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**Short Communication**

# Effect of six-week core strengthening exercises on inspiratory muscle strength and functional capacity in patients with chronic kidney disease undergoing haemodialysis

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## ABSTRACT

This study aims to evaluate the effect of core strengthening exercises on inspiratory muscle strength and functional capacity in patients with CKD undergoing Haemodialysis. The study included 10 patients with CKD undergoing hemodialysis according to the eligibility criteria. All patients performed core strengthening exercises for 6 weeks (2 times/week). The outcome measures are assessed before and after the intervention using inspiratory muscle strength and functional capacity. We found significant improvements in inspiratory muscle strength (p=0.150) and functional capacity (p=0.004) after the core strengthening exercises. At the end of the result, we concluded that the core strengthening exercise program improves the inspiratory muscle strength and functional capacity in patients with CKD undergoing Haemodialysis.

**Keywords:** Core strengthening exercise, Chronic kidney disease, Inspiratory muscle strength, Functional capacity

## INTRODUCTION

Chronic kidney disease (CKD) is a life-threatening disease affecting various body systems and is the leading cause of death and disability.[1] An adult patient is diagnosed with CKD when they present a glomerular filtration rate (GFR) less than 60ml/min/1.73 $m^2$ and albumin level more than 30 mg/g in an isolated urine sample.[2] CKD leads to progressive and irreversible loss of nephron mass, leading to irreversible renal injury interfering with normal kidney function like hormonal, regulatory, and excretory effects.[3] In 2017, 843.6 million individuals worldwide were affected with CKD, and 232 people per million have CKD in India.[4,5] The global prevalence of CKD is 11 -13%.[3] India represents the high prevalence (10.2 %) of CKD.[1] In CKD patients, uremic myopathy and haemodialysis cause protein breakdown, affecting the strength and endurance of the inspiratory and peripheral muscles. CKD patients have decreased exercise capacity by 40-50% compared to healthy individuals. Due to uremic myopathy and functional capacity impairment, there is a 10-20% increase in cardiac death. CKD patients show decreased inspiratory muscle strength compared to predictive value.[2] Core strengthening exercises cause contraction of abdominal muscle anteriorly, paraspinal and gluteal muscle posteriorly, diaphragm superiorly, and pelvic floor inferiorly. These exercises may contribute to strengthening the diaphragm and decreasing the use of accessory muscles for respiration. According to the study of Vardar et al core strengthening exercises showed increased MIP and MEP values in children with bronchiectasis. As the diaphragm is activated during core exercise, it can be used for diaphragmatic training. One traditional method of inspiratory muscle training is loaded inspiration, which improves inspiratory muscle strength

and endurance when the inspiratory resistance is sufficient.[6] Few authors have evaluated the impact of inspiratory muscle training to improve inspiratory muscle strength in patients with CKD on haemodialysis. Core strengthening exercise has been reported to improve respiratory parameters, muscle strength, and physical fitness in different populations and has not been applied in patients with CKD.

## METHODS

This study was a quasi-experimental study conducted in the haemodialysis unit of tertiary care teaching hospital. After obtaining approval from the institutional ethical committee, the written consent form was taken from patients. We conveniently sampled 10 patients with CKD, with stages 4 and 5 included in the study. We included patients with CKD who are on dialysis treatment for at least 4 months, who come to haemodialysis on an OPD basis, and Patients with both genders, aged between 30-60 years. Exclusion criteria include patients who developed hemodynamic complications during dialysis, high-grade fever, severe hypoxia, unable to cope with the exercise program, and diagnosed with any respiratory, orthopedic, or neurological conditions. All patients underwent an assessment of inspiratory muscle strength and functional capacity before and after the core strengthening exercise program. According to ATS guidelines, Maximum inspiratory pressure (MIP) was measured using a hand-held ABP pressure gauge device to assess the inspiratory muscle strength.[7] Functional capacity was evaluated using VO2 max calculated using a 6-minute walk test (6 MWT).[8] The core strengthening exercises treatment was given as ten repetitions for each exercise once a day, twice a week for six weeks.

### *Core strengthening exercises*

Abdominal drawing in maneuverer: In this exercise, the pressure biofeedback unit (PBU) consists of an air pump and sphygmomanometer. PBU was inflated to 40 mmHg and situated under the 5th lumbar vertebra, and the patient was then asked to contract the abdomen.[9] Single leg lift: The patient was asked to lie supine with arms at the sides and underwent a single leg lift. The individual raised his right leg parallel to the ground, maintained it there for two seconds, and lowered it to around six inches off the ground.[10] Pelvic bridging: The patient was asked to lie in a supine position with arm side and knee flexed, then they elevated the hip and pelvis from the floor while keeping the lumbar spine neutral. After holding the position for 10 seconds, the patient was asked to lower their pelvis to the ground.[11] Bent knee fallout: The patient was lying flat on his back and was instructed to flex both knees by 120 degrees, bend one hip slowly to around 45 degrees of external rotation and abduction while retaining the other leg in a neutral posture, and then slowly return to the starting position.[12] After six weeks of the core strengthening exercise program, all patients were again assessed for outcome measures.

### *Statistical analysis*

Statistical analysis was carried out using GraphPad Instat software. Results were tested for normal distribution using the Kolmogorov-Smirnov test. Normality is passed for parameters MIP and 6 MWT, after which a one-way ANOVA test is used to determine the group's predicted pre- and post-test differences. The confidence interval was at 95%, and any value <0.05 was considered significant and <0.001 was highly significant.

## RESULTS

Results of the present study showed that 6 weeks training of exercise significantly improved inspiratory muscle strength and functional capacity in patients with CKD undergoing haemodialysis. Before the core strengthening exercise intervention, we evaluated the MIP value and 6 MWT distance in all patient and compared it with their predicted value.

**Table 1: Predicted, pre- and post-intervention comparison of MIP.**

| Variable | Predicted | Pre-intervention | Post-intervention | P value | Result |
|---|---|---|---|---|---|
| **MIP ($cmH_2o$)** | 90±16.69 | 45±21.21 | 55±20.68 | 0.0001 | Extremely significant |

**Table 2: Pre- and post-intervention comparison of Functional capacity (VO2 max).**

| Variable | Pre-intervention | Post-intervention | T value | P value | Result |
|---|---|---|---|---|---|
| **VO2 max** | 36.30 ±6.25 | 37.61 ±6.26 | 3.83 | 0.004 | significant |

The mean and SD for the predicted value of MIP and pre-intervention MIP were 90±16.69 and 45±21.21, respectively, and after a 6-week core strengthening exercise program, it was 55±20.68. Compared to the predicted MIP value in preintervention, a 50% reduction was seen in MIP value, and after the core strengthening exercise program, it was 39% reduced from the predicted value. So, there was an 11% increase in MIP after core strengthening exercise intervention in patients with CKD undergoing haemodialysis. Our study found that the VO2 max calculated by a six-minute walking distance in meters was statistically highly significant. At baseline, the mean and SD of VO2 max was 36.30±6.25. After six weeks of core strengthening exercise training was 37.61±6.26, indicating a significant difference of 1.31% in VO2 max calculated by distance covered in 6 MWT.

Inspiratory muscle strength and Functional capacity difference within the groups is mentioned in (Table 1-2).

## DISCUSSION

In the result, we found there were significant differences in inspiratory muscle strength and functional capacity in patients with CKD undergoing haemodialysis after 6 weeks of core strengthening exercises intervention. This study's findings are consistent with those of Develi et al who gave core stabilization training to asthmatic patients and discovered a significant increase in MIP and functional capacity as a result.[6] Giacomo et al looked at the impact of Pilates training as a form of core stabilization exercise on inspiratory and expiratory muscle strength. They found that sedentary women who underwent the training experienced a significant improvement in their MIP and MEP values.[12] Another study done in Turkey found that 6 weeks of the core stabilization program increased MIP and MEP values in children with bronchiectasis.[13]

Strengthening the inspiratory muscles may help maintain the balance of intrapleural and intraabdominal pressures with the physiological mechanism of ventilation.[6] The mechanical properties of the chest and abdominal walls may influence the strength of the respiratory muscle. The diaphragm and other respiratory muscles are also required to support the trunk, which may increase their responsiveness and strength.[6]

According to Daveli et al functional exercise capacity levels in patients with asthma may be affected by improvement in MIP values. Thus, they suggested that higher inspiratory muscle strength could be the underlying mechanism for increased functional capacity.[6]

## CONCLUSION

Core strengthening exercise programs for six weeks have proven effective in increasing inspiratory muscle strength and functional capacity in patients with chronic kidney disease undergoing haemodialysis.

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