فروق ذات دلالة إحصائية فيما يتعلق بالتفاعل الاجتماعي. **الاستنتاج:** كان تمرين الساق فعالا في تحسين العديد من جوانب الحالة الوظيفية بين المرضى الذين يخضعون لغسيل الكلى. التوصية: يوصى باعتماد تمرين الساق كممارسة تمريضية للمرضى الذين من المقرر أن يخضعوا لغسيل الكلى الدموي.