

AN EXPERIMENTAL STUDY TO ASSESS THE EFFECTIVENESS OF INTRADIALYTIC STRETCHING EXERCISE ON FATIGUE, MUSCLE CRAMPS AND ACTIVITIES OF DAILY LIVING AMONG PATIENTS UNDERGOING HAEMODIALYSIS AT SELECTED HOSPITAL OF SOUTH GUJARAT

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ABSTRACT

Chronic kidney disease is considered to be a threat to health and particularly for the developing countries, because of therapy's cost and its chronic nature. The ultimate treatment of chronic renal disease is dialysis. Hemodialysis patients experienced a range of symptoms, with considerable variation in the frequency and severity of symptoms. Objectives of the study are to assess the level of muscle cramps, fatigue and activities of daily living, to evaluate the effect of intradialytic stretching exercises on muscle cramps, fatigue and activities of daily living among patients undergoing haemodialysis and to determine the association between muscle cramps, fatigue and activities of daily living with selected demographic variables among patients undergoing haemodialysis. The Aim of the study is to evaluate the effect of intradialytic stretching exercises on muscle cramps, fatigue and activities of daily living among patients undergoing haemodialysis. A true experimental randomized control group research design was adopted for this study. 50 clients selected by simple random sampling method, 25 clients each in control group and experimental group. Clients in the experimental group received intra dialytic stretching exercise for 20 minutes after the first 20 minutes of starting haemodialysis for 20 days. Data was collected by cramp assessment scale, fatigue assessment scale and Barthel Index. In the experimental group, the mean pre-test score of the level of muscle cramps, fatigue and Activities of daily living was 32.72, 27.36 and 65.80 respectively which is significantly changed to 15.96, 14.32 and 78.80 after the intervention. And the t test (4.423, 4.15, 4.10 respectively $p < 0.05$) score shows that, there is a significant effectiveness of intradialytic stretching exercise on fatigue, muscle cramps and activities of daily living among patients undergoing haemodialysis.

Keywords: Intradialytic Stretching Exercise, Fatigue, Muscle Cramps, haemodialysis.

INTRODUCTION

Chronic kidney disease is considered to be a threat to health and particularly for the developing countries, because of therapy's cost and its chronic nature. More than 1 million people are living with the help of dialysis. In the year 2000 in USA, about 30 million people suffered from CKD and by 2010 more than 6,00,000 patients needed renal replacement therapy, costing about 28 billion dollars. In India about 90% of the patients couldn't afford the cost at present, there is no comparable registry or national surveillance system to detect the earlier stages of CKD, before dialysis or transplantation. Hemodialysis is the most common method used to treat advanced and permanent

kidney failure. In recent years more compact and simpler dialysis machines have made dialysis increasingly attractive. But even with better procedures and equipment, hemodialysis is still a complicated and inconvenient therapy.

Hemodialysis patients experienced a range of symptoms, with considerable variation in the frequency of symptoms experienced and in the severity with which the symptoms affected the individuals. Symptoms expression is significantly associated with sleep problems, fatigue and poor physical functioning. There is considerable potential for enhancement of quality of life by minimizing the symptoms experienced.

MATERIALS AND METHODS

RESEARCH DESIGN AND APPROACH: The research design used in this study was **experimental research design and quantitative research approach** was used for this study.

POPULATION: CRF Patients undergoing hemodialysis.

SAMPLE AND SAMPLING TECHNIQUE: The samples for the present study were 50 chronic renal failure patients undergoing hemodialysis, 25 in experimental group and 25 in control group.

DATA COLLECTION INSTRUMENTS: Self structured Demographic profile for collecting demographic data, Cramp assessment scale to assess the level of muscle cramps, Fatigue assessment scale to assess level of fatigue and Barthel index for assessing the level of activities of daily living.

RESULT

Section I: Table I: Socio-Demographic Variables

Sl No	Demographic variable	Category	Experimental group		Control group	
			Frequency	Percentage (%)	Frequency	Percentage (%)
1	Age	a) 21- 30 yrs	1	4	3	12
		b) 31 - 40 yrs	4	16	2	8
		c) 41-50 yrs	7	28	8	32
		c)52- 60 yrs	6	24	9	36
		d)60 and above	7	28	3	12
2	Sex	a) Male	18	72	15	60
		b) Female	7	28	10	40
		c) Transgender	0	0	0	0
3		a) Sedentary	7	28	7	28

	Life style	b) Moderately active	13	52	8	32
		c) Active	5	20	10	40
4	Diet	a) Vegetarian	13	52	16	64
		b) Non-Vegetarian	12	48	9	36
5	Duration of Renal failure	a) 0- 1 years	9	36	7	28
		b) 1-4 years	7	28	12	48
		c) 5-8 years	4	16	6	24
		d)9 yrs. and above	5	20	0	0
6	Duration of hemodialysis, Since;	a) 0- 1 years	9	36	8	32
		b) 1-2 yrs.	7	28	7	28
		c)3-4 Yrs.	4	16	9	36
		d) 5 yrs. and above	5	20	1	4
7	Use of calcium Supplements	a) Yes	19	76	11	44
		b) No	6	24	14	56
8	Presence of comorbid illness	a) Yes	13	52	13	52
		b) No	12	48	12	48
9	No of dialysis sitting per week	a) 1	1	4	0	0
		b)2	16	64	17	68
		c) 3	8	32	8	32
10	Exercise performance at home	a) Regular	5	20	11	44
		b) Irregular	10	40	4	16
		c) Never	8	32	9	36
		d) Stopped due to illness	2	8	1	4
11	Family history of CKD	a) Yes	4	16	5	20
		b) No	21	84	20	80

SECTION II

Table 2: Comparison of the overall Pre-test and Post-test level of muscle cramp, fatigue and activities of daily living in experimental group using percentage, standard deviation, mean, mean difference and 't' test.

N=25

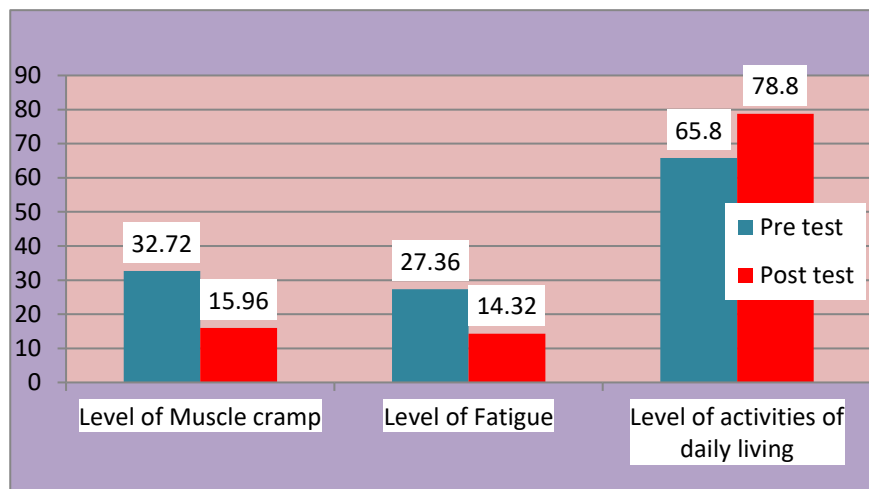
Observation	Percentage (%)	SD	Mean	Mean difference	Computed value of 't'	Table value of 't'	Significance
MUSCLE CRAMPS							
Pre-test	54.53	11.85	32.72	16.76	4.423	2.06	S
Post-test	26.6	4.49	15.96				
FATIGUE							
Pre-test	54.16	8.698	27.36	13.05	4.15	2.06	S
Post-test	28.88	3.20	14.32				
ACTIVITIES OF DAILY LIVING							
Pre-test	65.80	20.6	65.80	13.00	4.10	2.06	S
Post-test	78.8	15.8	78.80				

Note: S = Statistically significant, table value 2.06, $p \leq 0.05$, $df = 24$

With regard to percentage of the score of level of muscle cramps, it can be noticed that the pre-test score was 54.53 % which was significantly decreased to 26.6 % in the post test. The standard deviation of the pre-test level of muscle cramp was 11.85 and post- test was 4.49 respectively. Mean score distribution of pre-test level of muscle cramp was 32.72 which is significantly decreased to 15.96 in post-test with mean difference 16.76. The computed value of t was, $t = 4.423$ which was greater than the table value of $t = 2.06$ at the level of $p \leq 0.05$.

With regard to percentage of the score of level of fatigue, it can be noticed that the pre-test score was 54.16 % which was significantly decreased to 28.88 % in the post test. The standard deviation of the pre-test level of fatigue was 8.698 and post- test was 3.20. Mean score distribution of the level of fatigue shows that pre-test mean score was 27.36 which is significantly decreased to 14.32 in post-test with mean difference 13.05. The table 4 shows that the computed value of $t = 4.15$ which was greater than the table value of $t = 2.06$ at the level of $p \leq 0.05$. With regard to percentage of the score of level of activities of daily living, the pre-test score was 65.80 % which was significantly improved to 78.80% in the post test. The standard deviation of the pre-test level of activities of daily living was 20.7 and post- test was 15.8 respectively. Mean score distribution of the level of activities of daily living from the above table reveals that the pre-test mean score was 65.80 which is significantly improved to 78.80 in post-test with mean difference of 13. The computed t value shows that $t = 4.10$ which was greater than the table value of $t = 2.06$ at the level of $p \leq 0.05$. Hence **hypothesis is accepted for the score of muscle cramps, Fatigue and Activities of daily living in the experimental group.** i.e, there is a significant effect of intra dialytic stretching exercise on level of muscle cramps, fatigue and activities of daily living among patients undergoing Haemodialysis at the level of $p \leq 0.05$ in experimental group.

Graph I: Comparison of the mean Pre-test and Post-test level of muscle cramp, fatigue and activities of daily living in experimental group.



Graph 1 shows that the Mean pretest level of muscle cramp was 32.72 which is significantly decreased to 15.96 in post-test with mean difference 16.76. Mean pretest level of fatigue was 27.36 which is significantly decreased to 14.32 in post-test with mean difference 13.05. Mean pretest level of activities of daily living was 65.80 which is significantly increased to 78.80 in post-test with mean difference of 13.

SECTION III

Table 3: Comparison of the overall Pre-test and Post-test level of muscle cramp, fatigue and activities of daily living in control group using percentage, standard deviation, mean, mean difference and ‘t’ test.

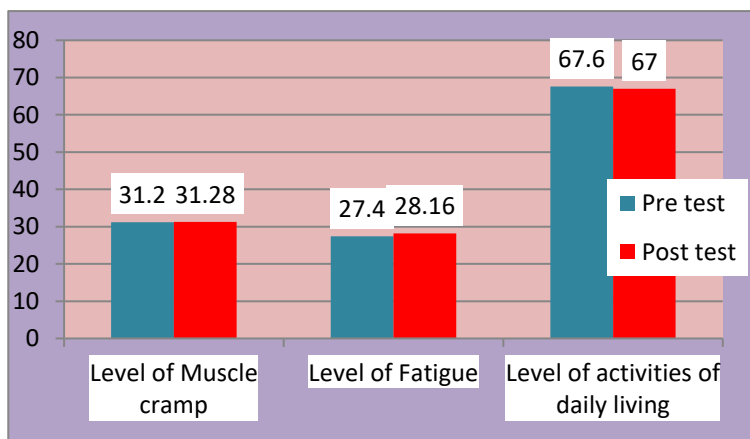
N=25

Observation	Percentage (%)	SD	Mean	Mean difference	Computed value of ‘t’	Table value of ‘t’	Significance
MUSCLE C RAMPS							
Pre-Test	52.07	9.48	31.2	0.082	0.56	2.06	NS
Post-Test	52.13	8.70	31.28				
FATIGUE							
Pre-Test	54.8	7.24	27.4	0.76	1.54	2.06	NS
Post-Test	56.32	6.87	28.16				
ACTIVITIES OF DAILY LIVING							
Pre-Test	67.6	18.66	67.60	0.60	0.61	2.06	NS
Post-Test	67.00	16.83	67.00				

Note: NS = Statistically not significant, table value 2.06, $p \leq 0.05$, $df = 24$

The table 3 shows the comparison of pre-test and post-test level of muscle cramp, fatigue and activities of daily living in control group using percentage, standard deviation, mean, mean difference and 't' test. It can be depicted from the table that the computed table of $t = 0.56, 1.54$ and 0.61 for the level of muscle cramps, fatigue and activities of daily living which was less than the table value of $t = 2.06$ at the level of $p \leq 0.05$. ie, there is no significant difference in pre test-post test level of muscle cramps, fatigue and activities of daily living among patients undergoing hemodialysis at in control group.

Graph 2: Comparison of the mean Pre-test and Post-test level of muscle cramp, fatigue and activities of daily living in control group.



The Graph 2 shows that the Mean score distribution of the level of muscle cramp in pre-test was 31.2 and 31.28 in post-test with no significant change with a mean difference of 0.08.

Mean score distribution of the level of fatigue from the above graph reveals that the pre-test mean score was 27.40 and 28.16 in post-test, there was no significant change with a mean difference of 0.76. Mean score distribution of the level of activities of daily living from the graph reveals that the pre-test mean score was 67.60 with no significant change in post test score, 67.80. with mean difference of 0.60.

SECTION IV

Table 4: Association between pre-test level of muscle cramps score among patients undergoing haemodialysis with selected demographic variables.

Sl no	Demographic variables	Category	Df	X ² Value & Significance
1	Age	a) 21- 30 yrs	4	4.58 NS
		b) 31 - 40 yrs		
		c) 41-50 yrs		
		c)52- 60 yrs		
		d)60 and above		
2	Sex	a)Male	1	2.68 NS
		b)Female		
		c) Transgender		

3	Life style	a) Sedentary	2	2.97
		b) Moderately active		NS
		c) Active		
4	Dietary Habit	a) Vegetarian	1	0.027
		b) Non Vegetarian		NS
5	Duration of Renal failure, Since	a) 0- 1 years	3	11.01
		b) 1-4 years		S
		c) 5-8 years		
		d) 9 yrs and above		
6	Duration of Dialysis treatment, Since	a) 0- 1 years	3	9.53
		b) 1-2 yrs		S
		c) 3-4 Yrs		
		d) 5 yrs and above		
7	Use of Calcium supplements	a) Yes	1	5.26
		b) No		S
8	Presence of co-morbid illness	a) Yes	1	11.78
		b) No		S
9	No of sitting for dialysis per week	a) 1	2	2.87
		b) 2		NS
		c) 3		
10	Exercise Performance at Home	a) Regular	3	14.58
		b) Irregular		S
		c) Never		
		d) stopped due to illness		
11	Family History of CKD	a) Yes	1	0.198
		b) No		NS

Note : $p \leq 0.05$, S – Significant, NS- Not Significant.

- The chi-square value shows that there was no association of level of muscle cramps among the patients undergoing haemodialysis with age, sex, life style, dietary habit, no of sitting for dialysis per week, family history of CKD.
- The chi-square value showing that there was an association of level of muscle cramps among the patients undergoing haemodialysis with duration of renal failure(since), duration of haemodialysis(since), use of Ca supplements, Presence of comorbid illness and exercise performance at home.

Table 5: Association between pretest level of Fatigue among patients undergoing hemodialysis with selected demographic variables

Sl no	Demographic variables	Category	Df	X ² Value & significance
1	Age	a) 21- 30 yrs	4	17.78 S
		b) 31 - 40 yrs		
		c) 41-50 yrs		
		c) 52- 60 yrs		
		d) 60 and above		

2	Sex	a) Male	1	0.03 NS
		b) Female		
		c) Transgender		
3	Life style	a) Sedentary	2	5.14 NS
		b) Moderately active		
		c) Active		
4	Dietary Habit	a) Vegetarian	1	0.07 NS
		b) Non Vegetarian		
5	Duration of Renal failure, Since	a) 0- 1 years	3	9.98 S
		b) 1-4 years		
		c) 5-8 years		
		d) 9 yrs and above		
6	Duration of Dialysis treatment, Since	a) 0- 1 years	3	15.57 S
		b) 1-2 yrs		
		c) 3-4 Yrs		
		d) 5 yrs and above		
7	Use of Calcium supplements	a) Yes	1	6.21 S
		b) No		
8	Presence of comorbid illness	a) Yes	1	4.77 S
		b) No		
9	No of sitting for dialysis per week	a) 1	2	5.08 NS
		b) 2		
		c) 3		
10	Exercise Performance at Home	a) Regular	3	10.88 S
		b) Irregular		
		c) Never		
		d) stopped due to illness		
11	Family History of CKD	a) Yes	1	0.16 NS
		b) No		

Note : * $p \leq 0.05$, S – Significant, NS- Not Significant.

- The chi-square value showing that there was no association of level of fatigue among the patients undergoing haemodialysis with sex, life style, dietary habit, no of sitting for dialysis per week and family history of CKD.
- The chi-square value showing that there was an association of level of fatigue among the patients undergoing haemodialysis with age, duration of renal failure since, duration of dialysis treatment since, use of Ca supplements, Presence of co morbid illness and exercise performance at home.

Table 6:- Association between pretest level of activities of daily living among patients undergoing hemodialysis experimental group with selected demographic variables.

Sl no	Demographic variables	Category	Df	X ² Value & Significance
1	Age	a) 21- 30 yrs	4	10.65
		b) 31 - 40 yrs		

		c) 41-50 yrs		S
		c)52- 60 yrs		
		d)60 and above		
2	Sex	a)Male	1	0.87 NS
		b)Female		
		c) Transgender		
3	Life style	a)Sedentary	2	0.733 NS
		b)Moderately active		
		c) Active		
4	Dietary Habit	a) Vegetarian	1	0.071 NS
		b) Non Vegetarian		
5	Duration of Renal failure, Since	a) 0- 1 years	3	12.9 S
		b) 1-4 years		
		c) 5-8 years		
		d)9 yrs and above		
6	Duration of Dialysis treatment, Since	a) 0- 1 years	3	10.69 S
		b) 1-2 yrs		
		c)3-4 Yrs		
		d) 5 yrs and above		
7	Use of calcium supplements	a) Yes	1	7.68 S
		b) No		
8	Presence of comorbid illness	a)Yes	1	12.98 S
		b) No		
9	No of sitting for dialysis per week	a) 1	2	0.586 NS
		b)2		
		c) 3		
10	Exercise Performance at Home	a) Regular	3	9.92 S
		b) Irregular		
		c) Never		
		d) Stopped due to illness		
11	Family History of CKD	a) Yes	1	0.25 NS
		b) No		

Note : *p ≤ 0.05, S – Significant, NS- Not Significant.

- The chi-square value showing that there was no association of level of activities of daily living among the patients undergoing haemodialysis with sex, life style, dietary habit, no of sitting for haemodialysis per week and family history of CKD.
- The chi-square value showing that there was an association of level of activities of daily living among the patients undergoing haemodialysis with age, duration of renal failure, duration of dialysis treatment, use of Ca supplements, Presence of co morbid illness and exercise performance at home.

DISCUSSION

A true experimental two group pre-test post-test with quantitative approach Study was conducted on 50 haemodialysis patients at selected settings to assess the effectiveness of intra dialytic stretching exercise on fatigue, muscle cramps and activities of daily living among patients

undergoing haemodialysis. Collected data were analyzed by using descriptive and inferential statistics and presented in the form of tables and figures.

The maximum number, 72 % of patients undergoing haemodialysis are males and 28 % are females. About 52% of the patients undergoing haemodialysis are living moderately active life style, 28 % are living sedentary life style and 20 % are living in active life style. About 52 % of patients undergoing haemodialysis are vegetarian and 48 % are non-vegetarians. There are about 36 % of patients undergoing haemodialysis are suffering with Renal failure from 0-1 years, 28 % patients from 1- 4 years, 20 % are from 9 years and above and about 16 % are suffering from renal failure from 5-8 years. 36% of the patients are undergoing haemodialysis from 0-1 years, 28% from 1-2 years, 20% from 5 yrs. and above and 16% from 3-4 years respectively. Majority 76% of patients undergoing are taking Calcium supplements and 26 % are not taking Calcium tablets. Majority 52% of patients undergoing are having comorbid illness such as DM, Hypertension. And 48% of patients are not having any comorbid illness. The results shows that 64 % of the patients undergoing haemodialysis treatment for 2 sittings in a week, 32% are undergoing dialysis for 3 times in a week and 4% of patients undergoing only for once in a week. About 40 % of the patients undergoing are not doing exercise regularly, 32 % are never doing exercise at home, 20 % are doing exercise regularly and 8 % of patients stopped exercise due to illness. About 84% of patients undergoing haemodialysis are not having family history of renal failure and 16% of patients are having family history of renal failure.

With regard to percentage of the score of level of muscle cramps, it can be noticed that the pre-test score was 54.53 % which was significantly decreased to 26.6 % in the post test. The standard deviation of the pre-test level of muscle cramp was 11.85 and post- test was 4.49 respectively. Mean score distribution of pre-test level of muscle cramp was 32.72 which is significantly decreased to 15.96 in post-test with mean difference 16.76. The computed value of t was, $t = 4.423$ which was greater than the table value of $t = 2.06$ at the level of $p \leq 0.05$. Hence, hypothesis H₁ is accepted for the level of muscle cramp in experimental group and it shows that there is a significant decrease in the muscle cramp score of haemodialysis patients who are receiving intradialytic exercise. With regard to percentage of the score of level of fatigue, it can be noticed that the pre-test score was 54.16 % which was significantly decreased to 28.88 % in the post test. The standard deviation of the pre-test level of fatigue was 8.698 and post- test was 3.20. Mean score distribution of the level of fatigue shows that pre-test mean score was 27.36 which is significantly decreased to 14.32 in post-test with mean difference 13.05. The computed value of $t = 4.15$ which was greater than the table value of $t = 2.06$ at the level of $p \leq 0.05$. Hence, hypothesis H₁ is accepted for the fatigue level in experimental group. It shows that there is a significant decrease in the fatigue score of haemodialysis patients who are receiving intradialytic exercise. With regard to percentage of the score of level of activities of daily living, the pre-test score was 65.80 % which was significantly improved to 78.80% in the post test. The standard deviation of the pre-test level of activities of daily living was 20.7 and post- test was 15.8 respectively. Mean score distribution of the level of activities of daily living reveals that the pre-test mean score was 65.80 which is significantly improved to 78.80 in post-test with mean difference of 13. The computed t value shows that $t = 4.10$ which was greater than the table value of $t = 2.06$ at the level of $p \leq 0.05$. Hence hypothesis H₁ is accepted for the score of Activities of daily living in the experimental group. Hence, it can be conclude that there is a significant improvement in the score of activities of daily living among

haemodialysis patients who are receiving intradialytic exercise. With regard to percentage of the score of level of muscle cramps, it can be noticed that the pre-test score was 52.07 % and there was no significant change in the post test score which is 52.13 %. The standard deviation of the pre-test level of muscle cramp was 9.48 and post- test was 8.70. Mean score distribution of the level of muscle cramp from the above table reveals that the pre-test mean score was 31.2 and 31.28 in post-test with no significant change with a mean difference of 0.08. It can be depicted from the table that the computed table of $t = 0.56$ which was less than the table value of $t = 2.06$ at the level of $p \leq 0.05$. Hence, hypothesis H1 is rejected for the level of muscle cramps in control group. Hence, it can be conclude that there is no significant change in muscle cramp score of haemodialysis patients who are not receiving intradialytic exercise. With regard to percentage of the score of level of fatigue, it can be noticed that the pre-test score was 54.80 % with no significant change with percentage score of 56.32 % in the post test. The standard deviation of the pre-test level of fatigue was 7.24 and post- test was 6.87 respectively. Mean score distribution of the level of fatigue from the above table reveals that the pre-test mean score was 27.40 and 28.16 in post-test, there was no significant change with a mean difference of 0.76. It can be depicted from the table that the computed table of $t = 1.54$ which was less than the table value of $t = 2.06$ at the level of $p \leq 0.05$. Hence, hypothesis H1 is rejected for the level of fatigue in control group. Hence, it can be conclude that there is no significant decrease in the fatigue score of haemodialysis patients who are not receiving intradialytic exercise. With regard to percentage of the score of level of activities of daily living, it can be noticed that the pre-test score was 67.60 % with no significant change in post test score of 67.00%. The standard deviation of the pre-test level of activities of daily living was 18.66 and post-test was 16.83 respectively. Mean score distribution of the level of activities of daily living from the above table reveals that the pre-test mean score was 67.60 with no significant change in post test score, 78.80. with mean difference of 0.60. It can be depicted from the table that the computed table of $t = 0.61$ which was less than the table value of $t = 2.06$ at the level of $p \leq 0.05$. Hence hypothesis H1 is rejected for the level of activities of daily living in control group. Hence, it can be conclude that there is no significant change in the score of activities of daily living among haemodialysis patients who are not receiving intradialytic exercise.

CONCLUSION

The study was conducted during to assess the effectiveness of intra dialytic stretching exercise on fatigue, muscle cramps and activities of daily living among patients undergoing haemodialysis. In the experimental group, the men pre-test score of the level of muscle cramps, fatigue and Activities of daily living was 32.72, 27.36 and 65.80 respectively which is significantly changed to 15.96, 14.32 78.80 after the intervention. And the t test score shows that, there is a significant effectiveness of intradialytic stretching exercise on fatigue, muscle cramps and activities of daily living among patients undergoing haemodialysis

CONFLICT OF INTEREST

The authors have no conflicts of interest regarding this investigation.

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REFERENCES

- 1- <https://www.worldkidneyday.org/facts/chronic-kidney-disease>.
- 2- Lewis S, Heitkemper M. and Dirksen S. Medical Surgical Nursing . 10th. edition Missouri comp. 2004; 141.
- 3- [Ezekiel Uba Nwose¹, Joshua Obianke, Ross Stuart Richards, Phillip Tederera Bwitit, Eunice Obiajuru Igumbor](#) 2019 Jan 22;90(1):97-103. doi: 10.23750/abm.v90i1.6576.
- 4- [Robert Thomas, Abbas Kanso, and John R. Sedor](#), Chronic Kidney Disease and Its Complications <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2474786/>.
- 5- Linda S Williams, Paula D Hopper, Understanding Medical Surgical Nursing, 2nd Edition, 2010, m FA Davis company # 600-607.
- 6- Suresh K Sharma, Nursing Research & Statistics, Elsevier Publications, Third edition 2018
- 7- Wills M, Evelyn, McEwen Melanie. Theoretical basis for Nursing. Philadelphia. Lippincott. 214-216.
- 8- Sanjay Aggarwal, Dialysis incidence of India. Research gate. 2018; 232-233.
- 9- [Mary Mallappallil, Eli A Friedman,¹ Barbara G Delano, Samy I McFarlane, and Moro O Salifu](#). <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4291282/>
- 10- Shyam.C. K.V. Dakshina Murty, V. Sreenivas, Rapur Ram. Chronic kidney disease; Need for national action plan, Indian J Med Res, India. 2007 April; 125(4):498-501 URL: <http://medind.nic.in/iby/t07/i4/ibyt07i4p498.pdf>.
- 11- Nolan.S, Podoll.S.A. et al. Prevalence of chronic kidney disease and progression of disease over time among patients enrolled in Houston West Nile. Plos one. 2017; 7(7): <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal>.
- 12- Zhang.L.Q, Rothenbacher.D. Prevalence of CKD in population based studies: systematic review. BMC Public health centre: 2018: <http://www.biomedcentral.com/1471-2458/8/117/>.
- 13- Huda.N, Rashid. et al. Prevalence of CKD and its association with renal failure in disadvantaged population. International journal of nephrology. 2012 <http://www.hindawi.com/journals/ijn/2012/267329/>
- 14- Centers for Disease Control and Prevention. Chronic kidney disease surveillance system website. <http://www.cdc.gov/ckd>. Accessed March 9, 2017 https://www.cdc.gov/kidneydisease/pdf/kidney_factsheet.pdf.
- 15- Vivekanandh Jha. Official journal of international society of nephrology. Vol3. Issue2; 157-60.
- 16- James.B. Wetmore. 2016. Global challenges posed by the growth of end-stage renal disease. Renal replacement therapy. 2016; 2-15.
- 17- [Bincy Joshwa, Deepika C Khakha and Sandeep Mahajan](#). Fatigue, depression and sleep problem among haemodialysis patients in tertiary care center. Saudi journal of kidney disease and transplantation. 2014; 23(4):729-735 Available at <http://www.sjkdt.org/article.asp?issn=1319-2442;year=2012;volume=23;issue=4;page=729;epage=735;aulast=Joshwa>
- 18- Raiman.G.J, Kruse.A. et al. Fatigue in haemodialysis patients with or without diabetes: Results from a randomized controlled trial of two glucose containing dialysate. American diabetic association, 2012; 33(9):21-<http://care.diabetesjournals.org/content/33/9/e121.full>
- 19- Davison. Pain in haemodialysis patients: prevalence, cause, severity and management Am J Kidney Dis. 2003; 42(6):1239-47.
- 20- Storer.W, Richard.C. et al. Endurance exercise training during haemodialysis improves strength, power, fatigability and physical performance in maintenance haemodialysis patients.

- Nephrology dialysis transplantation.2005;20(5):1429-1437 Available from <http://ndt.oxfordjournals.org/content/20/7/1429.short>.
- 21- Segura.E.Exercise in haemodialysis patients: systematic review. *Nefrologia*. 2010;30(2): 236-246. Available from <http://scielo.isciii.es/pdf/nefrologia/v30n2/evidencia.pdf> [Nada Salhab](#), [Mirey Karavetian](#), [Jeroen Kooman](#), [Enrico Fiaccadori](#), and [Cosette F. El Khoury](#), *J Nephrol*. 2019; 32(4): 549–566. Published online 2019 Jan 18. doi: 10.1007/s 40620-018-00565.
- 22- Paul.V.D.Eager.T.etal.The effectiveness of aerobic and muscle strength training in patients receiving hemodialysis and EPO.*American journal of kidney disease*.2012; 40:1219-1229 Available at <http://www.cebp.nl/media/m1048.pdf>
- 23- Chen.L.T,Godfrey.etal.Effect of intradialytic,low intensity strength training on functional capacity in adult hemodialysis patients: a randomized pilot trial. *Nephrology dialysis transplantation*.2010;25(6) Available from <http://ndt.oxfordjournals.org/content/25/6/1936>.
- 24- Fowels.H.J, Green.H.J.etal.Human neuromuscular fatigue is associated with altered Na⁺ K⁺ ATPase activity following isometric exercise. *Journal of applied physiology*.2002;92(4):1585-1593. Available from <http://www.jappp.org/content/92/4/1585.short>
- 25- Goshis FD. Hali G A, Fid G Noki. Fatigue and depression and sleep problems among haemodialysis patients in a tertiary care center. *A j kidney dis transpla* 2012 July [cited 2012 Dec 20]; 23.