



## EFFECT OF AEROBIC INTERVAL TRAINING ON THE LEVEL OF PERCEIVED EXERTION, DYSPNEA AND SATURATION OF OXYGEN IN POST COVID-19 PATIENTS

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### ABSTRACT

**Background** - Covid-19 infection caused by a virus known as SARS CoV-2, has created a complex scenario for global health, with various types of complications and functional impairments in millions of individuals recovering from the disease, Post Covid-19, symptoms have been seen beyond 3 weeks and up to 1 year following the acute illness. The most common symptoms are breathlessness due to impaired lung functions and weakness due to physical deconditioning. **Aim** – To study the effect of aerobic interval training on level of perceived exertion, dyspnea and saturation of oxygen on post Covid-19 symptoms. **Methodology** – 41 patients were subjected to a 4–6-week period of aerobic interval training followed by an assessment of outcome measures such as MMRC scale, Borg Scale and Oxygen saturation measurement. **Conclusion** – Aerobic interval training is highly effective in reducing perceived exertion, improving dyspnea and oxygen saturation in post Covid-19 patients.

**KEYWORDS** : Aerobic interval training, Post Covid-19, Perceived Exertion, Dyspnea, Saturation of Oxygen, Borg Scale

### INTRODUCTION

Post Covid-19 patient symptoms may range from dyspnea at rest and/or during activities of daily living (ADLs), They often need prolonged oxygen support for prolong and have a reduction in cardiorespiratory endurance and peripheral muscle strength.<sup>1,2,3</sup> They are also at risk of lung parenchymal damage, impairment of respiratory muscles and secondary infections that can affect other organs leading to persistent and significant adverse impact on their health. It also increases the risk of post-traumatic stress disorders, depression, anxiety and affects professional performance as well impedes social interactions.<sup>2,3</sup>

About 10% of patients remain unwell beyond 3 weeks, and a smaller proportion for months thereafter.<sup>5</sup> Patients who had significant respiratory illness may be benefited from pulmonary rehabilitation which focuses on personalised evaluation and management. This includes exercise training, education and behavioural modification designed to improve the physical deconditioning and psychological conditions.<sup>1,4,11</sup> Covid-19 pulmonary rehabilitation can also be delivered by various virtual models like videos, pamphlets, telephonic support, and online classes.<sup>1,2,3,4,6,7,8,10,12</sup>

This study was conducted on available guidelines to see the effects of aerobic interval training on work of breathing, saturation of oxygen and rate of perceived exertion in Covid-19 patients.

### MATERIALS AND METHODOLOGY –

41 Post Covid-19 patients fulfilling the inclusion criteria were included in this study. The inclusion criteria were post Covid-19 patients with clinical findings like fatigue during ADLs, muscle weakness, difficulty in breathing, oxygen saturation ranging from 88% to 94%, and need of oxygen support  $\leq$  4 litres/min or on room air. Exclusion criteria were unstable hemodynamic status and/or unable to cope up with virtual training.

Common complaints from most of the patients were difficulty in breathing on mild exertion and sometime even at rest, weakness, dry cough, and body ache. Few patients also required oxygen support on initial stage of exercise as well at rest. Prior to the rehabilitation intervention, all patients

underwent a detailed assessment and explained about the rational and purpose of the study. This was carried out through telephonic interview and video call. Following this, the treatment protocols, in the form of pamphlets and videos of aerobic exercise, were posted electronically to the patient. They were taught to take their own pulse manually and then confirm it with their home oximeter which also recorded the baseline oxygen saturation. MMRC scale was taken on first day and after each one week through telephonic interview The Borg's scale was filled up. All patients were asked to maintain a diary monitoring their vital parameters, information related to any limitations or discomfort during or post exercise and if required, patients were offered supervision by physiotherapist through video conferencing.

Aerobic interval training was given with coordination of respiration i.e., during flexion slow and deep inspiration and relaxed expiration during extension. Training was initiated with mild intensity of exercise of large group of muscles of upper limb and lower limb. Frequency of exercise was twice a day for 4 to 6 weeks. A rest of 1-3 minutes followed by each set of exercise and patients were informed to do diaphragmatic breathing during interval. A total duration of exercise was ranging from 30 to 40 minutes. Following all sets of exercises patients were instructed to walk for at least 5 minutes. This duration was gradually increased as per individual performance and control on their work of breathing. A total of 10-15 minutes rest was given between the walking and exercise. Out of 41 patients, 12 patients were on 1-4 L/min of oxygen support. The same protocol was maintained for these patients with their oxygen support continued for the 1st week and then tapered down following adequate rest and dyspnea relieving exercises. Emphasis was given to dyspnea relieving posture as well energy conservation therapy. Airway clearance therapy like coughing and huffing as well active cycle of breathing was taught to all patients as basic treatment and guided accordingly.

Prior, during and post exercise MMRC scale for dyspnea, Borg Scale for rate of perceived exertion and SpO<sub>2</sub> was noted. Progressions of exercise were done as per individual needs, and response to outcome measures.

### Statistical Analysis –

Statistical analysis was performed by using SPSS version

16.0. Paired t-test was performed to analyse the MMRC scale, Borg Scale and SpO<sub>2</sub> level for pre & post aerobic interval training. The p value of < 0.05 was considered to be statistically significant.

## RESULT –

41 patients were included in the study, out of which 27 were male and 14 were female. A baseline data as mentioned in table – 1

**Table 1 – Baseline Data Of The Post Covid Patients**

	N	Mean ± SD
Age	41	50.98 ± 9.79
Male	27	
Female	14	

Paired t-test was performed to analyse the level of significance for pre & post aerobic interval training in MMRC scale, Borg Scale and SpO<sub>2</sub> level.

**Table – 2 Outcome Measures – Pre And Post Aerobic Interval Training**

	Mean	SD	t test	P Value
MMRC	1.51	0.75	12.58	< 0.001
Borg Scale	1.84	0.69	16.73	< 0.001
SpO <sub>2</sub>	5.56	1.62	22.24	< 0.001

At 40 degree of freedom 5% significant limit of 't' is 2.02. The observed t value for MMRC, Borg Scale and SpO<sub>2</sub> is 12.58, 16.73 & 22.24 times the standard error respectively; these proved that the aerobic interval training is highly effective in controlling dyspnea, perceived rate of exertion and improving saturation of oxygen. ('t' = 12.58 (MMRC), ('t' = 16.73 (Borg Scale), ('t' = 22.24 (SpO<sub>2</sub>), P < 0.001, highly significant).

## DISCUSSION –

This interventional study was designed to evaluate the effect of aerobic interval training in post Covid-19 patients. Novel finding of the study is as follows – 4 to 6 weeks of aerobic interval training is highly effective in improving patient's rate of perceived exertion, dyspnea and saturation of oxygen.

A total of 41 patients were included in the study out of which 12 patients were on oxygen therapy. For them initially first week all the exercises were performed with oxygen with more focus on diaphragmatic breathing and energy conservation techniques. After a week and gradually the exercises were progressed without oxygen support with strict monitoring of SpO<sub>2</sub> and other vitals. The remaining 29 patients were treated with individualise protocol of aerobic interval training as mentioned above. In 3 out of 41 patients, the exercises were continued for 8 weeks. 6 patients recovered within 2 weeks whereas rest of 32 patients successfully completed 4-6 weeks of training with good recovery. Throughout the 6 week all patients were instructed to maintain work diary with real time monitoring and any events that's limits their exercises. If required, patients were guided and monitored through video conferencing.

European Respiratory Society & American Thoracic Society have suggested a patient tailored approach of early mobilization as well exercise training and airway clearance is effective in restoration of patient's muscular, physical, and mental status.<sup>4</sup> An Italian Statement also suggested pulmonary rehabilitation in post Covid-19 could improve symptoms, functional capacity and quality of life through an aerobic exercise with initial intensity <3.0 METs with progressive increase of intensity based on symptoms.<sup>1</sup>

Post Covid-19 patient have a significant reduction in physical activity as well difficulty in breathing and pulmonary rehabilitation plays a major role. A recent guideline given by

Santana *et al* on pulmonary rehabilitation after Covid-19 also recommended Physical exercises must be adapted to individual needs and limitations of patients and symptoms during physical exercise (such as dyspnea, desaturation, and fatigue) should be taken into consideration. They also suggested 6-8 weeks of light intensity aerobic exercise as well strength training via tele-rehabilitation and video conferencing.<sup>2</sup>

After literature review of 40 recent articles of pulmonary rehabilitation of post covid 19 by Md Abu Bakar Siddiq; also suggests that in post Covid -19 cases, oxygen therapy, early mobilization, airway clearance, aerobic exercise, gradual-graded limb muscle resistance exercise, nutritional and psychological interventions are important measures to be offered for improvement in their symptoms.<sup>8</sup> A recent study done by Elisabetta Z *et al.* on post covid 19 patients also found significant improvement in dyspnea as well physical activity status.<sup>9</sup>

A pilot study on short term effect of respiratory telerehabilitation on Covid 19 patient done by Gonzalez-Gerez JJ *et al* also concluded that 1 week of telerehabilitation program based on respiratory exercises is effective, safe, and feasible in COVID-19 patients with mild to moderate symptomatology in the acute stage.<sup>10</sup>

Physical distancing is strongly recommended in Covid-19 as it is an extremely infectious disease this makes the traditional approach of outpatient pulmonary rehabilitation practically impossible to carry out. Tele- rehabilitation is an effective alternative method as shown in our study.

The small sample size and few outcome measures are the limitations of our study, but we hope this will stimulate future research in more severely affected patients and include more objective measures such as pulmonary function test. Future research can be done along with combine training of aerobic exercise and strength training through large sample size.

## CONCLUSION –

4-6 weeks of aerobic interval training is highly effective in reducing the rate perceived exertion, improving dyspnea and oxygen saturation in post Covid-19 patients.

## REFERENCES –

- Vitacca M., Lazzeri M., Guffanti E., Frigerio P, D'Arosca F., Gianola S. *et al.* An Italian consensus on pulmonary rehabilitation in COVID-19 patients recovering from acute respiratory failure: results of a Delphi process. *Monaldi Archives for Chest Disease* 2020; 90:1444.
- Santana AV, Fontana AD, Pitta E. Pulmonary Rehabilitation after Covid-19. *J Bras Pneumol.* 2021;47(1): e20210034.
- Thomas P Baldwin C, Bissett B, Boden I, Gosselink R, Granger CL, Hodgson C, Jones AYM, Kho ME, Moses R, Ntoumenopoulos G, Parry SM, Patman S, van der Lee L (2020) Physiotherapy management for COVID-19 in the acute hospital setting: clinical practice recommendations. *Journal of Physiotherapy* 66:73–82.
- Spruit MA, Holland AE, Singh SJ, *et al.* COVID-19: interim guidance on rehabilitation in the hospital and post-hospital phase from a European Respiratory Society- and American Thoracic Society-coordinated international task force. *Eur Respir J* 2020; 56: 2002197 [https://doi.org/10.1183/13993003.02197-2020].
- Greenhalgh T, Knight M., A'Court C., Buxton M., Husain L., Management of post-acute covid 19 in primary care. *BMJ* 2020;370:m3026 | doi: 10.1136/bmj.m3026.
- Wang TJ, Chau B., Lui M., Lam GT, Lin N., Humber S., PM&R and Pulmonary Rehabilitation for COVID-19. *American Journal of Physical Medicine & Rehabilitation.* DOI: 10.1097/PHM.0000000000001505.
- Curci C, Pisano F, Bonacci E, Camozzi DM, Ceravolo C, Bergonzi R, *et al.* Early rehabilitation in post-acute COVID-19 patients: data from an Italian COVID-19 Rehabilitation Unit and proposal of a treatment protocol. *Eur J Phys Rehabil Med* 2020; 56:633-41. DOI: 10.23736/S1973-9087.20.06339-X.
- Siddiq MAB, Rathore FA, Clegg D, Rasker JJ. Pulmonary Rehabilitation in COVID-19 patients: A scoping review of current practice and its application during the pandemic. *Turk J Phys Med Rehab* 2020;66(4):480-494.
- Zampogna E., Pameroni M., Belli S., Aliani M., Gandolfo A., Visca D., *et al.* Pulmonary Rehabilitation in patients recovering from COVID-19. *Respiration* 2021; 100:416-422.
- Gonzalez-Gerez, J.J., Saavedra-Hernandez, M., Anarte-Lazo, E., Bernal-Utrera, C., Perez-Ale, M.; Rodriguez-Blanco, C. Short-Term Effects of a Respiratory Telerehabilitation Program in Confined COVID-19 Patients in the

- Acute Phase: A Pilot Study. *Int. J. Environ. Res. Public Health* 2021, 18,7511.
11. Chokshi T. Combined effect of aerobic and resisted exercise on saturation of oxygen and cardiopulmonary endurance in patient with h1n1 influenza – case report. *IJRAR* June 2020; 7(2): 419-20.
  12. Salawu A., Green A., Crooks MG., Brixey N., Ross DH., Sivan M., A proposal of multidisciplinary Tele-Rehabilitation in the assessment and rehabilitation of Covid-19
  13. Survivals. *Int J Environ. Res Public Health* 2020,17, 4890.