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Effect of Aerobic Exercise Versus Resistance Training on Anxiety and Physical Fitness Among the Post Covid Young Adults - A Comparative Interventional Study

Amatullah Azizbhai Bhurka[1], Dr. Yagna Unmesh Shukla[2]

[1]M.P.T(Cardio-Respiratory Disorders), [2]M.P.T (Musculoskeletal Conditions),
Ph.D. Principal, Government Spine Institute and Physiotherapy College, Civil Hospital, Ahmedabad

Corresponding Author: Amatullah Azizbhai Bhurka

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ABSTRACT

INTRODUCTION: Coronavirus is a major pathogen which attacks the respiratory system of human primarily. It results in decreased activities of daily living (A.D.L.), quality of life (QOL), decreased physical activity and mental functions. The ability to perform moderate to high-intensity Aerobic exercise or resistance for a prolonged period is linked to cardio respiratory fitness. It is best indicated by Maximum oxygen uptake. Preliminary evidence suggests that symptoms of anxiety range from 16 to 28% and self-reported stress is around 8% during COVID-19 pandemic throughout the world. Many rehabilitation protocols are designed for the individuals recovered from covid-19. Mostly includes the combination of aerobic exercises and resistance training along with flexibility exercises, breathing exercises. Hence, need of study is to compare the aerobic exercise and resistance training to provide more effective treatment for relieving the symptoms of anxiety and improving physical fitness.

METHODOLOGY: Approval of The Ethical Committee Was Taken. Selection of the Subjects According to The Inclusion Criteria and Exclusion Criteria Has Been Done. After Taken Written Informed Consent from The Screening of all Subject Has Been Done. Physical Activity Questionnaire Hamilton Anxiety Scale Were Filled by Participants. Queen College Step Test Was Conducted for Pre-Data of Vo2 Max and Heart Rate Recovery. Participants Were Divided into Two Groups- Group A (Aerobic Exercise) And Group-B (Resistance Training) using cheat method of randomization. Each Group Underwent 4 Weeks Intervention Programmed and Post Data Was collected using the Hamilton anxiety rating scale and Queen College Step Test step test. Analysis was done using SPSS.28.

RESULT: paired t-test and Wilcoxon signed rank test were used in both Group A (aerobic exercise) and group B (resistance training) within group analysis demonstrated statistically significant increases in physical fitness (HRR AND VO2MAX) and decreases in anxiety levels. Compared to group B (resistance training), Vo2 max rises greater in group A (aerobic activity) ($p<0.05$). Heart rate recovery in (2min, 3min and 5min) showed significant ($p<0.05$) decline in group A Compared to Group B. No Significant Difference Was Found Between Both Groups in Level of Anxiety Symptoms and HRR in 1 min ($p>0.05$).

CONCLUSION: participants engage in either aerobic exercise or resistance training is found to be beneficial in improving physical fitness and reducing symptoms of anxiety. But aerobic exercise gives better results in improving physical health.

KEYWORDS: Aerobic Exercise, Resistance Exercise, Physical fitness, Anxiety, Post-covid young adults.

INTRODUCTION

COVID-19 is a fresh enclosed RNA beta-corona virus and recognized as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2)[1]. The disease characterized by a widespread, highly contagious inflammatory process that causes respiratory, physical, and psychological dysfunction in patients. COVID-19 emerged in December 2019 in Wuhan, Hubei province, China, and alarmingly spread worldwide, with the growth in the number of cases and deaths being considered a global outbreak with a dramatic impact [2]. The world is still facing this virus, and it continues to a serious threat to everyone [3].

It has been two years since the corona virus disease 2019 (COVID-19) pandemic was first declared. Still, treatments have been developed rapidly during this time, and effective vaccines have been widely administered to the population, both children and adults, protecting millions from severe disease and death. Until now, the focus was primarily aimed at the acute phase of the disease. However, many individuals experience debilitating COVID-19 symptoms months' later, requiring additional medical attention and follow-up[4].

Adult age group classification[5]

Young-aged adults (age 18-35)

Middle-aged adults (age 36-55)

Older adults (age ≥55 years)

On February 2nd, 2022, the National Institute for Health and Care Excellence (NICE) published a guideline defining long-COVID as signs and symptoms that continue or develop after acute COVID-19. This includes ongoing symptomatic COVID-19 (from 4 to 12 weeks) and post-COVID-19 syndrome (12 weeks or more)[6.] The common residual symptoms among COVID-19 survivors at one-year post infection included fatigue/weakness (28%), dyspnea (18%), arthromyalgia (26%), depression (23%), anxiety (22%), memory loss (19%), concentration difficulties (18%), and insomnia (12%).[7]

It is self-limited infection[8].Physical fitness is considered as the degree of ability to execute a physical task under various ambient conditions. The low physical fitness level of an individual is associated with higher mortality rate. Three main aspects of the physical fitness: static fitness (absence of disease), dynamic fitness (ability to perform strenuous work) and motor skills fitness[9].

In post-COVsID-19 patients, it is possible to improve functional capacity and quality of life (reduce stress and mental disorders) through exercise regimens that combine resistance exercise (e.g., 1-2 sets of 8–10 repetitions at 30–80% of 1RM) and aerobic exercise (e.g., 5–30 minutes at moderate intensity). In order for patients to finally resume their pre-disease levels of physical activity and resume their usual activities of daily living (ADLs), aerobic exercises should be introduced to them gradually. Because exercise training causes morphological changes (such as an increase in the amount of contractile proteins and mitochondria), it may be possible to employ it as a strategy to lessen the harmful effects of COVID-19 on muscle tissue.[10].

For the majority of individuals, brisk walking appears to provide an appropriate aerobic training stimulus. Fast walking lowers anxiety levels and increases cardiopulmonary endurance (VO2MAX) [8, 11.12]. The effects of aerobic training have ranged from having no effects to increasing aerobic fitness by 40%, defined as maximal oxygen consumption, have been around 10-15% of the baseline values. The exact mechanisms that cause this heterogeneity in response to frequent aerobic exercise are unknown[13].

Resistance training (RT), a well-liked form of exercise, has been recommended as an essential element of a physical exercise program. It covers a variety of topics, such as controlling blood sugar, lowering blood pressure, increasing bone mineral density, treating cancer, controlling depression, and controlling weight[14].

Numerous studies have demonstrated that resistance training (RT) can improve quality of life (QOL), muscle strength, and exercise

capacity. Encourage patients to include multi-joint exercises in their regular routines[15].Heart rate (HR) is mediated primarily by the direct activity of the autonomics nervous system (ANS) [16]. Heart rate recovery can be defined as the rate at which the HR declines from either maximal or sub maximal exercise to resting levels. It has been identified as a powerful and independent predictor of cardiovascular fitness in healthy adults[17].Some studies shows that HRR from the peak exercise level to 1 to 2 minute of recovery is considered to be typical in healthy adults[17]. HRR after 3 minute of recovery is also considered to be significant value[18]. VO2 max is related to HRR[17]. Step tests are one of the most widely used field tests for estimating VO2Max[9]. The COVID-19 pandemic has introduced extraordinary life changes and stress, particularly in adolescents and young adults. Initial reports suggest that depression and anxiety are elevated during COVID-19[19]. Patients with COVID-19 (symptomatic or asymptomatic) exhibit a high frequency of neuropsychiatric complications with highest percentage attributed to anxiety[20].In a healthy person, a 20-minute exercise program of moderate intensity was able to significantly lower anxiety levels.

A minimum of 150 minutes per week of moderate-intensity aerobic activity and two days of muscular strengthening activities are advised by current international adult physical activity (PA) guidelines for health[21]. Therefore, the current study's objective is to determine how aerobic exercise and resistance training affect physical fitness using vo2 max, heart rate recovery, and anxiety levels using the Hamilton anxiety scale.

MATERIALS & METHODS

RESEARCH METHOD:

- STUDY DESIGN: A Comparative interventional study
- STUDY SETTING: ODP in physiotherapy college
- METHOD OF RANDOMIZATION: Chit method
- STUDY DURATION: One year
- TREATMENT DURATION: 4 WEEKS (Aerobic Exercise -5days/week) and (Resistance Training- 2days /week).
- SAMPLE SIZE: 34 Participants

GROUP A: 17 subjects (AEROBIC EXERCISE)
GROUP B: 17 subjects (RESISTANCE TRAINING)

INCLUSION CRITERIA:

- Subjects' willingness to participate.
- Both male and female were included.
- Subjects age between 18-45 years.
- Post covid young adults with duration greater than 6 months.
- Subjects having Hamilton Anxiety Rating scale score greater than 17.
- Fulfilling the fitness criteria as per PARQ+ scale.

EXCLUSION CRITERIA:

- Patient with any cardio respiratory (excluding COVID), cardio vascular or musculoskeletal problems and neurological problems.

WITHDRAWL CRITERIA:

- Participants with dyspnea during Exercise (RPE>16)
- Patient wants to discontinue the treatment

MATERIALS USED FOR THE STUDY:

- Pulse Oximeter (Sensitivity 74.1% Specificity 95.7%[22])
- Hamilton Anxiety Rating Scale
- Weights (For Resistance training)
- Stopwatch
- Metronome
- PAR-Q +(- Sensitivity 74.1%, Specificity 95.7% [23])
- Treadmill machine
- Exercise Mat
- Stepper
- Assessment form
- Consent forms, Pen, pencil, paper.

(figure 1: shows the materials used for the study)

OUTCOME MEASURES:

1. Vo2 max (maximal oxygen consumption) by using queen's college step test [24]**.** It is also called the Mc Ardle Step Test. It requires participants to step at a rate of 24 steps · min−1 for men and 22 steps · min−1 women for 3 min with pre-set frequency of (88 for female and 94 for male) metronome. The bench height is 16.25 in (41.25 cm). Wait 5 s, take a 15-s HR count, and multiply the HR by 4 to convert to beats · min−1. VO2 max is calculated using the formulas below for men and women. Its reliability=0.92 and validity=0.75 for the above test.

FOR MEN: **VO2 MAX (mL kg^{-1} $mint^{-1}$) = 111.33 – (0.42 × HR)**

FOR WOMEN: VO2 MAX (mL kg^{-1} $mint^{-1}$) = 65.81-(0.1847×HR)

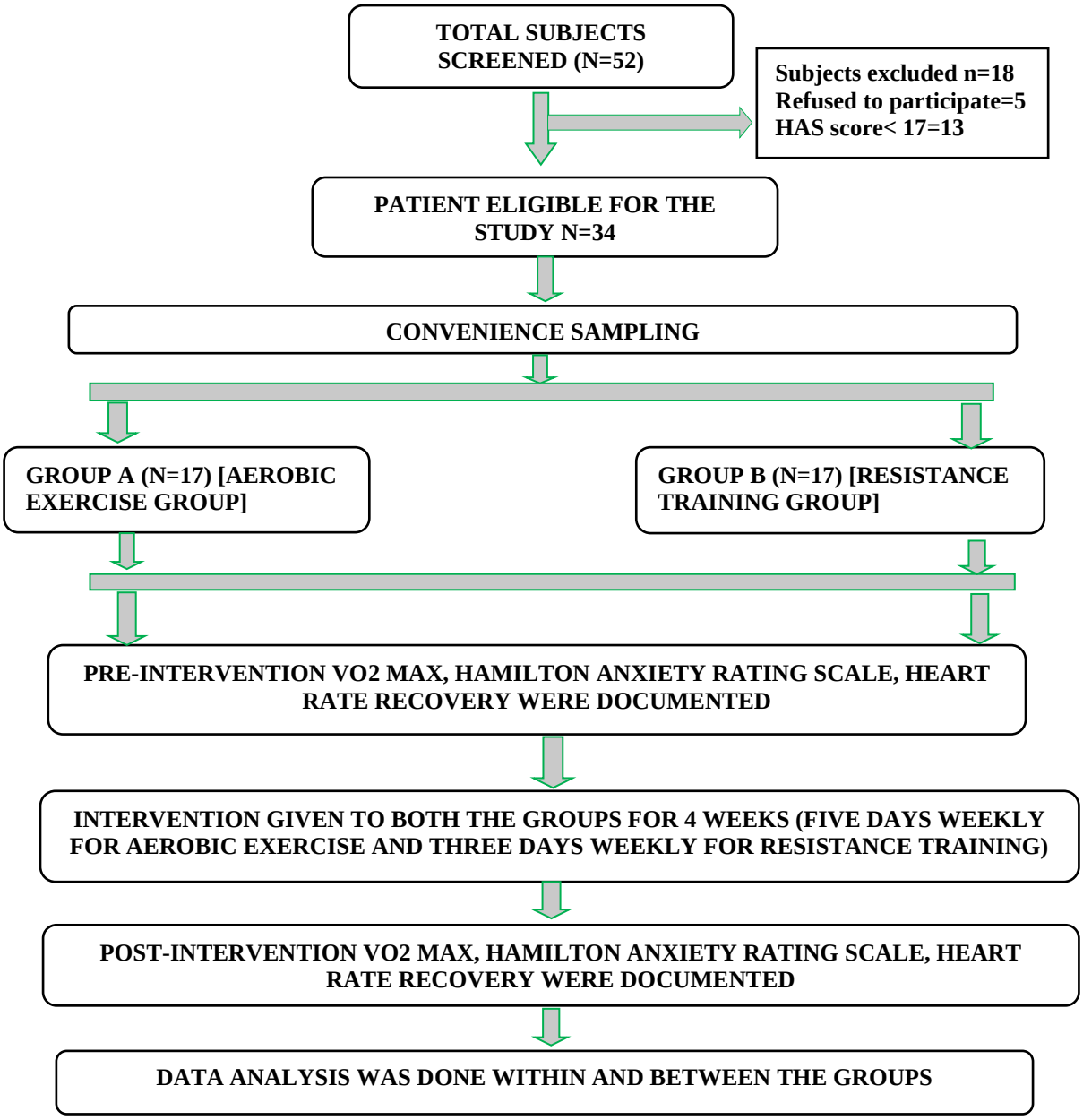
2. HAMILTON ANXIETY SCALE [20]: Hamilton anxiety measurement scale is one of the first rating scales developed to measure the severity of anxiety symptoms. Each item is scored on a scale of 0 (not present) to 4 (severe), with a total score range of 0–56. <17 score indicates mild severity,18-24 score indicate mild to moderate severity and ,25–30 score indicates moderate to severe. Its reliability=0.87 and validity=1.00.

3. HEART RATE RECOVERY [5]: Heart rate (HR) is mediated primarily by the direct activity of the autonomics nervous system (ANS) [20]. Heart rate recovery can be defined as the rate at which the HR declines from either maximal or submaximal exercise to resting level. It has been identified as a powerful and independent predictor of cardiovascular fitness in healthy adults. HRR from the peak exercise level to 1 to 2 minute of recovery is considered to be typical in healthy adults[25]. HRR after 3 minute of recovery is also considered to be significant value[18].

PROCEDURE

A total of 52 post-covid19 subjects were evaluated, and of those, 34 were screened for the study because they met the inclusion and exclusion criteria. The patient was given a thorough explanation of the condition, the need for the study, the assessment, and the treatment process in plain language. In order to ensure their healthy participation in the study, subjects were asked to complete a physical activity readiness questionnaire. Through the use of the chit method of randomization, the subjects were split into two intervention groups. A pre-assessment was conducted in both groups after the subject gave informed written consent. Using the Queen's College Step Test and the Hamilton Anxiety Rating Scale, respectively, Vo2max, heart rate recovery, and anxiety level were assessed and recorded. Both groups will receive treatment for 4 weeks, particularly group A (Aerobic) for 5 consecutive days of the week and group B (resistance) for 3 consecutive days of the week. Follow-up measurements of post-intervention VO2 max, heart rate recovery, and anxiety level would be made after 4 weeks, with the results being analyzed.

FLOW CHART



CLINICAL INTERVENTION: Study participants were divided into two intervention groups:

- Subjects in group A were provided with Aerobic Exercise
- Subjects in group B were provided with resistance Training

EXERCISE PRISCRIPTION FOR BOTH THE GROUPS ARE AS FOLLOWS[26]:

- Warm up and cool down exercises was same for both the Groups A and B.

WARM UP: 10 MINUTE (2 sets of 10 repetition)

COOL DOWN: 10 MINUTES (Hold: 30 sec, Repetitions: 3 times)

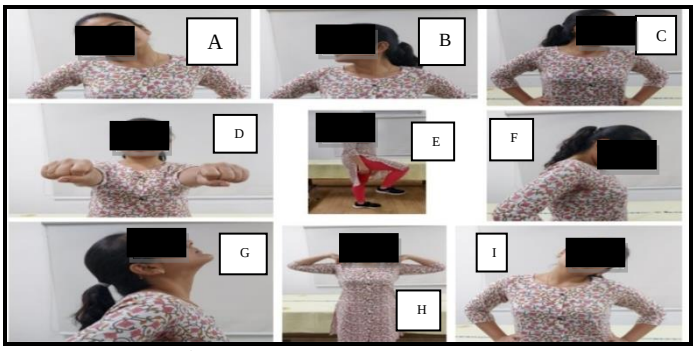


figure 2: Shows Warm up Exercises

A) Neck right side flexion
B) Neck right side rotation,
C) Neck left side rotation,
G) Neck extension,
I) Neck right side flexion
D) Wrist rolling
E) Marching
F) Neck flexion
H) Shoulder roll

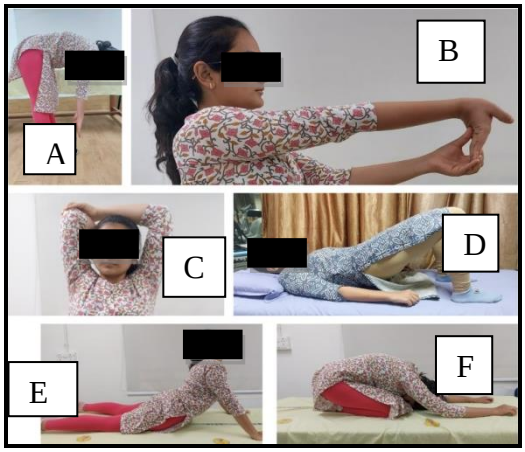


figure3: shows cool down exercises

A) Toe touch, B) Bicep stretch, C) Triceps stretch, D) Bridging, E) Prone on hand, F) Child pose

GROUP A-Aerobic Exercise: Warm up Exercise (10 minutes). Frequency: 5 days/week for 4 week. **Intensity:** 50% -60% HRR, or RPE between 4 and 6. **Time:** 20-30 minutes Progression 5-10 min/day for once or twice a week for 4 weeks. **Mode:** Brisk Walking with speed 3.5 km/hr. **Cool Down:** Stretching Exercise for Major group of muscle.

Figure4: shows the brisk walking on treadmill

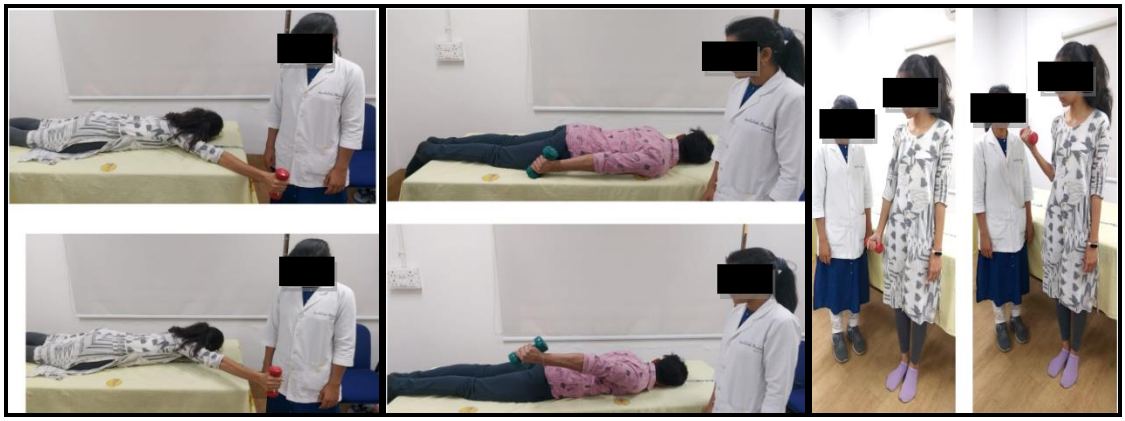
GROUP B-Resistance Training Protocol: Warm up Exercise (5 minutes). **Frequency:** 3 days/week for 4 week. **Intensity:** 60% - 80% - 1 RM. **Time:** 8 to 12 Repetitions of 2-4 Sets. Progression: Made by increase in resistance, repetition and sets of exercise. **Mode:** All major group of muscle of upper limb and lower limb. Diaphragmatic Exercise and Purse Lip Breathing Exercise. **Cool Down:** Stretching Exercise for Major group of muscle. Participants were asked to report if there is any discomfort during the treatment.

TABLE 1: SHOWS TYPES OF RESISTANCE EXERCISES

Resistance exercises	Types of exercises
Lower limb strengthening exercise. (resistance applied as per 1 RM)	• **Quadriceps strengthening** • **Heel raise** • **Squatting** • **Lunges**
Upper limb strengthening Exercises (resistance applied as per 1 RM)	• **Forward Shoulder raise exercise** • **Prone lying shoulder horizontal abduction with elbow extension and shoulder abduction to 90 degrees with dumbbells** • **Prone lying scapular depression exercise with shoulder 120-degree elevation with dumbbells** • **Shoulder extension (prone)** • **Wall push ups** • **Arm curls with dumbbells** • **Triceps curls with dumbbells**

Wall squatting with support heel raises Forward Shoulder Raise

Figure 5: shows the resistance exercises



Scapular depression exercise With dumbbell Prone Shoulder Extension Exercise with Dumbbell Bicep Curls

Figure 6: shows the resistance exercises

Wall Push up A. Diaphragmatic Breathing Exercise
B. Pursed Lip Breathing Exercise

Figure 7: shows the resistance exercises

Figure 8: shows the resistance exercises for upper and lower limbs

RESULT

Data were analyzed at baseline and after 4 weeks of treatment for the following outcome measures:

1. Vo2max
2. Hamilton anxiety rating scale
3. Heart rate recovery

Shapiro-Wilk Test were applied to check whether the data follows normal distribution or not. Baseline data was calculated by using Mann Whitney test for age, gender, heart rate, vo2max, HAM-A, HRR1MIN, HRR2MIN, HRR3MIN, HRR5MIN.within group analysis and between group analysis was done using the baseline outcome measure before intervention and after the 4 week of intervention. Confidence interval was kept at 95% and level of significance was kept at 0.05. table 2 shows baseline distribution of all the outcome measures, which shows no statistically significant difference was found ($p>0.05$) which suggest that all the parameters were same at baseline.

Table 2 Baseline characteristics

Variable	U value	P value (<0.05, Significant)
Age	144.5	1.000
Gender	127	0.563
Heart rate	143	0.973
Vo2 max	125	0.518
HAM-A	136.50	0.786
HRR1min	135.00	0.760
HRR2min	126.5	0.540
HRR3min	107	0.205
HRR5min	107	0.205

Table 3 shows gender distribution of subjects of both groups. There was female predominance in both groups.

GENDER	GROUP A	GROUP B
MALE COUNT %	5(29.41%)	6(35.29%)
FEMALE COUNT %	12(70.58%)	11(64.70%)
TOTAL	17	17

WITHIN GROUP ANALYSIS

GROUP A-Aerobic Exercise Protocol:

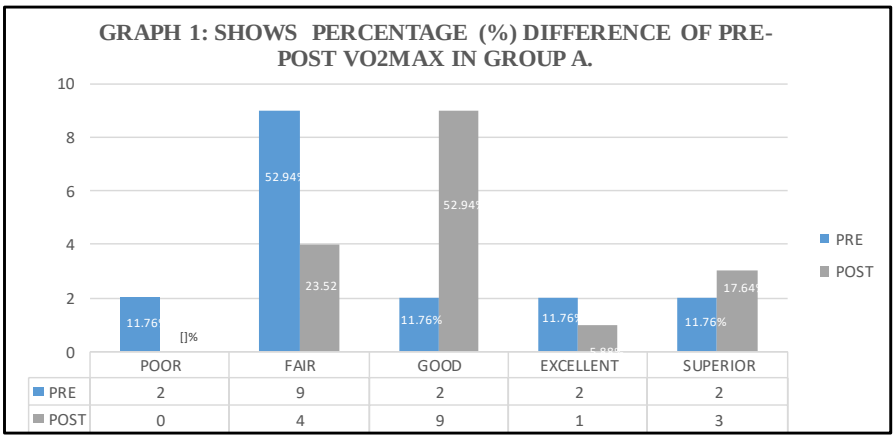
In aerobic exercise group (Group A) analysis of pre and post, Hamilton anxiety scale, HRR 1min, HRR 2 min, HRR 3 min, HRR 5min was done by using paired t-test, because the data was normally distributed and pre-post vo2 max analysis was done by using Wilcoxon sign rank test, because the data was not normally distributed. There was significant statistical difference($p<0.05$) between pre and post treatment vo2max,

Hamilton anxiety scale, HRR1 min, HRR 2 min, HRR 3min and HRR 5 mint.

1. VO2MAX

Table 4 shows Wilcoxon sign rank test result between pre and post vo2max within group A

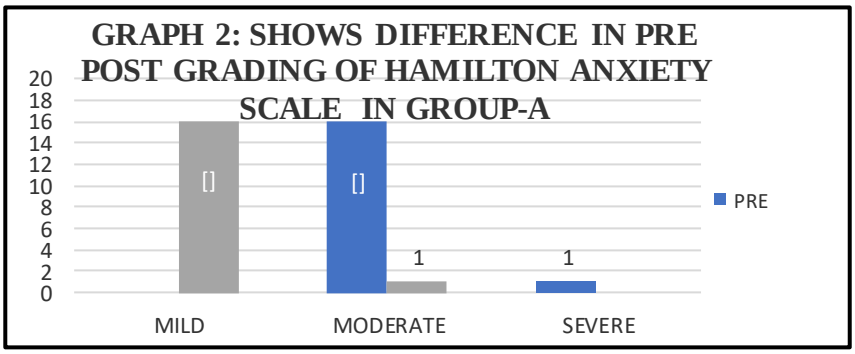
Pre- means±SD	Post- means±SD	Z-value	Significance p value (p<0.05=significant)
40.88±6.85	46.18±5.94	-5.086	0.0001



2. HAMILTON ANXIETY MEASUREMENT SCALE (HAM-A):

Table 5 shows paired t-test result between pre and post HAS within group A

Pre -means┼SD	Post-means┼SD	t-value	Significance P value (p<0.05)	CI (confidence interval)
21±2.26	12.05±3.5	15.05	0.001	12.99-17.06



3. HEART RATE RECOVERY

Table 6 shows paired t-test result between pre and post heart rate recovery within group A

	Pre means┼SD	Post means┼SD	t value	P value Significance (p<00.05)	CONFIDENCE INTERVAL (CI)
HRR1 MIN	22.70±11.53	24.05±10.13	9.91	0.001	14.21-21.55
HRR2MIN	37.23±11.8	40.47 ±7.34	19.09	0.0001	30.87-38.24
HRR3 MIN	48.76 ±10.5	52.82±9.25	26.93	0.001	42.00-48.87
HRR5 MIN	58.17±9.13	61.23±5.37	33.57	0.0001	50.7-57.24

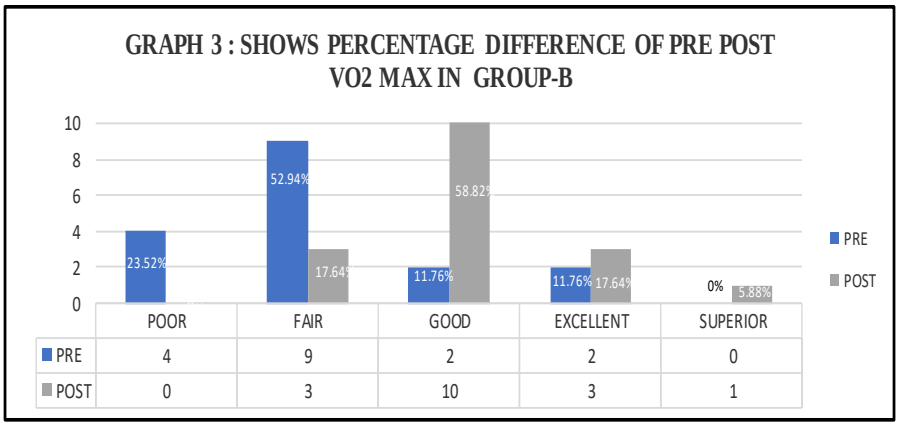
GROUP B: RESISTANCE TRAINING GROUP

In Resistance group, pre and post analysis of vo2max, HRR1min, HRR3 min, HRR5min was done using paired t-test because they are normally distributed. Pre-post analysis of Hamilton anxiety rating scale and HRR 2min was done using Wilcoxon sign rank test because they are not normally distributed. There was significant difference (p<0.05) between pre and post treatment vo2max, HAS, HRR1 min, HRR, 2HRR min, HRR3min, HRR5min within group.

1. VO2MAX

Table 7 shows paired t-test result between pre and post vo2max within group B

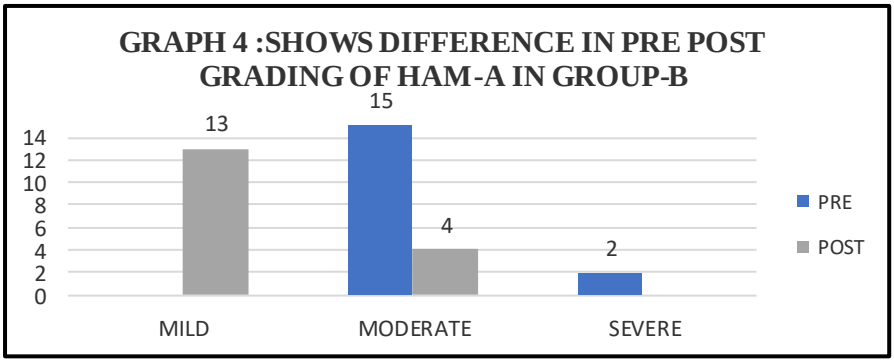
Pre- means┼SD	Post- means┼SD	t value	Significance p value (p<0.05=significant)	CI (confidence interval)
37.87±4.95	41.22±4.52	3.26	0.005	38.29-42.40



2. HAMILTON ANXIETY MEASUREMENT SCALE (HAM-A):

Table 8: shows Wilcoxon sign rank Test Result between Pre and Post Hamilton Anxiety Measurement Scale within Group B

Pre-Mean ± SD	Post- means┼SD	Pre median	Post median	Z- Value	Significance P Value (P<0.05=Significant)
21.47± 3.02	14.58±4.2	21	15	-5.093	0.0001



3. HEART RATE RECOVERY

Table 9: shows Paired T-Test Result between Pre and Post Heart Rate Recovery within Group B

Variable	Pre means┼SD	Post means┼SD	t value	P value Significance (p<0.05)	CI (confidence interval)
HRR1 MIN	18.88±7.4	21.29±9.60	12.51	0.001	15.56-21.609
HRR3 MIN	40.70±6.8	45.11±9.99	28.12	0.001	39.42-45.57
HRR5 MIN	51.94±9.8	53.70±11.23	28.28	0.0001	47.63-55.01

Table 10: shows Wilcoxon sign rank test Result between Pre and Post Heart Rate Recovery within Group B

Variable	Pre means	Post means	Pre median	Post median	Z-value	P value Significance (p<0.05)
HRR2MIN	35.35±12.08	32.05±6.40	33	32	-5.089	0.0001

BETWEEN GROUP ANALYSIS:

For between group analysis Mann Whitney U test has been applied, as data are nominal and some data are not normally distributed, which showed statistically significant results between groups except in HRR 1min and Hamilton anxiety scale, which shows non-significant difference between both groups.

Table 10 shows Mann Whitney test of Pre-Post Mean Difference of VO2MAX Between both groups

variable	GROUP A (Pre-Post mean difference) means±SD	GROUP B (Pre-Post mean difference) means±SD	U value	P value Significance (p<0.05)
Vo2max	4.03±7.72	2.19±1.42	82	0.03*

*** (P<0.05=statistically significant)**

Table 11 shows Mann Whitney test of pre-post mean difference of Hamilton anxiety measurement scale between both groups

variable	GROUP A (Pre-Post mean difference) means±SD	GROUP B (Pre-Post mean difference) means±SD	U value	P value Significance (p<0.05)
Hamilton Anxiety Scale	8.94±3.64	6.84±2.49	90	0.06

Table 12 shows Mann Whitney test of pre-post mean difference of HRR between both groups

variable	GROUP A (Pre-Post mean difference) means±SD	GROUP B (Pre-Post mean difference) means±SD	U value	P value Significance (p<0.05)
HRR1 MIN	9.23±6.75	7±6.05	114	0.306
HRR 2MIN	13.35±7	10±9.2	87.50	0.04*
HRR 3MIN	10.64±5.8	6.64±7.4	**77**	0.02*
HRR 5MIN	9±4.8	5.52±4.2	79	0.03*

*** (P<0.05=statistically significant)**

TABLE 13 SHOWS EFFECT SIZE OF INTERVENTION GROUPS:

OUTCOME MEASURE	EFFECT SIZE	COHEN'S STANDARD
VO2 MAX	0.9	LARGE
HAMILTON ANXIETY RATING SCALE	0.6	LARGE
HEART RATE RECOVERY 1MIN	0.3	MEDIUM
HEART RATE RECOVERY 2 MIN	1.2	LARGE
HEART RATE RECOVERY 3MIN	0.5	MEDIUM
HEART RATE RECOVERY 5 MIN	0.8	LARGE

Vo2 max score show that there is statistically significant difference between group A (aerobic exercise) and group B (resistance training) (p<0.03). The **Cohen's score (d=0.9)** of mean difference between the group shows **82th percentile** of difference of mean is noted in vo2max, suggesting that **GROUP A has advantage over GROUP B.**

HRR (2 min, 3min, 5min) score shows that there is statistically significant difference between group A (aerobic exercise) and group B (resistance training) **(p<0.05**). **The Cohen's score (d=1.2)** shows mean difference of **88th percentile in HRR 2min, (d=0.5) shows mean difference of 69th percentile in HRR 3min** and **(d=0.8) shows mean difference of 79TH percentile in 5min**, suggesting **that GROUP A has advantage over GROUP B.**

HRR 1min and HAM-A score shows there is **no statistically significant** difference between group A (aerobic exercise) and group B (resistance training) **(p=0.36, HRR 1min and HAM-A (p=0.06).** The **Cohen's score (d=0.3) and (d=0.6)** shows mean difference of 62th **percentile** and **73th percentile** in **HRR 1min** and **HAM-A** respectively, suggesting that **GROUP A has advantage over GROUP B.**

The result of the study shows that:

- **The null hypothesis (H0): $H_0$3: "**There are no significant effects of Aerobic exercise versus Resistance training on Anxiety among post COVID young adults" is **accepted.**
- **The null hypothesis (H0): $H_0$4**: "There are no significant effects of Aerobic exercise versus Resistance training in heart rate recovery in 1 min among post COVID young adults" is **accepted.**

The following alternate hypothesis are accepted:

- **H_1: "**There are significant effects of Aerobic exercise on Anxiety and

physical fitness among post COVID young adults".

- **H_2**: "There are significant effects of Resistance Training on Anxiety and physical fitness among post COVID young adults".
- **H_5**: "There are significant effects of Aerobic exercise versus Resistance Training on Heart rate recovery in 2 min among post COVID young adults".
- **H_6**: "There are significant effects of Aerobic exercise versus Resistance Training on Heart rate recovery in 3 min among post COVID young adults".
- **H_7**: "There are significant effects of Aerobic exercise versus Resistance Training on Heart rate recovery in 5 min among post COVID young adults".
- **H_8**: "There are significant effects of Aerobic exercise versus Resistance Training on VO2MAX among post COVID young adults".

DISCUSSION

In terms of their physical fitness and anxiety levels, this study will contrast the effects of resistance training versus aerobic exercise on young adults who have recovered from COVID-19.

Both group A (aerobic exercise) and group B (resistance training) in the current study demonstrated statistically significant (P 0.05) increases in physical fitness and decreases in anxiety levels. But when both groups were compared, group A (aerobic exercise) was found to differ statistically significantly from group B (resistance training). Vo2 max (U=82, P=0.03) Vo2 max rises more during aerobic exercise in group A than during resistance training in group B.

Heart rate recovery in 2min (U=87.50, P<0.04), 3min (U=77, P<0.02) and 5min (U=79, P<0.03) showed the significant decline among the aerobic exercise group than resistance training group. On the other side, there wasn't statistically significant difference between group A (aerobic exercise) and group B (resistance training) in anxiety level (U=90, P>0.06) and physical fitness (U=114, P>0.306) level for heart rate recovery in 1 mint.

The present study showed that Aerobic exercise and resistance training both improves physical fitness and reduces anxiety levels. Similarly, a study by Mayer et al. also found that resistance and aerobic exercise can cause both positive physiological and psychological changes[27]. This may be due to release of endorphins and other neurotransmitters during exercise, which can act as natural mood elevators[28].

According to the present study, resistance training and aerobic exercise both had a similar impact in lowering anxiety. As the previous study reported that physical exercise improves the response to treatment, especially aerobic training among the individuals with depressive disorder[29].

Study conducted by T.S. DA COSTA et.al among the subjects who involved in the physical activity on anxiety during covid 19 pandemic also found that aerobic exercise and combine aerobic exercise and resistance training group individuals shows similar effects in reducing anxiety[30].

Effect of Strength training on mental health is difficult to compare because most studies were carried out only with aerobic exercise and the results of studies on strength exercises are contradictory[31]. Strength training has the potential to have a favorable impact on self-esteem as well. Self-esteem is a global assessment of one's value and self-image that includes a number of factors, including cognitive, affective, and behavioral components. It is also lower in depressed individuals[32].

Present study also manifested that anxiety level is higher with poor and medium cardio respiratory fitness. Similar study by Papasavvas et al concluded that cardiovascular fitness and depression levels have the opposite relationships among healthy and depressed adults (aged 18 years and over)[33]. Likewise, Loprinzi et al. discovered that those with poor and medium cardio respiratory fitness has a higher risk of mental health difficulties[34].

Present study found Improvement in the physical fitness and anxiety level with Aerobic exercise and resistance training. It doesn't not include the effect of combination of aerobic exercise and resistance training on vo2max, heart rate recovery and anxiety level. Similarly, study by Everaerts et al., on combination of Aerobic exercise and resistance training on 6 min walk test, handgrip strength, quadriceps force, cardiopulmonary exercise test, HADS shows significant improvement in VO2peak (ml.kg−1. min−1) but Anxiety score shows a non-significant change[35].

In the present study we have heart rate recovery and vo2max for the indicator of physical fitness. Aerobic exercise and resistance training found the enhancement in the vo2max and heart rate recovery after 4 weeks of intervention. A similar study by Rahman et al among people with depression found that improvement in vo2 max with 12 week aerobic exercise of different levels (low, intermediate and strenuous) for 3days/week[36].

The comparative studies are very less which defines the effect of aerobic exercise versus resistance training among post-covid 19 young adults. A mostly study conducted includes combination of aerobic exercise and resistance training. One such finding byBruna T. S. Araújoet.al verified the effects of cardiopulmonary rehabilitation consisting of continuous aerobic and resistance training of moderate-intensity on pulmonary function, respiratory muscle strength, and maximum and sub maximal tolerance to exercise, fatigue, and quality of life in post-COVID-19 patients[37]. Likewise, a study by Daynes et al. showed the improvement in exercise capacity, respiratory symptoms, fatigue and anxiety by implementing a supervised 6 weeks programme comprised of aerobic exercise (walking/treadmill based), strength training of upper and lower limbs and education discussion among post covid individuals.

In Present study the mode of aerobic exercise was brisk walking on treadmill for 30 minutes. Studies concluded that mainly includes treadmill walking or cycling as suitable exercise method for sedentary patients with COVID-19. For aerobic exercise, three session/week is a safe and helpful frequency for patients with COVID-19[38-41].

Present study found that the physical fitness improves by aerobic exercise compared to resistance training by improving the vo2 max and decline in heart rate recovery in 2min, 3mint, and 5mint. Our research supports the study's conclusion that Resistance training frequently produces less pronounced cardio-respiratory reactions than aerobic exercise (i.e., an increase in pulmonary ventilation and oxygen consumption) because it improves immune function without significantly wearing one out[14]. Aerobic exercise shows significant improvement when compared with resistance training mainly in 2mint, 3mint and 5mint of heart rate recovery. No significant difference was found between both groups in heart rate recovery in 1 mint. By employing weight training, aerobic activity, and flexibility exercises over the course of eight weeks, Mara Fernanda Valleu et al. found improvement in Resting Heart Rate and Heart Rate Recovery in mint in COVID-19 patients who survived Mechanical Ventilation[16].

Present study demonstrated the effect of aerobic exercise is more effective resistance training among post covid young adults. Similarly, Guirong found that college students who engaged in appropriate aerobics exercise were better able to manage their depression and anxiety as well as their confidence, fitness, physical self-esteem, and interpersonal relationships than students who had never engaged in physical activity[13]. According to a study on the safety of resistance training during and after the SARS-Cov-2 by Paulo Gentil et al., the use of low-volume/duration techniques and the modification of training variables (low number of sets, exercise choice, large rest intervals, and regulated movement velocity) may be especially helpful. These changes would help the RT programmed to be safer

and logistically feasible during a pandemic era[42].

Present study, it includes the resisted training of major muscles of upper limb and lower limbs with the use of free weights as per the 1RM with intensity of 60-70% of MHR for 20-30 min, on three non-consecutive days for 4 weeks.

Resistance training mixed with aerobic exercise may even have greater effects on developing health issues than aerobic exercise alone, such as the treatment or prevention of sarcopenia and preservation of physical function[27].

The COVID-19 epidemic has sparked an increase of mental diseases that will damage both society at large and people who recover from long-COVID exposure. Based on the scant scientific data and evidence now available, it is reasonable to assume that physiatrists and physiotherapists will become more involved in the treatment of COVID-19 infected patients in order to enhance pulmonary function, physical and psychological efficiency, and to improve patient quality of life[28]. One year following the commencement of the illness, a cohort study's findings revealed severe lung capacity impairment in 23.7% of SARS survivors. Additionally, the level of health and ability to exercise was noticeably lower than that of the general population[30].

In the present study resistance training also improves the physical fitness, it has been proposed as an effective method for improving cardio respiratory health, either when used alone or in conjunction with aerobic exercise.

Resistance training is also proved to reduce the symptoms of depression and anxiety. It has been suggested that resistance training, whether done on its own or in conjunction with aerobic exercise, may boost muscular performance and enhance quality of life.

A study conducted to evaluate the benefits of cardio-pulmonary rehabilitation on severe to moderate COVID-19 patients shows that the maximal aerobic capacity (VO_2max) and maximal workload of the COVID-19 patients increased by 18% and 26% [32].

Some of these possible mechanisms are associated with neuroplasticity, neuroendocrine response, inflammation, and oxidative stress. Aerobic exercises produce similar neurophysiological effects to those observed from antidepressant drugs[27].

CONCLUSION

This Study concluded that both Aerobic exercise and Resistance training shows statistically significant improvement in physical fitness and reducing anxiety level but Aerobic exercise shows more statistically significant effect in improving physical fitness (vo2max and HRR 2min, 3min, 5min) among post covid-young adults. The effect size of outcome measures (vo2max and HRR and HAM-A) shows moderate to large effect size. Hence, Aerobic Exercise and Resistance Training group shows clinically significant improvement in physical fitness and reducing anxiety levels.

Clinical Implication

As per the present study, either Aerobic exercise or resistance training can be considered as a part of treatment protocol in reducing anxiety level among the post covid young adults. But for improving physical fitness Aerobic exercise can have a better additive effect among post covid-young adults.

Limitation

- Only young- Adults were included in the study

Future Recommendation

- Long-term follow-up (>4 weeks) is possible, and the carryover effect should be examined.
- Symptoms specific study will be done with this protocol.

Declaration by Authors

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