Original Article

# Effectiveness of Strength Training among Post Covid Subjects in Activities of Daily Living

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**Abstract**

**Background:** The current COVID 19 caused by severe acute respiratory syndrome. COVID 19 is not limited to the respiratory system but has widespread involvement. Some specific problems are described, including severe muscle weakness and fatigue, joint stiffness, dysphasia, psychological problems, impaired functioning concerning mobility, activities of daily life and work get affected. Rehabilitation care for COVID-19 survivors must therefore be delivered by specialist multidisciplinary team, need focused and planned for the longer term to meet the needs of these individuals.

**Purpose:** To evaluate the effect of strength training exercise and conventional care on levels of dyspnea and post COVID functional levels among post COVID-19 participants.

**Materials and Methods:** 30 individuals diagnosed with post COVID-19 were selected based on the inclusion and exclusion criteria. Post COVID-19 patients were selected from the inpatient ward, Saveetha hospital. The selected subjects were allocated into 2 groups. Strength training group and conventional group. Strength training group were treated with diaphragmatic strength training and conventional group was treated with thoracic mobility exercise. The effectiveness of the treatment was assessed at the end of 6 weeks, using various outcome measures.

**Conclusion:** We conclude, Diaphragmatic strength training exercise has better impact in improving in functional levels among post COVID-19.

**Key Word:** COVID-19, diaphragmatic breathing, strengthening exercise, daily activities

## Introduction

The current COVID 19 caused by severe acute respiratory syndrome. COVID 19 is not limited to the respiratory system but has widespread involvement including gastrointestinal tract and liver, with evidence of prolonged faecal shedding and feco oral transmission. SARS-CoV-2 (severe acute respiratory syndrome-coronavirus-2) is a novel coronavirus that causes COVID-19, a highly contagious respiratory illness The disease is transmitted by inhalation or contact with infected droplets and the incubation period ranges from 2 to 1[1]. The symptoms are usually fatigue, cough, sore throat, fever malaise, breathlessness among others. The disease is mild in most people; in some (usually the elderly and those with co morbidities), it may progress to pneumonia, acute respiratory distress syndrome (ARDS) and

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multi organ dysfunction[2]. Rehabilitation is important for patients with COVID-19. In the intensive care unit (ICU), patients frequently spend a lot of time immobile. Patients frequently spend long periods of time in the prone position, which can result in post-ICU dysphasia, muscle weakness, myopathy, and neuropathy due to critical illness, as well as decreased joint mobility, neck and shoulder pain, difficulty standing, and impaired balance and gait, with subsequent limitations in daily activities[3].

It is necessary to formulate rehabilitation program for these patients to help them restore physical and respiratory function and to reduce anxiety and depression to restore a good quality of life. It is necessary to formulate rehabilitation program for these patient to help them restore physical and respiratory function and to reduce anxiety and depression to restore a good quality of life[3,4]. Patients are affected by neurological, respiratory and musculoskeletal systems. Poorer health is associated with higher risk for severe respiratory complications from the COVID-19[4].

About 30% to 80% of people have cognitive impairments, which include difficulties with focus, memory, processing, and problem-solving. About 30% of patients experience psychological symptoms like anxiety and despair, while 10% to 50% of patients express signs of post-traumatic stress disorder.

As soon as patients have achieved cardiopulmonary stability and meet established safety criteria, physical rehabilitation can begin. They undergo not only physical weakness, but may also suffer from problems on the psychosocial, pulmonary, physical and cognitive domain[5].

A precise and consistent pharmaceutical treatment plan and breathing exercises are the most crucial steps in treating dyspnea and associated symptoms. The current global availability of pulmonary rehabilitation treatments is disturbingly low, even though it is beneficial at enhancing physical performance and quality of life after hospitalization. Airflow restriction is a significant health issue that is not only caused by a straightforward respiratory condition but also by a number of other underlying issues[6]. Therefore, improving respiratory function is crucial for preserving ADL and QoL in older patients who had COVID-19 and were discharged with positive outcomes[7]. Strengthening exercise regimens can result in a combination of central and spindle mechanisms, an increase in gamma motor activity, and an improvement in the central processes of motor control[8].

This study aimed to determine whether diaphragmatic breathing and strengthening were effective in treating post COVID.

## Aim

To evaluate the effect of strength training exercise and conventional care in activities of daily living among post COVID-19 participants.

## Material and Method

It was an experimental study conducted on 30 subjects with post COVID, age between 25- 45 yrs , taken from Saveetha Medical College and Hospital, Chennai during the period of July 2022 to August 2022. Convenient sampling Technique using closed-envelope method.

**Inclusion Criteria:**

- An adult between 25 to 45 years.
- Subjects who had confirmed with RT-PCR test negative after the post-COVID.

**Exclusion Criteria:**

- Subjects who had other systemic problems, joint degeneration, awaiting other surgeries.
- Participants with low muscle mass in observation, handgrip strength less than 24kg and slow gait speed were excluded.
- Participants with prior exercise training, under medication, history of lower limb surgeries, fractures, cardiac problems, respiratory Problems and any other contraindications for strengthening exercise were excluded.

**Outcome Measure:**

- PCFS SCALE: Post COVID functional scale.
- Dyspnea scale.

**PCFS scale:**

A respondent chooses a whole number (0-4 integers) on the PCFS that best describes the functional

activity of the post- COVID. Score- 0 represents no functional limitations, score- 1 represents negligible functional limitations, score- 2 represents slight functional limitations, score- 3 represents moderate functional limitations, score- 4 represents severe functional limitations.

***3.6.2. Dyspnea scale:***

The degree of baseline functional impairment brought on by dyspnea is measured using the MRC Dyspnea scale.MRC dyspnea grade describes grade-0 evaluate only breathless with strenuous exercise, grade-1 they get short of breath when hurrying on level ground or walking up a slight hill, grade-2 represents on level ground, I walk slower than people of my age because of breathlessness, grade- 3 `stop for breath after walking about 100 yards or after a few minutes on level ground, grade-4 represents too breathless to leave the house or I am breathless when dressing / undressing.

**Procedure**

Thirty respondents were chosen for the convenient sampling technique, based on the inclusion and exclusion criteria. After receiving more information about the study, all individuals provided written informed consent before beginning the study. Dyspnea scale and Post-COVID functional scale (PCFS) were used to evaluate the pre-test and post-test. Using the closed-envelope method, participants were randomly assigned to one of two groups.

Diaphragmatic strength training exercise were performed in the strength training group. Thoracic mobility exercises with diaphragmatic breathing exercise were performed in the conventional group.

- Strength training group:

  Participants were given diaphragmatic strength training exercise.

**Exercise 1:**

- Patient was asked to be in supine position
- Patient was asked to keep one hand on the upper chest and half kg sand bag was placed on the upper abdomen.
- Patient was asked to breathe in slowly through their nose, letting the air in deeply, towards the chest. The hand on the chest should remain still, while the lower chest expands gradually.
- Patient asked to tighten the abdominal muscles and let them fall inwards as they exhale. And they feel the resistance during inspiration.
- Patient is asked to repeat the procedure for 15reps/2sets/day.
- For a total period of 5days a week for 4weeks.

**Exercise 2:**

- Resistance training was prescribed with weights based on an individual, personal strength assessment basis. A 10-repetition maximum is the greatest amount of weight that a participant can lift through the range of motion for 10 times. Each group of muscles was trained for 10 repetitions for three sets with a rest period of 60 seconds. The resistance was increased gradually as per the individual requirements and the training was given four days a week, for eight weeks. This training was conducted by a trained physiotherapist on an individual basis at the physiotherapy department.

**Upper limb exercises:**

- **Shoulder front raise** with weight Patient was asked to hold 1kg dumbbell in hands in erect standing posture. Then asked to raise the hands in front of thighs with palms in a neutral position, without bending elbows with co-ordinate breathing exercise. (i.e., inspiration during lifting up the hand and expiration during lowering the hand down) and then lower the weights.
- **Shoulder lateral raise** with weight Patient was asked to hold 1kg dumbbell in hands in erect standing posture.

  Then asked to raise the hands in front of thighs with the top of each weight pointed away, and then lift arms up by sides without bending elbows with co-ordinate breathing exercise. (i.e., inspiration during lifting up the hand and expiration during lowering the hand down), then lower the arms.

- **External rotators** with weight Patient should be positioned in supine lying by holding 1kg dumbbell with the shoulder abducted to

900 and the elbow bent to 900 , so the hand points to the roof, patient should rotate the shoulder joint externally so that the hand moves backwards and the palm faces the roof along with co-ordinate breathing exercise.

- **Internal rotators** with weight Patient should be positioned in supine lying by holding1kg dumbbell with the shoulder abducted to 900 and the elbow bent to 900, so the hand points to the roof. Patient should rotate the shoulder joint internally so that the hand moves forwards and the palm faces the floor along with coordinate breathing exercise.

**Treatment Protocol:**

- Resistance\weight - 1 kg dumbbell
- Frequency-5days per week for a period of 4 weeks
- 1 session per day
- 10 to 15repetitions \ 2 sets

Conventional group:

Participants received thoracic mobility exercise and diaphragmatic breathing exercise.

**Thoracic mobility exercise:**

**Sitting position:**

The patient should exhale while bending forward to touch the floor with arms crossed at the feet then the patient should extend up while taking a deep inspiration and lift the arm up with a frequency of 5 days per week and 2 sets of 10 repetitions.

**Standing Procedure:**

The patient should stand with his knees straight, the patient instructed to exhale while bending forward to touch the floor with arms; then the patient should extend up by lifting his hands simultaneously taking a deep inspiration. 10 repetitions/set–2sets with a frequency of 5 days per week.

**Diaphragmatic breathing exercise:**

**Sitting Position:**

- Sit up straight in a chair lengthen the distance between your navel and sternum. Keep shoulders relax. Keep the pelvis in neutral position (Sit on sitting bones). Place your hands at either side of your lower ribs.
- Breath in slowly through nose. As you inhale feel the ribs expanding outwards and upwards. During inhalation is generated expansion of the trunk in three directions front, sides and back. Breath out from your nose. As you exhale feel the lower ribs moving inwards.

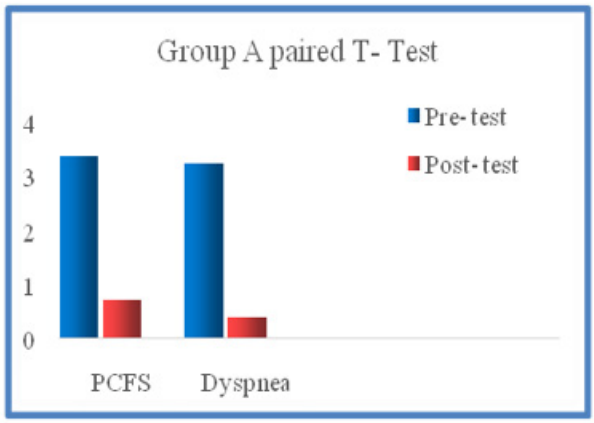
**Standing position:**

- Lie on the back on a flat surface (or in bed) with the knees bent. You can use a pillow under head and knees for support if that's more comfortable. Place one hand on the upper chest and the other on the belly, just below your rib cage. Breathe in slowly through the nose, letting the air in deeply, towards the lower belly. The hand on the chest should remain still, while the one on the belly should rise. Tighten the abdominal muscles and let them fall inward as you exhale through pursed lips. The hand on the belly should move down to its original position.

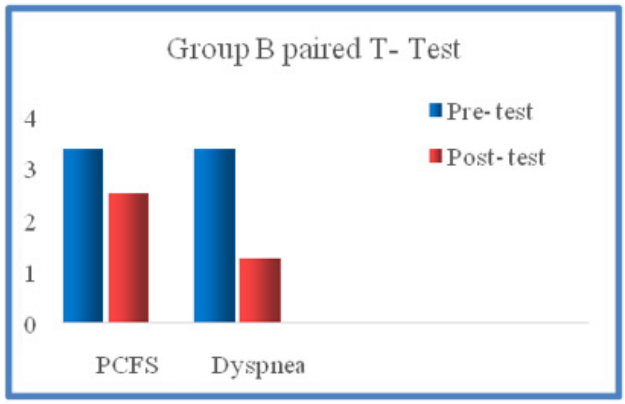
*3.5.2. Treatment protocol:*

- Duration of the session: 30-40 minutes
- Frequency: Single session per day / 4 weeks
- Sets: 2 sets
- Repetitions: 10-15 repetitions
- Rest: 2-3 minutes break between sets.

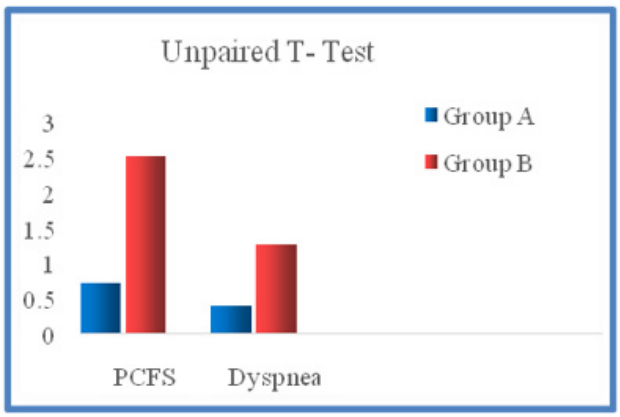
**Data analysis**




**INTERPRETATION: Fig. 1 shows that the values are extremely statistically significant.**




**INTERPRETATION: Fig. 2 shows that the values are extremely statistically significant.**




**INTERPRETATION: Fig. 3 shows that the values are extremely statistically significant.**

## Result

- The study was conducted on 30 subjects. Both the group has 15 subjects each.
- The mean for PCFS was 0.7300for group A, and 2.5300 for group B with p value= <0.0001 and t value was 10.0414 indicating that the results were extremely statistically significant.
- The mean for dyspnoea was 0.4000 for Group A and 1.2700 for Group B, with p value =<0.0001 and t value was 4..9060 indicating that the results were extremely statistically significant.

## Discussion

The purpose of this study was to determine the effectiveness of strength training exercise on functional recovery in patients with post COVID. The study involved 30 people 25 to 45years. Random group allocation separated the groupings in half. The experimental group did strength training exercise and while the control group did thoracic mobility exercise. The trial lasted 5 weeks, and workouts were given 5 days each week. During the treatment, there is no drop-out.

When data from the experimental group, which received diaphragmatic breathing and strengthening exercise, were analysed using paired t-tests within the study population for MRC dyspnoea scale, PCFS scale, there was a statistical difference in these two measures of outcome, namely breathlessness, function, and strength. High levels of impairments in the physical, cognitive, and psychosocial domains are possible. Providers of rehabilitation services will be a crucial link in the continuum of care, assisting in the transition of patients from acute care facilities to eventual community discharge. Rehabilitation is a complex intervention and a longitudinal process with the goals of minimizing the impact of an individual's impairments on daily functioning, promoting and optimizing functional independence in daily living activities, and maximizing opportunities to participate meaningfully in society on the basis of any new functional baseline. In order to support bio-psycho-social functioning, rehabilitation is best provided by specialists working in multidisciplinary teams[9].

The present results confirm the hypothesis that the PCFS Scale can be used to measure the impact of symptoms on the functional status of subjects after COVID-19, especially in slight to severe categories. It is believed that COVID-19 may significantly affect patients with moderate illness presentations in terms of their physical, cognitive, mental, and social health status. The proposed "Post-COVID-19 Functional Status (PCFS) scale" could be assessed upon discharge from the hospital, at 4 and 8 weeks post-discharge to monitor direct recovery, and at 6 months to assess functional squeal[10].

When pre- test and post- test analysis was done for experimental group for which resistance exercise and diaphragmatic breathing exercise was given, data was analysed using paired t- test within the group for PCFS scale and dyspnea score showed statistical difference in the two outcome measures that is functional activities, breathing capacity.

After COVID-19, dyspnea is the most often reported respiratory complaint. A prevalence of persistent dyspnea following hospitalisation and in non-hospitalized patients with moderate COVID-19 ranges from 5% to 81%, according to studies reporting respiratory symptoms from 1 to 12 months after COVID-19. Breathing exercise includes exercise to improve a good inspiration marked by deep and long inspiration[11].

Although exercise capacity increased in the majority of patients during this time, we discovered indications of long-lasting physiological and radiographic alterations in a subgroup of individuals. Finally, prior to COVID-19, we lacked the pulmonary function, exercise capacity, or CT results necessary to determine COVID-19's effects over time. Dyspnoea is a symptom limiting exercise and ADL; therefore, we searched the literature also for papers reporting this symptom. The severity of dyspnoea cannot be predicted from lung function; therefore, dyspnoea must be assessed specifically. Pranayama has been used as a exercise strategy to cope up the stress ,anxiety and fatigue in covid 19 individuals[12].

This finding demonstrates that strength decreases in patients with post COVID. Statistical analysis revealed higher strength[13].

Several instruments are commonly used to measure different domains of dyspnoea such as sensory-perceptual experience, affective distress, symptom impact or burden. We found twelve studies investigating dyspnoea during physical activity with various scales. Some studies have investigated that only breathing and strengthening exercise does not improve the quality of life in post COVID-19 individuals, also it needs some of the pharmacological support. In this study there is improvement in quality of life to the individuals participated.

As a result, the purpose of this study is to look into the effectiveness of combining strengthening exercise and diaphragmatic breathing exercise for people with post COVID, which could lead to better treatment outcomes and overall patient outcomes. This conclude that post COVID affects the functional activities and respiratory system. Hereby we conclude that Diaphragmatic strength training exercise was more effective than the conventional group.

## Conclusion

All outcome indicators in both groups showed significant improvement. Somewhat more improvement in strength training group and is statistically significant for PCFS(post COVID functional scale) and dyspnea scale.

Post COVID affects the functional activities and respiratory system. Diaphragmatic strength training has a better effect in improving muscle strength and breathing capacity among post COVID-19. This study shows improvement in post COVID functional scale as well as reducing dyspnea level. Hereby we conclude that Diaphragmatic strength training exercise was more effective than the conventional group.

**Ethical clearance:** The study was approved by the committee of institutional scientific review board. All study participants were informed about the study objectives, and those who agreed to Participate signed informed consent forms.

**Funding:** None

**Conflicts of interest:** The authors declare that they have no conflicts of interest.

## Reference

1. Singhal T. A review of corona-virus disease-2019 (COVID-19). The Indian Journal of Pediatrics. 2020 Mar 13:1-6.
2. Shi Y, Wang G, Cai XP, Deng JW, Zheng L, Zhu HH, Zheng M, Yang B, Chen Z. An overview of COVID-19. Journal of Zhejiang University. Science. B. 2020 Jan 1:1.
3. Demeco A, Marotta N, Barletta M, Pino I, Marinaro C, Petraroli A, Moggio L, Ammendolia A. Rehabilitation of patients post-Covid-19 infection: a literature review. Journal of International Medical Research. 2020 Aug;48 (8):0300060520948382.
4. Belli S, Balbi B, Prince I, Cattaneo D, Masocco F, Zaccaria S, Bertalli L, Cattini F, Lomazzo A, Dal Negro F, Giardini M. Low physical functioning and impaired performance of activities of daily life in COVID-19 patients who survived hospitalization. European Respiratory Journal. 2020 Oct 1;56(4).
5. Bij de Vaate E, Gerrits KHL, Goossens PH. Personalized recovery of severe COVID19: Rehabilitation from the perspective of patient needs. Eur J Clin Invest. 2020 Jul;50(7):e13325. doi: 10.1111/eci.13325. Epub 2020 Jul 6. PMID: 32558922; PMCID: PMC7323030.

6. McNarry MA, Berg RMG, Shelley J, Hudson J, Saynor ZL, Duckers J, Lewis K, Davies GA, Mackintosh KA. Inspiratory muscle training enhances recovery post-COVID-19: a randomized controlled trial. Eu Respir J. 2022 Oct 6;60(4):2103101. doi: 10.1183/13993003.03101-2021. PMID: 35236727; PMCID: PMC8900538.
7. Liu K, Zhang W, Yang Y, Zhang J, Li Y, Chen Y. Respiratory rehabilitation in elderly patients with COVID-19: A randomized controlled study. Complementary therapies in clinical practice. 2020 Apr 1:101166.
8. Jimeno-Almazán A, Franco-López F, Buendía-Romero Á, Martínez-Cava A, Sánchez-Agar JA, Sánchez-Alcaraz Martínez BJ, Courel-Ibáñez J, Pallarés JG. Rehabilitation for post-COVID-19 condition through a supervised exercise intervention: A randomized controlled trial. Scand J Med Sci Sports. 2022 Dec;32(12):1791-1801. doi: 10.1111/sms.14240. Epub 2022 Sep 23. PMID: 36111386; PMCID: PMC9538729.
9. Simpson R, Robinson L. Rehabilitation After Critical Illness in People With COVID-19 Infection. Am J Phys Med Rehabil. 2020 Jun;99(6):470-474. doi: 10.1097/PHM.0000000000001443. PMID: 32282359; PMCID: PMC7253039.
10. Klok FA, Boon GJAM, Barco S, Endres M, Geelhoed JJM, Knauss S, Rezek SA, Spruit MA, Vehreschild J, Siegerink B. The Post-COVID-19 Functional Status scale: a tool to measure functional status over time after COVID-19. Eur Respir J. 2020 Jul 2;56(1):2001494. doi: 10.1183/13993003.01494-2020. PMID: 32398306; PMCID: PMC7236834.
11. Montani D, Savale L, Noel N, Meyrignac O, Colle R, Gasnier M, Corruble E, Beurnier A, Jutant EM, Pham T, Lecoq AL, Papon JF, Figueiredo S, Harrois A, Humbert M, Monnet X; COMEBAC Study Group. Post-acute COVID-19 syndrome. Eur Respir Rev. 2022 Mar 9;31(163):210185. doi: 10.1183/16000617.0185-2021. PMID: 35264409; PMCID: PMC8924706.
12. Kumaresan A, Sebastian N, Suganthirababu P, Srinivasan V, Vishnuram S, Kumar P, Jayaraj V, Alagesan J, Prathap L, Kandakurti P. Efficacy of physiotherapy management on burnout syndrome amongst it professionals during the COVID-19 pandemic. Work. 2022 Aug 17(Preprint):1-7.
13. Wu X, Liu X, Zhou Y, Yu H, Li R, Zhan Q, Ni F, Fang S, Lu Y, Ding X, Liu H, Ewing RM, Jones MG, Hu Y, Nie H, Wang Y. 3-month, 6-month, 9-month, and 12-month respiratory outcomes in patients following COVID-19-related hospitalisation: a prospective study. Lancet Respir Med. 2021 Jul;9(7):747-754. doi: 10.1016/S2213-2600(21)00174-0. Epub 2021 May 5. PMID: 33964245; PMCID: PMC8099316.