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[ORIGINAL ARTICLE]

Consequences of COVID-19 in the Status of Physical Fitness in Post COVID Patients: A Cross Sectional Study.

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ABSTRACT :

Background: Aim of the study is to analyze the consequences of covid-19 in the status on physical fitness in post COVID patient's.

Methodology: - The research was carried out in the Physiotherapy OPD at Vikhe Patil Memorial Hospital. A cross-sectional study was designed. Purposive sampling was used in the sampling process. The sample size for this study was 50. Consent form for a six-month study was made. Peak flow metre, Sterilium, Cotton wool, Weighing machine and Measuring tape, Post COVID-19 Functional status scale, 2 cones, stop watch, Pedometer, tape measure were among the materials utilised. Patients with COVID 19 infection who were recovered and willing to participate, both genders, ages 20 to 55, and able to walk without assistance met the inclusion criteria. Patients who were not cooperative or who had additional systemic illnesses, such as diabetes, were excluded.

Result: - Data has summarized by using descriptive statistic of mean and standard deviation. A total of 50 patients entered the study who were in the age group of 20-55 yrs. We compare PEFR values among symptomatic and asymptomatic patients. The study shows that comparison of PEFR values between symptomatic and asymptomatic patients was not significant (p value 0.2265) and PEFR values of symptomatic patients were less than that of asymptomatic patients. The patients who were symptomatically ill were affected more and show symptom of pain, anxiety, depression rather than asymptomatic patients and there was no sign of functional limitation. There is no effect on endurance of the patients as such after recovery from COVID-19 infection.

Conclusion: - This study shows that there is effect of COVID on physical fitness of post COVID patients after recovery with respect to lung function capacity. Symptomatic patients were more affected than asymptomatic patients. The functional status of the post COVID patients is not affected, few of them suffered from pain, depression and anxiety after recovery. There is no effect on endurance in post COVID patients after recovery.

Keywords: - COVID-19, PEFR, Post COVID-19 Functional Status Scale (PCFS), Figure of 8 test, Endurance etc.

Introduction:

The COVID-19 pandemic, caused by the extremely infectious SARS-CoV-2 virus, has killed over 643,000 people and affected over 15.9 million people in 200 countries. India has 14.5 lakh instances of COVID-19 as of July 21, 2020, and the figure is continually rising. The coronavirus is a highly contagious virus that transmits via droplets produced by coughing, sneezing, talking and even breathing.[(1)] These complications may be the result of direct virus tissue invasion (possibly mediated by the presence of angiotensin-converting enzyme 2 receptor), severe inflammation and cytokine storm, immune system damage, the hypercoagulable state described in association with severe COVID-19, or a combination of these factors.[(9)]

A person's maximal rate of expiration is measured by their peak expiratory flow rate (PEFR). It determines the amount of airflow through the bronchi and, as a result, the degree of obstruction in the airways. PEFR

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is the highest rate of airflow that may be obtained from entire lung capacity during a forced expiratory manoeuvre. The total volume of air in the lungs after taking the deepest breath possible, which is around 6,000 ml, is referred to as total lung capacity. The method's greatest advantage is its simplicity. A conventional Wright Peak Flow metre or a Mini Wright meter is used to measure it. It is a little handheld instrument that measures the speed at which air is exhaled from your lungs, giving you a measurement of how well your airways are performing. It is widely recognised as the "GOLD STANDARD" in peak flow measurement. The peak expiratory flow is usually expressed in litres per minute. PEFR is one of the most sensitive metrics for assessing lung function, and lung examinations provide a reasonable assessment of physical endurance. [2]

After addressing the increase of infections in acute care settings, the post COVID-19 functional status (PCFS) scale focuses on relevant areas of daily functioning during follow-up. Because an infection with the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) is expected to have a significant long-term impact on physical, cognitive, mental, and social health status, even in patients with mild disease presentation, it is critical to have a simple tool to track the progression of symptoms and their impact on patients' functional status. A simple and repeatable instrument to identify patients who are recovering slowly or incompletely would aid in the careful use of medical resources while also standardising research activities.[3]

There are tests to measure functional capacity like 6 min walk test, TUG test etc. A figure-of-8 was chosen because the task is readily recognized by name alone; the pattern consists of walking on curved paths, with straight-path walking between the curved paths alternation between straight and curved paths requires switching motor strategies, including biomechanical and movement control adjustments and motor planning is needed to navigate the straight and curved paths.[4]

Post acute COVID-19 is defined as the presence of symptoms lasting longer than 3 weeks after the initial onset of symptoms, and chronic COVID-19 is defined as the presence of symptoms lasting longer than 12 weeks, according to the COVID Symptom Study, in which more than 4 million people in the US, UK, and Sweden have entered their symptoms after a COVID-19 diagnosis. 1 It's probable that people who have symptoms were more likely to take part in this study than those who didn't.

Fatigue and dyspnoea are the most commonly reported symptoms following an acute COVID-19 infection. Joint pain and chest pain are two more typical symptoms. Specific organ dysfunction, especially involving the heart, lungs, and brain, has been observed in addition to these generic symptoms. [9]

Because fatigue and dyspnoea are the most common complaints reported after COVID-19, the purpose of this study is to determine the effects of COVID 19 on physical fitness in terms of functional status, endurance, and lung capacity in post-COVID-19 patients. Physiotherapy has an important role in rehabilitation of patients recovered with COVID-19 who experience limitations in daily physical functioning in accordance with lung capacity, endurance and functional status of the patient.

Material and Methodology :

The research was carried out in the Physiotherapy OPD at Vikhe Patil Memorial Hospital. A cross-sectional study was designed. Purposive sampling was used in the sampling process. The sample size for this study was 50. The study lasted for six-months. Patients with COVID 19 infection who were recovered and willing to participate, both genders, ages 20 to 55, and able to walk without assistance met the inclusion criteria. Patients who were not cooperative or who had additional systemic illnesses, such as diabetes, were excluded. Peak flow metre, Sterilium, Cotton wool, Weighing machine and Measuring tape, Post COVID-19 Functional status scale, 2 cones, stop watch, Pedometer, tape measure were among the materials utilised. Graphpad InStat was used to analyse the data. All of the outcome measures had their mean and standard deviation computed. All of the parameters were subjected to descriptive analysis

Procedure:

At Dr. Vitthalrao Vikhe Patil tertiary care hospital, the following research was conducted. A total of 50 post-COVID patients were included in the study through selection criteria. Before beginning the investigation, all required measures were performed. The participants were first given a brief explanation of the study purpose and process, after which they were asked to sign a consent form. The participants were chosen using inclusion and exclusion criteria.

On a proforma, demographic data was collected, including past history and reports. A Mini Wright's Peak Flow Meter was utilised to capture PEFR after a full explanation of how the instrument worked, as well as a scale proper demonstration and trial performance. The recordings were made while sitting. The participants were advised to take a deep breath and blow hard through the mouthpiece. The test manoeuvre was performed three times, with the best result being used for analysis. Each individual used sterilium and cotton wool to sanitise the equipment between applications.

The F8W requires a person to walk a figure-of-8 around 2 cones placed 5 ft (1 ft=0.3048 m) apart. To complete and score the F8W, you'll need only a few pieces of equipment (2 cones, a stopwatch, and a tape measure), some training, and some time. Individuals were asked to walk a figure-of-8 around cones spaced 4, 5, and 6 feet apart to calculate the 5-foot distance between them. The 5 ft distance was difficult, but adults of various sizes and ages were able to complete it.

As a results of which the brain sends signals of breathing faster to enhance the flow of oxygen-rich air into the lungs via which the oxygen gets into the bloodstream and is pumped around to the body via the aorta of heart.[7-9]

A normal healthy individual breathes in and out up to twenty times a minute, which accounts for nearly 30,000 breaths a day.10 An active exercise or an exertional session of work may throw a kink in that pattern due to breathlessness since the lungs don't supply the increasing demand for oxygen to the body via the heart. This is termed as exercise-induced breathlessness.[7-10]

Rate of perceived exertion measured by using MBS. Borg scale rating is from 0-10 grade.

A patient is continually exposed to gravity, thus every position the patient assumes reflects the effect of gravity on oxygen transport, thus, oxygen transport is often improved, maintained, or worsened with changes in body position. Despite being essential to normal cardiopulmonary function, gravity is that the principal contributor to significant inhomogeneity of physiological function down the lungs.[11]

When upright, the diameter of the most airways increase slightly. If the airways are obstructed even small degrees of airway narrowing induced by recumbency may result in significant airway resistance. The vertical gravitational gradient is maximal when upright, the anteroposterior dimension of the chest wall is that the greatest, and compression of the heart and lungs is minimal.12 The shortened position of the diaphragmatic fibers is countered by a rise in the neural drive to respire in the upright position.[13]

The supine position is not physiological position for humans unless sleeping, and this position is physiologically the least justifiable position for ill patients irrespective of whether they exhibit cardiopulmonary dysfunction.[14-17]

The supine position alters the chest wall configuration, the anteroposterior position of the hemidiaphragm, the intrathoracic pressure, and therefore the intraabdominal pressure secondary to the shifting of the abdominal viscera during this position.[18-24]

Because of the reduction in vertical gravitational gradient, and therefore the intrapleural pressure gradient of the lung in supine, the distribution of V/Q matching appears more uniform and evenly matched within the supine position.[25]

The prone position improves the arterial oxygenation and reduces the work of inhalation in patients with cardiopulmonary dysfunction. Arterial oxygen tension, tidal volume and lung compliance can be improved in prone position.[26-28]

Submaximal exercise tests may be used to predicts aerobic capacity or to assess the flexibility to perform the same exercise or task. Additionally, measurements taken before, during, and after the test can yield valuable information regarding the person's exercise response.

Material and Methodology:

This was an observational study with a study duration of 6 months. A total of 40 participants were recruited using the purposive sampling method from Dr. Vitthalrao Vikhe Patil College of Physiotherapy, Ahmednagar. The study materials included Weighing Machine, Measuring Tape, Stepper, Pulse Oximeter, MBS, Metronome.

The inclusion criteria included healthy students with age 18-25, both male and female, healthy students with normal Body Mass Index. (18.5 – 24.9), healthy students with normal Chest-Xray findings, healthy students with normal breath sounds on auscultation. While the exclusion criteria included students with BMI > 24.9 and < 18.5, students diagnosed with

respiratory problem, students with high blood pressure (SBP>180mm Hg (DBP>100mm Hg), Resting heart rate >120/ min (Tachycardia), Recent fracture, Smokers, Unstable Angina, Myocardial infarction during previous month.

Procedure:

Institutional Ethical Committee approval was obtained before the commencement of the study. Healthy students were selected based on inclusion and exclusion criteria. Informed consent was obtained prior to involving them in the study in a language best understood by them. Basic demographic data like name, age, gender, weight, height, BMI, smoking history was documented on data collection sheet. The subjects were explained about the procedure, benefits, and the need of the study in a language best understood by them. Check vitals and RPE in sitting position ask the subject to perform the submaximal exercise test after that place subject in supine/ prone / upright sitting on alternate day and records the SPO2 by pulse oximeter and RPE by MBS Immediately, at 1min, at 3 min, at 5 min. Compare the recovery of oxygen saturation and RPE in three positions.

Procedure of submaximal exercise test (Queens college step test)

The queen college step test is one of many variations of step test procedures used to determine aerobic fitness.

Purpose- This submaximal test provides a measure of cardiorespiratory or endurance fitness.

Equipment required- 16.25 inches / 41.3 cm step, stopwatch, metronome or cadence tape, pulse oximeter.

Procedure- The subject steps up and down on the platform at a rate of 22 steps per min for females and at least 24 steps per min for male. The subjects are to step using four-step cadence, “up-up-down-down” for 3 minutes (Fig-1).

Fig. 1: Positive Expiratory Flow Rate (PEFR) Device

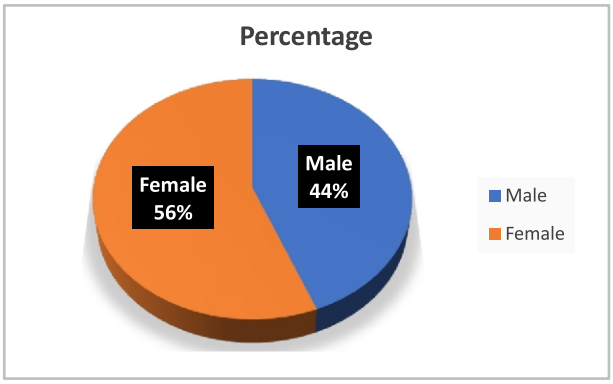
Fig. 2: Patient performing PEFR in presence of a therapist.

Result :

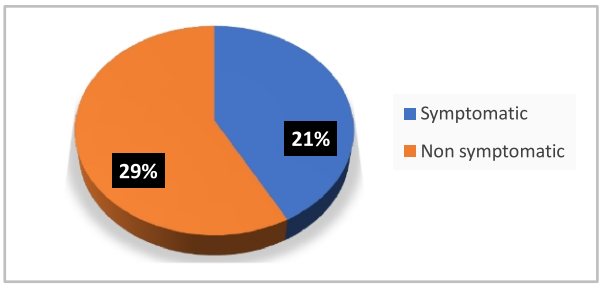
A total of 50 participants aged 20 to 55 years old were enrolled in the trial. There were 22 males and 28 females among the 50 patients, with 21 symptomatic and 29 asymptomatic patients. Graphpad InStat was used to analyse the data. All of the outcome measures had their mean and standard deviation computed. All of the parameters were subjected to descriptive analysis. The information was gathered and entered into an excel spreadsheet. In young adults, demographic analysis was conducted for age and gender.

Table 1: Shows Demographic Profile.

Demographic Details		No. of patients/ Mean ± SD
Age		32.4±9.6
Gender	Male	22(58.57%)
	Female	28(41.42%)
Duration		3.5±1.7
Symptom wise distribution	No. of symptomatic patients (%)	21(42%)
	No. of asymptomatic patients (%)	29(58%)



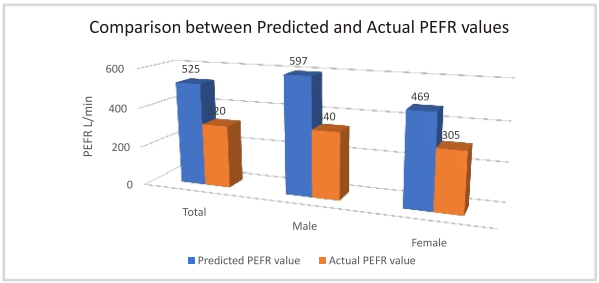
Graph 1.a: Shows Gender Wise Distribution.



Graph 1.b: Shows Distribution According to Symptomatic and Non-Symptomatic Patients.

Table 2: Shows Comparison Between Predicted and PEFR Values in Males and Females.

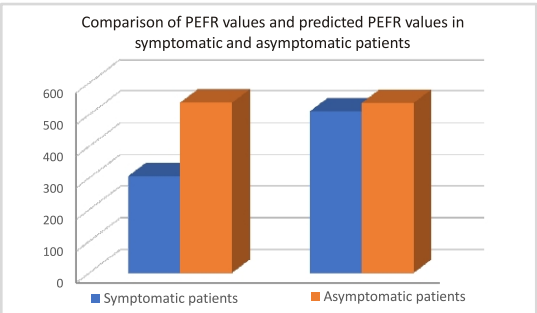
Subjects	PEFR Value (Mean ± SD)	Predicted PEFR Value (Mean ± SD)
Total	320.8±74.4	525.7±65.6
Male(N=22)	340.4±72.9	597.9±15.44
Female(N=28)	305.3±73.2	469±7.24



Graph 2: Shows Comparison Between Predicted and Actual PEFR Values in Males and Females.

Table 3: Shows Comparison of Actual and Predicted PEFR Values in Symptomatic and Asymptomatic Patients.

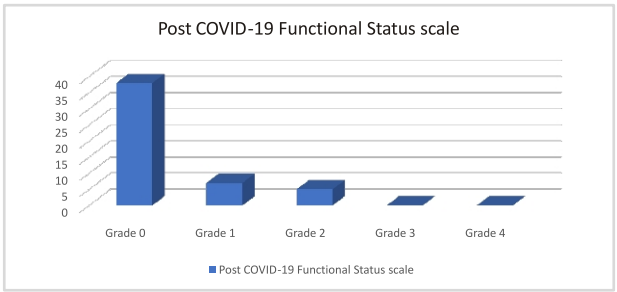
	PEFR in symptomatic patients (Mean ± SD)	PEFR in asymptomatic patients (Mean ± SD)
Actual PEFR values	305.71±72.63	331.72±75.12
Predicted PEFR values	510.09±62.92	537.06±66.34



Graph 3: Shows Comparison of PEFR values and predicted PEFR values in Symptomatic and Asymptomatic patients

Table 4: Shows Post COVID-19 Functional status scale Grade wise distribution

Total no. of patients	Post COVID-19 Functional Status Scale (Grades)				
	Grade 0 (No functional limitations)	Grade 1 (Negligible functional limitations)	Grade 2 (Slight functional limitations)	Grade 3 (Moderate functional limitations)	Grade 4 (Severe functional limitations)
50	38	7	5	0	0



Graph 4: Shows Post COVID-19 Functional status scale Gradewise distribution.

Table 5: Shows mean values of steps and time required while performing Figure of 8

Figure of 8 test	No. of subjects	Steps (MEAN±SD)	Time (MEAN±SD)
Symptomatic	21	13.61±6.1	9.47±0.6
Asymptomatic	29	13.79±1.04	9.62±0.8

Discussion:

A total of 50 participants aged 20 to 55 years old were enrolled in the trial. There were 22 males and 28 females among the 50 patients. The average age was 32 years. There were 21 symptomatic and 29 asymptomatic patients among the 50 patients.

In this study we assessed lung function capacity, functional status and endurance with assessing different outcome measurements including Peak Expiratory Flow Rate (PEFR), Post COVID-19 Functional Status Scale (PCFS), Figure of 8 walk test.

PEFR levels were compared between symptomatic and asymptomatic subjects and were reduced in all patients, but symptomatic patients had lower values than asymptomatic patients, indicating that symptomatic patients have lower lung capacity than asymptomatic patients who have recovered from COVID-19. PEFR values were reduced with 40.2% in symptomatic patients when compared with predicted value and 38.37% in asymptomatic patients, also there is reduced lung capacity in females rather than in males by 10.3%, it is because of body built, muscle strength and nutritional status,

increase in height and a good muscle power in males as compared to females. Author Fabio Anastatio et al. conducted study on 'Medium-term impact of COVID-19 on pulmonary function, functional capacity and quality of life.' concluded that lung injury during COVID-19 correlates to a decline in pulmonary function after 4 months from acute infection. This study supported the result as lung capacity was reduced in post COVID patients.

After recovering from COVID-19, the majority of patients showed no functional limitations and no symptoms of pain, anxiety, or depression, but only a few patients who were symptomatically unwell were affected and showed symptoms of pain, anxiety, and depression, as opposed to asymptomatic patients. There was no significant functional limitations like difficulty in performing ADL's present in 76% of the patients. Author Cristina Udina et al did study on 'Rehabilitation in adult post COVID-19 patients in post-acute care with therapeutic exercise.', he assessed pre-post impact on physical performance of multi-component therapeutic exercise for post-COVID-19 rehabilitation in a post-acute care facility and concluded that adults surviving COVID-19 improved their functional status, including those who required ICU stay, resulted to emphasize the need to establish innovative rehabilitative strategies to reduce the negative functional outcomes of COVID-19 . This article supported the study and showed negative effect on health status of the patient.

Our study found no effect on the patients' endurance after recovering from COVID-19 infection. Similar study was made by Carlos Del Rio et al did study titled 'Long-term Health Consequences of COVID-19,' discovered that the clinical spectrum of severe acute respiratory syndrome coronavirus (SARS-CoV) 2 infection ranges from asymptomatic infection to life threatening and fatal disease. Current estimates are that approximately 20 million people have recovered globally, however, clinicians are observing and reading reports of patients with persistent severe symptoms and even substantial end-orbital disease. Because COVID-19 is a new disease, much regarding the clinical course, particularly the long-term health effects, is unknown.

This study will provide information about impact of COVID-19 on the health status of the patients after recovery. Limitations of this study were: Pre PEFR was not taken in COVID-19 patient, because on first day of admission patient was active to spread infection so it was very difficult to take pre PEFR values by following all universal precautions in such cases.

In COVID-19 pandemic situation reaching to the patients was difficult so the sample size was less. Clinical implication of this study is as follows: In post COVID phase as a part of rehabilitation prescribing exercises to improve endurance training, functional capacity and Lung capacity. Emphasize various ways to establish innovative rehabilitative strategies to reduce the negative impact on health due to COVID-19 in post COVID patients.

Conclusion:

This study demonstrates that COVID has an influence on physical fitness in post-COVID patients after recovery, as well as on lung function capacity, since the PEFR value is lower than their expected value. The PEFR value in symptomatic patients is lower than in asymptomatic people. The functional condition of post-COVID patient's remains unaffected, and just a handful of them had pain, depression, or anxiety following their recovery. After recuperation, there is no effect on endurance in COVID patients.

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Conflict of Interest- None

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my study

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