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Original Research Article

# Feasibility of Physiotherapy Treatment on Functional Capacity in Chronic Kidney Disease Patients

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## ABSTRACT

**Background:** Chronic kidney disease (CKD), is a irreversible decline in renal function that usually develops over the years. With its high prevalence, morbidity and mortality, is an important public health problem. Several issues contribute to increase in number of same in India. There are limited exercise guidelines on the optimal type, frequency, intensity, and duration of physical activity to prevent chronic kidney disease. There is a need to study whether physiotherapy interventions can improve cardiorespiratory fitness, reduce or prevent muscle wasting, make patients with chronic illness more independent in activities of daily living, and improve quality of life during or even before dialysis.

**Purpose of the study:** To study the feasibility of physiotherapy treatment on functional capacity in chronic kidney disease patients.

**Results:** The results were statistically significant with respect to all the outcome measures. Results showed improvement in all the outcome parameters and significant improvement was seen in 2-minute step test,1-min sit to stand test, and Fatigue severity scale.

**Conclusion:** Based on results obtained it proves that exercises significantly improved patients exercise/functional capacity (muscular strength and aerobic endurance), quality of life, number of steps in 2-minute duration as well as number of repetitions of sit to stand in 1 minute duration and also decrease in experimental group.

**KEYWORDS:** Chronic kidney disease, Exercise therapy, Rehabilitation, Post-dialysis physical therapy.

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## INTRODUCTION

Chronic kidney disease (CKD), formerly known as chronic renal failure, represents an irreversible decline in renal function that usually develops over the years [1].

CKD, with its high prevalence, morbidity and mortality, is an important public health problem. Several issues contribute to increase in number of CKD in India.Prevalence of chronic kidney disease (CKD) appears to be increasing in India. Few studies have recorded occurrence of CKD in urban population, but there is a paucity of such studies in the rural populations [2].

Some of the common causes of CKD are Congenital and Inherited, Renovascular Disease, Hypertension, Glomerular Disease, Interstitial Disease, Systemic Inflammatory disease, Diabetes Mellitus.1Most patients with slowly progressive disease are asymptomatic until GFR falls below 30ml/min/1.73m2 (stage 3 and 5) [1]. Few characteristics of chronic kidney disease include immune dysfunction that leads to increased susceptibility to infectious diseases; anemia; electrolyte imbalances and metabolic acidosis; endocrine abnormalities that lead to prolonged insulin half-life; neurological and muscular dysfunction; cardiovascular disease; metabolic disorders of the bone [1].

Sarcopenia, defined as decreased muscle mass or function, is prevalent in chronic kidney disease CKD) increasing the risk of mobility impairment and frailty. There are reports that exercise could suppress or prevent muscle wasting. In patients with CKD, it was reported that endurance exercise undertaken just before a dialysis improves strength, power, fatigability, and physical performance in maintenance hemodialysis patients [3].

Fatigue is a commonly reported and debilitating symptom among patients with CKD. People with Chronic Kidney Disease regardless of whether they are predialysis or receiving either peritoneal or hemodialysis experience high levels of fatigue and are able to engage in fewer daily activities. Physical activity has been shown to improve fatigue in some small but promising trials, and so should be recommended, given the additional benefits of exercise [4].

Renal disease (CKD) is an important risk factor for cardiovascular disease (CVD) and death. The increase in CKD over the last few decades has been associated with an increase in obesity, diabetes and metabolic syndrome. Lack of exercise is a correctable risk factor that can affect the onset and progression of chronic kidney disease. Exercise is known to improve many metabolic factors such as blood pressure and insulin resistance, maintain renal function, and reduce the risk of cardiovascular disease [5]. Exercise improves cardiorespiratory fitness, hemodynamic response, malnutrition-inflammatory complex syndrome, and quality of life in CKD patients. Formal exercise recommendations for diabetes and hypertension have been published, but guidelines on the optimal type, frequency, intensity, and duration of physical activity to prevent CKD have not yet been formalized. Few studies assess physical activity in non-dialyzed chronic kidney disease populations. No studies have reported a decline in renal function as a result of exercise [6].

One of the main goals in the treatment of chronic kidney disease before dialysis is to slow the progression of the disease. Exercise has the ability to positively influence many of the upstream factors associated with the progression of kidney disease. In fact, the higher the level of recreational physical activity, the slower the decline in renal function in the elderly and existing chronic kidney disease patients [7].

Physical fitness is an important factor in maintaining physical function, significantly diminishing in predialysis patients, ranging from 50-80% in healthy subjects, and diminishing as the disease progresses. Peak oxygen consumption (VO2peak), a measure of athletic performance, is an independent predictor of mortality in End stage renal disease (ESRD) patients, emphasizing the importance of measures to improve CKD athletic performance. Aerobic exercise has been shown to significantly increase peak VO2, exercise tolerance, and anaerobic work thresholds in predialysis patients. Increased physical fitness has also been reported due to improved physical function and quality of life (QOL).[7]One of the main causes for reduced exercise capacity in CKD is muscle weakness. Increases in muscular strength have been reported following 4 months of aerobic walking and cycling with an increased VO2peak [7].

The lack of written guidelines and coordinated exercise provision means the incorporation of exercise in the treatment and management of CKD has been neglected, and falls far behind that of cardiac and pulmonary services. Trials conducted in the pre-dialysis stages of CKD suggest that exercise can improve exercise capacity and multiple measures of physical function, which have been shown to decrease as disease progresses. Data also suggests that aerobic exercise in particular, confers protection against the decline in cardiac function and the development of cardiovascular disease through the improvement of both traditional and nontraditional risk factors [7].

There are limited exercise guidelines on the optimal type, frequency, intensity, and duration of physical activity to prevent chronic kidney disease. There is a need to study whether physiotherapy interventions can improve cardiorespiratory fitness, reduce or prevent muscle wasting, make patients with chronic illness more independent in activities of daily living, and improve quality of life during or even before dialysis. Therefore, this study is undertaken that aims to assess the feasibility of physiotherapy treatment on functional capacities in chronic kidney disease patients.

## METHODS

**Study design:** This was an experimental study with random selection of patients using convenient sampling. Ethical clearance was obtained from Ethical committee, Shree Dharmasthala Manjunatheshwara College of Medical Sciences and Hospital, Sattur, Dharwad. All the subjects were explained about the treatment procedure. A written consent was obtained from the subjects willing to participate in the study. Inclusion criteria were Patients those who were willing to participate in the study, patients of either gender, patients with age from 18-70 years, patients able to follow commands, CKD patients with any etiology. Exclusion criteria were patients who were unable to ambulate with any lower limb fracture from past 1 year or locomotor disability or ulcers, patients with psychiatric illness and non-cooperative individuals, patients with stroke with paralysis, patients on any kind of oxygen support, patients contraindicated for stress testing.

**Type of materials involved:** Consent form, demographic data sheet, pulse oximeter, stop watch, measuring tape, chair (Armless) Stationery.

**Description of all comparison:** Once the subjects were in OPD or Dialysis Unit, they were assessed for vitals prior to the commencement of assessment of functional capacity. Followed by which fatigue was assessed using the Fatigue severity Scale, and 2minute step- test was asked to perform by the patient to assess functional capacity. A 1-minute Sit to Stand test was asked to Perform to assess the lower extremity endurance of the patient.

**Experimental study group was given following set of exercise protocol-** Seated knee extension, Seated hip flexion, Seated arm curls, standing leg exercises (hip-knee flexion with chair support, toe raises with chair support) accompanied by breathing exercises. Each of these exercises were asked to perform for ten repetitions for 3 months. Control group patients were given general mobility exercises followed by breathing exercises for 3 months.At the end of the 3rd month, functional capacity of all the patients was reassessed, using the 1 min sit to stand test and fatigue severity scale, 2-minute step-test.Exercise dosage was 3 times a week, for 3 months. All the exercises were taught to patient's caretaker to carry them out at home. weekly telerehabilitation was done to have a check on exercises and for any corrections if needed.

**Study Analysis:** The data were analyzed using statistical software R software version 4.1.2 and Microsoft Excel.

## RESULTS

This table is presenting comparison between 2 groups- control and experimental with respect to gender. In experimental group there were 25 samples, out of 25 samples males were 14 and females were 11 with 56% and 44% respectively. Similarly in control group 21 were males and 4 were females and the percentage was 84% and 16 % respectively. The difference for gender distribution between experimental and control group was not significant.

Similarly for age groups, maximum that is 9 in experimental group belongs to 51-60 years and in control group maximum that is 7 were in 41-50 years and 61-70 years age group. Overall, there was difference in distribution of experimental participants and control participants in different age groups. P value was 0.0310 that is <0.05 that means significance. Mean wise there was no difference but distribution wise there was difference.

**Table 1:** Comparison of experiment group and control group with gender and age.

| Profile | Experiment group | % | Control group | % | Total | % | $\chi^2$ | p-value |
|---|---|---|---|---|---|---|---|---|
| Gender | | | | | | | | |
| Male | 14 | 56 | 21 | 84 | 35 | 70 | 2.161 | 0.706 |
| Female | 11 | 44 | 4 | 16 | 15 | 30 | | |
| Age groups | | | | | | | | |
| 20-30yrs | 2 | 8 | 3 | 12 | 5 | 10 | 4.667 | 0.0310* |
| 31-40yrs | 3 | 12 | 3 | 12 | 6 | 12 | | |
| 41-50yrs | 7 | 28 | 7 | 28 | 14 | 28 | | |
| 51-60yrs | 9 | 36 | 5 | 20 | 14 | 28 | | |
| 61-70yrs | 4 | 16 | 7 | 28 | 11 | 22 | | |
| Total | 25 | 100 | 25 | 100 | 50 | 100 | | |
| Mean | 49.6 | | 50.24 | | 49.92 | | | |
| SD | 11.51 | | 13.27 | | 12.3 | | | |

*p<0.05

**Table 2:** Normality of pretest and posttest scores of all parameters in experiment group and control group by Kolmogorov Smirnov test.

| Parameters | Time points | Experiment group | | Control group | |
|---|---|---|---|---|---|
| | | Z-value | P-value | Z-value | P-value |
| HR (bpm) | Pretest | 0.097 | 0.2 | 0.127 | 0.2 |
| | Posttest | 0.091 | 0.2 | 0.112 | 0.2 |
| | Difference | 0.144 | 0.195 | 0.15 | 0.153 |
| SBP(mmHg) | Pretest | 0.166 | 0.073 | 0.144 | 0.195 |
| | Posttest | 0.133 | 0.2 | 0.177 | 0.0410* |
| | Difference | 0.239 | 0.0010* | 0.282 | 0.0001* |
| DBP(mmHg) | Pretest | 0.343 | 0.0001* | 0.488 | 0.0001* |
| | Posttest | 0.3 | 0.0001* | 0.449 | 0.0001* |
| | Difference | 0.296 | 0.0001* | 0.459 | 0.0001* |
| SPO2(%) | Pretest | 0.217 | 0.0040* | 0.268 | 0.0001* |
| | Posttest | 0.245 | 0.0001* | 0.2 | 0.0110* |
| | Difference | 0.203 | 0.0090* | 0.303 | 0.0001* |
| 1MSTS | Pretest | 0.096 | 0.2 | 0.118 | 0.2 |
| | Posttest | 0.122 | 0.2 | 0.105 | 0.2 |
| | Difference | 0.177 | 0.0400* | 0.226 | 0.0020* |
| FSS | Pretest | 0.169 | 0.064 | 0.235 | 0.0010* |
| | Posttest | 0.114 | 0.2 | 0.215 | 0.0040* |
| | Difference | 0.243 | 0.0010* | 0.158 | 0.107 |
| 2MinStepTest | Pretest | 0.118 | 0.2 | 0.13 | 0.2 |
| | Posttest | 0.103 | 0.2 | 0.127 | 0.2 |
| | Difference | 0.216 | 0.0040* | 0.172 | 0.0500* |

*p<0.05 indicates skewed distribution

Note that, the pretest and posttest scores of HR (bpm) in two groups followed normal distribution. Therefore, the parametric tests were applied and remaining parameters pretest and posttest scores were not following normal distribution. Therefore, the non-parametric tests were applied.

**Table 3:** Comparison of experiment group and control group with pretest and posttest 1-MSTS scores by Mann-Whitney U test.

| Time points | Experiment group | | | Control group | | | U-value | Z-value | p-value |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean rank | Mean | SD | Mean rank | | | |
| Pretest | 12.96 | 6.28 | 27.18 | 14.28 | 6.24 | 23.82 | 270.5 | 0.8052 | 0.4207 |
| Posttest | 15.76 | 6.81 | 23.92 | 14.08 | 5.74 | 27.08 | 273 | -0.7567 | 0.4492 |
| Difference | -2.8 | 1.5 | 34.96 | 0.2 | 1.87 | 16.04 | 76 | 4.5791 | 0.0001* |

*p<0.05

Non-significant difference was observed between experiment group and control group with pretest 1-MSTS scores (Z=0.8052, p=0.4207). It means that, the pretest 1-MSTS scores were similar in experiment group and control group.Non-significant difference was observed between experiment group and control group with posttest 1-MSTS scores (t=-0.7567,p=0.4492). It means that, the posttest1-MSTS scores were similar in experiment group and control group.A significant difference was observed between experiment group and control group with changes in 1-MSTS scores from pretest to posttest. It means that, the significant and higher changes in 1-MSTS scores after posttest was more in experiment groupas compared to control group.

**Table 4:** Comparison of pretest and posttest 1-MSTSscores in experiment group and control group by Wilcoxon matched pairs test.

| Groups | Time points | Mean | SD | Mean Diff. | SD Diff. | % of change | Z-value | p-value | Effect size |
|---|---|---|---|---|---|---|---|---|---|
| Experiment | Pretest | 12.96 | 6.28 | -2.8 | 1.5 | -21.6 | 4.3051 | 0.0001* | 0.784 |
| | Posttest | 15.76 | 6.81 | | | | | | |
| Control | Pretest | 14.28 | 6.24 | 0.2 | 1.87 | 1.4 | 0.6168 | 0.5373 | 0.012 |
| | Posttest | 14.08 | 5.74 | | | | | | |

*p<0.05

A significant difference was observed pretest and posttest1-MSTS scores in experimental group (t=4.3051, p=0.0001). It means that, the posttest 1-MSTSscores were significantly higher as compared to pretest scores in experimental group with effect size 0.7840.No significant difference was observed pretest and posttest 1-MSTSscores in control group (Z=0.6168, p=0.5373). It means that, the posttest 1-MST Sscores were similar in control group with effect size 0.0120.

**Table 5:** Comparison of experiment group and control group with pretest and posttest FSS scores by Mann-Whitney U test.

| Time points | Experiment group | | | Control group | | | U-value | Z-value | p-value |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean rank | Mean | SD | Mean rank | | | |
| Pretest | 5 | 1.59 | 24.52 | 4.72 | 1.88 | 26.48 | 288 | -0.4657 | 0.6415 |
| Posttest | 4.25 | 1.6 | 27.74 | 4.7 | 1.72 | 23.26 | 256.5 | 1.0769 | 0.2815 |
| Difference | 0.75 | 0.96 | 19.22 | 0.01 | 0.52 | 31.78 | 155.5 | -3.0365 | 0.0024* |

*p<0.05

Non-significant difference was observed between experiment group and control group with pretest FSS scores (Z=-0.4657, p=0.6415). It means that, the pretest FSS scores were similar in experiment group and control group. Non-significant difference was observed between experiment group and control group with posttest FSS scores (Z=-1.0769, p=0.2815). It means that, the posttest FSS scores were similar in experiment group and control group. A significant difference was observed between experiment group and control group with changes in FSS scores from pretest to posttest. It means that, the significant and higher changes in FSS scores after posttest was more in experiment group as compared to control group.

**Table 6:** Comparison of pretest and posttest FSS scores in experiment group and control group by Wilcoxon matched pairs test.

| Groups | Time points | Mean | SD | Mean Diff. | SD Diff. | % of change | Z-value | p-value | Effect size |
|---|---|---|---|---|---|---|---|---|---|
| Experiment | Pretest | 5 | 1.59 | 0.75 | 0.96 | 15.03 | 3.6571 | 0.0003* | 0.399 |
| | Posttest | 4.25 | 1.6 | | | | | | |
| Control | Pretest | 4.72 | 1.88 | 0.01 | 0.52 | 0.3 | 0.112 | 0.9108 | 0.002 |
| | Posttest | 4.7 | 1.72 | | | | | | |

*p<0.05

A significant difference was observed pretest and posttest FSS scores in experimental group (Z=3.6571, p=0.0003). It means that, the posttest FSS scores were significantly higher as compared to pretest scores in experimental group with effect size

0.3990. No significant difference was observed pretest and posttest FSS scores in control group (Z=0.1120, p=0.9108). It means that, the posttest FSS scores were similar in control group with effect size 0.0020.

**Table 7:** Comparison of experiment group and control group with pretest and posttest 2MinStep test scores by Mann-Whitney U test.

| Time points | Experiment group | | | Control group | | | U-value | Z-value | p-value |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean rank | Mean | SD | Mean rank | | | |
| Pretest | 40.68 | 23.55 | 27.36 | 45.84 | 23.54 | 23.64 | 266 | 0.8925 | 0.3721 |
| Posttest | 42.92 | 23.6 | 25.68 | 43.44 | 23.31 | 25.32 | 308 | 0.0776 | 0.9381 |
| Difference | -2.24 | 5.58 | 32.94 | 2.4 | 2.78 | 18.06 | 126.5 | 3.5992 | 0.0003* |

*p<0.05

Non-significant difference was observed between experiment group and control group with pretest 2MinStep testscores (Z=-0.4657, p=0.6415). It means that, the pretest 2MinStep test scores were similar in experiment group and control group. Non-significant difference was observed between experiment group and control group with posttest 2MinStep testscores (Z=-1.0769, p=0.2815). It means that, the posttest 2MinStep testscores were similar in experiment group and control group. A significant difference was observed between experiment group and control group with changes in2MinStep test scores from pretest to posttest. It means that, the significant and higher changes in 2MinStep testscores after posttest was more in experiment group as compared to control group.

**Table 8:** Comparison of pretest and posttest 2MinStep test scores in experiment group and control group by Wilcoxon matched pairs test.

| Groups | Time points | Mean | SD | Mean Diff. | SD Diff. | % of change | Z-value | p-value | Effect size |
|---|---|---|---|---|---|---|---|---|---|
| Experiment | Pretest | 40.68 | 23.55 | -2.24 | 5.58 | -5.51 | 2.0449 | 0.0409* | 0.144 |
| | Posttest | 42.92 | 23.6 | | | | | | |
| Control | Pretest | 45.84 | 23.54 | 2.4 | 2.78 | 5.24 | 3.3768 | 0.0007* | 0.436 |
| | Posttest | 43.44 | 23.31 | | | | | | |

*p<0.05

A significant difference was observed pretest and posttest 2MinStep test scores in experiment group (Z=2.0449, p=0.0409). It means that, the posttest 2MinStep test scores were similar in experiment group with effect size 0.1440.A significant difference was observed pretest and posttest 2MinStep test scores in control group (Z=3.3768, p=0.0007). It means that, the posttest 2MinStep test scores were significantly higher as compared to pretest scores in control group with effect size 0.4360.

## DISCUSSION

In the present study 50 patients with chronic kidney disease stage-5 (25 in experimental group and 25 in control group) were examined. Aim of the study was to study the feasibility of physiotherapy treatment on functional capacity in chronic kidney disease patients. And study shows that a 12-week program of guided exercise, affords measurable significant improvements in physical function testing, like the 2-minute step test and the 1-minute Sit to stand test and also enhances quality of life including reduction in fatigue faced by chronic kidney disease stage patients in their day-to-day life. It also shows improvement in functional capacity in terms of muscular strength and aerobic endurance and helps them to carry out activities of daily living. Overall, exercise training in this particular study setting and patient population was well tolerated, with no exercise-related adverse events observed.

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significant improvements in physical function testing, like the 2-minute step test and the 1-minute Sit to stand test and also enhances quality of life including reduction in fatigue faced by chronic kidney disease stage patients in their day-to-day life. It also shows improvement in functional capacity in terms of muscular strength and aerobic endurance and helps them to carry out activities of daily living. Overall, exercise training in this particular study setting and patient population was well tolerated, with no exercise-related adverse events observed.

In order to assess the level of physical activity, estimate individual fitness, either standardized questionnaires or exercise testing can be used. Simple 2-minute step test in place was considered in the study. This decision was motivated by reports showing that decreased physical fitness, rather than reported physical inactivity, was independently associated with increased mortality risk. For this purpose, decision on using a simple and convenient 2-minute step-in-place test was taken. This can be used as immediate feedback to further emphasize the relevance of physical fitness to quality of life and longevity [10].

All participants understood and successfully completed the protocol, with no documented clinical complications resulting from the test [10]. 2-minute step test appeared to be an objective, safe, and easy to implement and interpret method [9].

In the present study, gender analysis of the subjects revealed that it considered of 14 males and 11 females in experimental group whereas 21 males and 4 females on control group with a slight bias towards males as they were numerically outnumbered females.

The age of the subjects included in this study was between 18-70 years, maximum that is 9 in experimental group belongs to 51-60 years category and in control group maximum that is 7 belongs to age group 41-50 and 61-70 years. P value is less than 0.05 that means significance (0.0310). Mean wise there is no difference but distribution wise there is difference in age groups of subjects.  A significant difference was observed in pre-test and post-test heart rate scores in experimental group (t= 6.8952; p= 0.001) with the effect size of 0.6650 as compared to control group where the pre-test and post-test scores of heart rate were not significant (t= 0.2693; p= 7.900) with the effect size of 0.0030. Along with heart rate a significant difference was observed in post-test systolic blood pressure as well as in SPO2 scores whereas in diastolic blood pressure scores, no changes were observed.

Chronic kidney disease (CKD) is rapidly spreading worldwide. The awareness level among the people is poor. This is attributed to the increasing prevalence of diabetes, hypertension and ischemic heart disease.1 It is an important risk factor for cardiovascular disease and mortality. To reduce the burden of renal disease and related diseases, it is important to identify modifiable factors in at-risk individuals so that intervention strategies can be designed and implemented [6].

It is well known that exercise ameliorate many of the risk factors associated with developing chronic kidney disease. Moreover, evidence to date suggests that higher levels of cardiorespiratory fitness, increased participation in physical activity, and less time spent in sedentary activities are all associated with better outcomes in same [4].

Patients with renal disease with regular exercise habits can maintain better cardiorespiratory endurance. These patients typically follow a low-protein diet, and protein intake is another factor that affects muscle strength [8]. Decreased mitochondrial capacity and quality control can impair muscle function and contribute to decreased physical endurance [3]. Exercise has the ability to positively influence many of the upstream factors associated with the progression of kidney disease. In fact, the higher the level of recreational physical activity, the slower the decline in renal function in the elderly and existing chronic kidney disease patients [7].

Fatigue is a commonly reported debilitating symptom inchronic kidney disease patients and may impact quality of life as early as in stage 2, with findings across studies. The pathophysiology of fatigue in renal disease is multifactorial, involving multiple factors contributing to decreased oxygenation and lactic acidosis, chronic metabolic acidosis, protein energy wasting, hyperphosphatemia and depression. Approaching patients with fatigue should begin with an assessment of potentially manageable factors. Physical activity is worth recommending in light of the additional benefits of exercise in these cases [4].

Exercise training improves a number of metabolic factors in patients with cardiorenal metabolic syndrome, including triglyceride and HDL cholesterol levels, resting blood pressure, and insulin resistance, which, in turn, would be expected to reduce progressive chronic kidney disease and cardiovascular disease risk. Since diabetes and hypertension are the two greatest contributors to end-stage renal disease, lifestyle modifications that include physical activity are relevant. Moreover, chronic kidney disease, like hypertension and diabetes, progresses insidiously in asymptomatic patients precisely during the time when physical activity interventions might be most effective [5].

Increased physical activity is beneficial at all stages of the disease and can help empower patients to take more control over their own health, which is why exercise training should be considered an important part of the overall care of people with chronic kidney disease stage [11].

**Limitations:** The sample size of our study was relatively small, long term follow up was not considered.

**Future scope of study:** A large sample size should be considered. Multi-centered study must be conducted so that the results can be generalized to a larger population. Future research should focus on examining the effectiveness of combining aerobic and resistance exercise to determine whether the combination provides both cardioprotective and anabolic benefits.

## CONCLUSION

Exercise program in chronic kidney disease stage is a non-pharmacological intervention that has been demonstrated to reduce fatigue, dyspnoea, increase patient's work tolerance/ performance and improve quality of life. Having examined 50 patients with chronic kidney disease stage-5 it was found that exercises significantly improved patients exercise/functional capacity (muscular strength and aerobic endurance), quality of life, number of steps in 2-minute duration as well as number of repetitions of sit to stand in 1 minute duration and also decrease in experimental group. While results of the control group proved not to be significant.

## ABBREVATIONS

**CKD-** chronic kidney disease;

**2MST-** 2-minute step test;

**1MSTS-** 1 minute sit to stand test;

**FSS-** fatigue severity scale.

**Conflicts of interest:** **None**

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