A COMPARISON OF POST COVID AND NON COVID INDIVIDUALS FOR CARDIOPULMONARY FITNESS TEST

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Abstract

Background - The lung and heart have been predominantly impacted by the cov-19 pandemic worldwide. Physiotherapists are currently crucial in the evaluation and management of patients as well as the many measures implemented by the Indian government to address the crises, which have a big influence on citizens' daily life. This study compares CRF between post-cov-19 and non-cov-19 individuals as its main goal.

Objective of study - Hypothesis of research - There will be a significant difference between post-covid-19 and non- covid-19 individuals on cardiorespiratory fitness. Null Hypothesis: There will be no significant difference between post-covid-19 and noncovid-19 individuals on cardiorespiratory fitness.

Methodology -A cross-sectional study was performed. We enrolledthe post-cov-19 individuals who had been diagnosed with cov-19 infection before five months and also enrolled the non-cov19 individuals. A total of 30 samples were collected, and the data was analyzed using SPSS software. The Harvard step test and YMCA step test were performed for the evaluation of CRF.

Results- Independent Student- Compare the two groups using the sample size (15 post-covid group 1 and 15 non-covid group 2) and obtain a P value of 0.05. Therefore, the findings show that there is a significant difference in cardiorespiratory fitness between post-cov-19 and non-cov-19 individuals.

Conclusion - This study found the significant reduction of cardiorespiratory fitness among the post-cov19 individuals as compares to non cov-19 individuals.

Key words –cardiorespiratory fitness, post-covid-19, Non-covid-19, Harvard step test, YMCA step test.

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INTRODUCTION

Coronaviruses are ss-positive sense RNA viruses with a high rate of mutation and recombination. Coronaviruses have been connected to respiratory and intestinal disorders in humans and animals. Acute respiratory infections like influenza, respiratory syncytial virus, and bacterial pneumonia, are quite well impulsive of cardiovascular disease, and the underlying CVD is frequently associated with comorbidities, which can enhance the frequency and severity of infectious illnesses. The emergence of the SARS-CoV-2 virus, which induces coronavirus disease 2019, has quickly spread to become a pandemic, with a large majority of individuals affected suffering from underlying cardiovascular disease. [1] On December 12, 2019, COVID-19 initially appeared in Wuhan, China, as a spread of atypical pneumonia. As of April 14, 2020, it had infected over 1963,943 people worldwide and killed over 123,635 people in more than 200 nations. On a global scale, this sickness has had a huge impact on both the economy and wellness.[2]

Infection with two recently developed coronaviruses, SARS-Coronavirus and MERSCoronavirus, results in more severe lung illness with shockingly high case fatality rates. In the winter of 2002, SARS-Coronavirus initially appeared in China's Guangdong province. SARSCoronavirus infected more than 8000 people in 29 countries, resulting in 774 deaths. In June 2012, MERS-Coronavirus was initially reported in Saudi Arabia, ten years later. Other countries in the Middle East with cases include Jordan, Qatar, Oman, and the United Arab Emirates. [3]

The coronavirus made a major impact on the cardiovascular system which leads to onerous recovery from the SARS-COV-2 other than in later stages it has long-term complications. Between 8 percent and 28percent of individuals with COVID-19 infestations have elevated troponin levels, indicating cardiac injury. Numerous patients suffered cardiomyopathy in a cohort of patients from Seattle, the very first major COVID-19 clinic in the United States. The mortality rate of 57 individuals with indicators of cardiac participation was substantially greater, highlighting the relevance of the cardiovascular system in these patients' outcomes. [2]

This has just come to light, with studies showing that persons who have endured COVID-19 illness were associated with poor physical fitness when they were allowed to leave the hospital. The influence of COVID-19 on physical fitness in the mid-and long-term is unknown, while cardiovascular deficits and symptoms like dyspnoea and fatigue can last for months following discharge. However, field experiments, such as those done during hospitalization, provide such a general assessment of health and fitness that does not reveal the underlying cause of the impairment.[4]. Because of the unique nature of the current COVID-19 epidemic, it is impossible to predict how the constraint created for enforcement will be applied. COVID-19 limitation may have influenced the population's cardiorespiratory level of fitness. Although it is well established that long period bed rest causes a 0.3–0.4% daily decline in VO2 maximum in young adults, restricted teenagers are unlikely to have spent the most of their day completely idle. Prior studies have revealed that in nations with strong free-movement limitations, such as Spain, children and adolescents engage in less physical exercise. It's entirely possible that young people's cardiorespiratory fitness levels have deteriorated with time as a result of a decrease in their amount of physical activity. [5]

There has been research done on post-cov-19 and it has shown shortness of breath, fatigue, cough, and chest pain are persistent and specifically during physical activity after three months and six months of diagnosis. The sample size that has been taken so far from the existence of research is like a grain of salt. Research into the long-term effects of post-cov-19 has only recently begun and previous literature cannot draw any firm conclusions about the disease's long-term impact. In recent months, a growing number of research there have been scientific studies that look into the existence of post-COV-19 symptoms. In fact, a preprint of a metaanalysis was currently posted. According to this meta-analysis, 80% of COVID-19 survivors suffered at least one symptom post-COVID-19, with tiredness (58%) which was the most prevalent, followed by headache (44%), focus difficulties (27%), loss of hair (25%), and breathlessness (24 percent). [6]

Cardiorespiratory fitness is a form of physical endurance that need the vascular, pulmonary, and muscular systems to collaborate in order to transfer oxygen to the working tissues throughout physical exercise. According to a large body of research, inferior CRF is related to an increased risk of Men and women both dying as a result of cardiovascular and metabolic comorbidities.[4]. The significance of cardiorespiratory fitness (CRF), is now regarded as an essential indicator, of muscular performance, and for decades, bone and joint health fitness have all been related to functional independence, life quality, and health trajectories. Wasserman and colleagues first devised the gear model to show

how the pulmonary, vascular, and skeletal muscle systems interact during aerobic exercise. [7]
The prior impacts of the Coronavirus disease 2019 is spreading rapidly and becoming clearer. Physical activity (PA) patterns are diminishing globally due to social alienation. COVID-19's influence on muscular performance, bone, and joint health is also a source of worry. According to preliminary findings, persons infected with COVID-19 with increased CRF and muscle force generation, as well as a physically active living, are protected against more severe symptoms. Although, during the early phases of recovery for people affected people with COVID-19, there are early signs of a reduction in CRF. [7]

VO2max is the primary parameter for measuring cardiopulmonary ability and pulmonary circulation lifestyle activities such as exercise intensity. The value of VO2max is defined as the quantity of oxygen transported first from the atmosphere to contracting muscles via the cardiorespiratory system, accompanied by oxygen utilisation by metabolically active tissue.[8] Previous researchers stated that employing an app-based or streamed exercise program to deliver exercise interventions may be a realistic and cost-effective option to administer treatment approaches right now, as the COVID-19 outbreak embraces new ways of functioning. Using VO2 max has several benefits, along with the fact that it is straightforward to get and may be included in a patient's comprehensive care record, similar to a list of previous clinical difficulties. It can also be used to initiate advanced care plans for "high-risk" individuals, which take their preferences into account and outline the adequate resources of medical intervention. [9]

OBJECTIVE OF THE STUDY

Hypothesis of research - There will be a significant difference between post-covid-19 and non- covid-19 individuals on cardiorespiratory fitness.
Null Hypothesis: There will be no significant difference between post-covid-19 and noncovid-19 individuals on cardiorespiratory fitness.

METHODOLOGY

At Galgotias University, a cross-sectional study was conducted from January 20 to March 13 to compare the cardiorespiratory fitness of university students. The people who had cov-19 then recovered in the previous five months were chosen for group one using the convenience sample technique. Group two was made up of persons who had never used cov-19 before. The kind and subject of the study will be fully disclosed to every chosen volunteer. Prior to the study, the volunteer was asked to sign the consent form. The data collecting form will have a record of all the information gathered.

PROTOCOLS

Harvard step test - Subjects were instructed to step up and down the step box with a frequency of 30 steps in a minute for 5 minutes, or till the time they were exhausted. After completion of the test, the participant instantaneously sits down. The pulse rate was recorded after the exercise: The physical index was determined by using following formula PFI = Duration of exercise (seconds) × 100 divided by 2× sum of pulse count in recovery.
The YMCA Step test in three minutes - On a thirty Centimeter box, subjects must step up and down 72 times in 3 min (step up down-down). The stepping rates of steps is twenty four step per minute. After completion of test subject tend to stop and sit down still. After five seconds, the subjects heart rate is monitored for one minute and then subject need to sit for five minute for recovery phase. For estimating VO2max, a Korean equation was utilized. The VO2 max

RESULTS

Statistical data analysis

Continuous data (age, weight, height, gender) were summarized as Mean + SD (standard deviation) in number and percentage (%). Independent Student`s t-test was used to compare two groups of continuous data. Analyses were carried out on SPSS software (window version 22.0)

Result and Observation

The present study evaluates the effect on CRF among post-cov-19 and non-cov-19 individuals. A total of 30 (15 individual post-cov-19 and 15 non-cov-19) were recruited.

The primary outcome measure was cardiorespiratory fitness assessed by using PFI and VO2 max. Besides that, baseline demographic characteristics viz. age and gender were also noted. The primary objective of the study was to compare cardiorespiratory fitness.

Demographic characteristic

The baseline demographic characteristic (age, weight, height, and gender) of two groups at presentation is summarized in table 1. And also depicted in figure 1.

POST COVID-19 GROUP (n=15)	NON COVID-19 GROUP(n=15)	t value	*P* value
67.27 + 7.469	78.47+6.968	-4.247	<0.05

Table 1: PFI Comparison

POST COVID-19 GROUP (n=15)	NON COVID-19 GROUP (n=15)	t value	*P* Value
34.126667+6.4104231	40.366667+6.5660019	-2.634	<0.05

Table 2: VO2 Max Comparison

RANK

GROUP	N	MEAN RANK	SUM OF RANKS
PFI 1	15	10.10	151.50
2	15	20.90	313.50
TOTAL	30		
VO2MAX 1	15	11.77	176.50
2	15	19.23	288.50
TOTAL	30		

Table 3: Mann-Whitney Test

	PFI	VO2MAX
MANN WHITNEY U	31.500	56.500
WILCOXON W Z	151.500	176.500
ASYMP. SIG.(2-TAILED)	-3.362	-2.323
EXACT SIG.[2*	.001	.020
(1-TAILED SIG.)]	. 000	.019

Table 4: T-Est Statistics

	Non Cov-19		Post Cov-19	
Variables	Mean	S.D	Mean	S.D
Age	21.46667	2.828427	22.6	2.12132
Weight	55.2	18.38478	64.2	7.071068
Height	1.674	0.106066	1.696667	0.06364
BMI	19.94467	8.93783	21.3	3.945656

Table 5: Mean and standard deviation

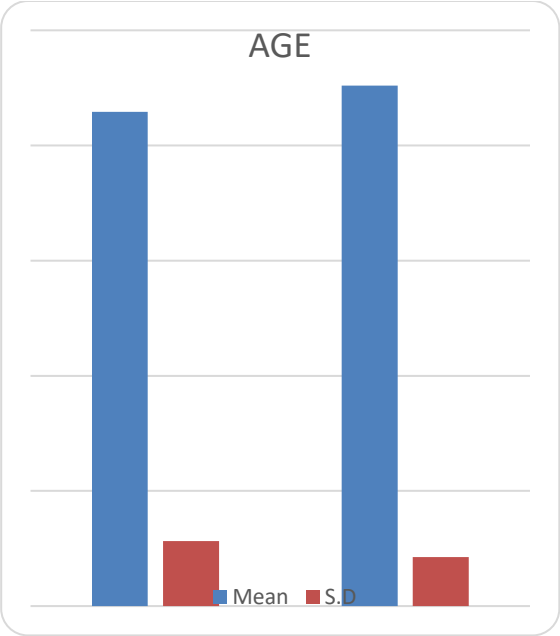

Figure 1: Age

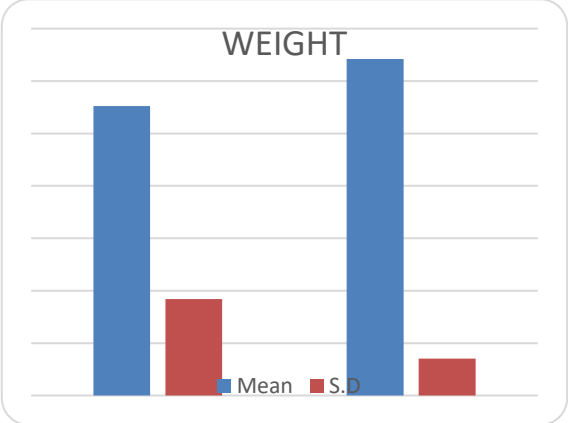

Figure 2: Weight

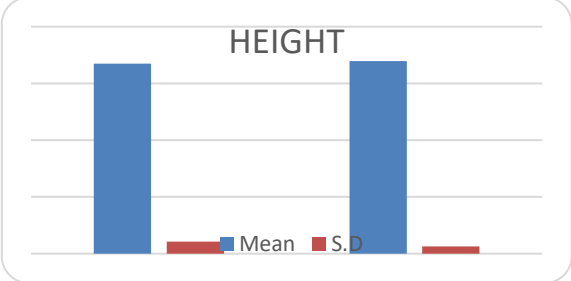

Figure 3: Height

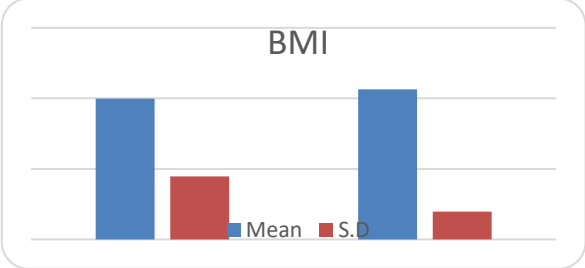

Figure 4: This Graphs shows BMI (Body mass index)

DISCUSSION

The findings of the study provide direct information regarding both groups' cardiorespiratory fitness, maximal oxygen consumption (VO_{2MAX}), and dyspnoea. As a result, during an examination, it can be utilized to diagnose the underlying pathology of patients and athletes. It can assist in the development of rehabilitation programs. The CRF drop in post – covid patients is also demonstrated in earlier literature. The research also takes into account the state of the patient and CRF.

The most common mechanisms of cardiovascular damage include direct virus-mediated cytotoxic activity, ACE 2 receptor down-regulation, immune-mediated inflammatory conditions the myocardium, and pericardium, and clinical symptoms such as dyspnoea, fatigue, myocarditis, reduce cardiac reserve, RAAS imbalance, autonomic dysfunction, and arrhythmias. [10] The underlying mechanism of organ damage during the early stages of COVID-19 can explain why survivors of severe COVID-19 have persistent cardiorespiratory symptoms. The SARS-CoV-2 virus primarily damages the lung, though it can also impact other organ systems. In order to infect the host and cause lung harm, the virus exploits the epithelial alveolar lining's pneumocytes containing ACE2 receptors, which convert angiotensin to angiotensin II. Several post-mortem tests revealed the diffuse alveolar injury, raising the possibility of long-term pulmonary function impairment. [11]

A study also divulged that there was an explicit reduction in the maximal oxygen consumption (VO2MAX) in those individuals who have long-term symptoms of covid-19 as compared to those who do not have long-term symptoms. Several studies have found that long-term symptoms persist several investigations have documented the initial COVID-19 infection. The researchers looked at the characteristics of CPET in patients with a COV-19 history, comparing subjects based on whether or not they had post-COVID-19 manifestation. Cross-sectional research was conducted. People over the age of 18 who had a history of the study comprised SARS-CoV-2 infections validated by a PCR examination and a CPET in 45 and 120 days following the infectious event. According to the findings, the Post-COVID-19 condition was linked to lower peak VO2, a lower likelihood of reaching the anaerobic threshold, and an increased likelihood of having discomfort while the CPET.[1]

Previous investigations concluded that statistics from 145 COVID-19 participants wasanalysed, and it was observed that 41 percent of the patients had persisting difficulties 100 days after taking COVID-19, with breathlessness being the most severe the most common complaint (36 percent).And over 100 days after being diagnosed with COVID-19, a large number of post-COVID-19 patients experienced long term symptoms, pulmonary function deterioration, and x-rays showed pulmonary anomalies. [12] Individuals who have covid-19 are experiencing onerous symptoms during recreational activities and symptoms are especially noticeable in those individuals with comorbidities. The current COVID-19 patient sample appears to be representative of Italian hospitalized patients. However, compared to hospitalized COV-19 patients in the United States, the current sample appears to be older and has a lower mean BMI. When patients are discharged home following early mobilization and bedside physiotherapy, they may have diminished physical functionality. [13].

A Shortness of breath is also observed following aerobic exercise. The most prevalent symptoms are tiredness and breathlessness, which have a collective occurrence based on the follow-up, the percentage ranges from 35 to 60%. Other post-COV-19 issues comprised cough (20-25%), anosmia (10-20%), ageusia (15-20%), and joint soreness (15-20%). More than 60% of SARS-Cov-19 patients, as per the researcher, have post-COVID-19 abnormalities. [6] Poor CRF is linked to a higher risk of morbidity and death in both women and men due to cardiovascular and metabolic risk factors, according to a significant body of data.[8]

During a study of teenage cardiorespiratory fitness before and after confinement with COV19, it was also ruled out. They looked at how 89 Spanish schoolchildren aged 12 to 14 years old changed their maximum oxygen intake (VO_{2max}) levels before and after being confined with COVID-19 (49.8 percent of girls). A 20-meter shuttle run was used to calculate the VO2 max. Before and after COVID-19's imprisonment. The majority of the study participants, girls, and boys aged 14 and 12, had lower values than the average VO_2 max rate growth. Confinement, according to the author, may also impede adolescents from naturally building their VO_{2max}. [9]. The CPET was tested in post-covid-19 individuals three months following discharge from the hospital in research. Both exercise capacity and VO_{2max} have changed dramatically.[14]

These findings show that patients who have spent a lot of time in the hospital for an extended period of time should be closely watched in order to determine their particular rehabilitation needs. According to our findings, muscular reactivation, breathing retraining, and probably pulmonary muscle strengthening should all be included in a rehabilitation program to alleviate symptoms. [4]

LIMITATION

There are a few limitations to this research that make it difficult to obtain precise results. Despite the lack of tools such as a treadmill, blood pressure monitor, ECG monitor, and spo2 monitor, we were able to complete our study and achieve our desired

outcomes. The sample is also little enough to be treated as a grain of salt. As a result, our conclusion is tentative. Previously, research was carried out in labs with volunteers exercising on a treadmill. For example, VO2 max measurement is over-priced, time-taking, and not feasible out of the laboratory and on the field, and it demands a high caliber of technical skill and guidance. As a result, when time is limited, sub-maximal exercise testing is routinely utilized to determine VO2max, laboratory supplies are unavailable, or greater activities are regarded as dangerous. One of the first submaximal tests to predict VO2max was the step test.

CONCLUSION

In conclusion, the current study finding suggests that the post covid-19 individuals has lower CRF comparatively to non covid-19 individuals. Future study can be done on a large sample size by using different tools for measuring cardiorespiratory fitness.

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