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A Systematic Review of Trials Investigating the Efficacy of Physical Therapy Management on Functional Capacity, Psychological Well-Being, And Quality of Life in Post COVID-19-Patients

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ABSTRACT

Objective: this study was conducted to determine the effect of therapeutic exercises on functional capacity, Psychological well-being, and life quality in post-COVID-19 patients.

Data sources: CINAHL, SCOPUS, Web of Science, MEDLINE, ProQuest, PEDRO, and Google Scholar databases were searched for trials published between January 2020 and may 2023.

Study selection: the selected studies involved any type of exercise applied to patients who recovered from COVID-19 infection. Data extraction: Two authors screened articles, extracted data, and assessed the quality by PEDro scale. Opinion from other authors was used to resolve any conflict. the level of evidence for each outcome was measured by the modified Sackett Scale.

Data synthesis: Out of 5089 hits, 14 trials included with 1473 patients. The period of the treatment ranged from one week to 12 weeks. The quality of studies ranged from good (10 studies) to fair (4 studies) According to the Pedro scale. All trials had a positive effect on the evaluated outcomes.

Conclusion: Therapeutic exercises for post-COVID-19 patients improve functional capacity and quality of life and achieve beneficial clinical outcomes. It is still important to conduct high-quality evidence research examining exercise's effects in the future.

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INTRODUCTION

COVID-19 was by the World Health Organization as a serious threat to everyone around the world, COVID-19 has infected over 98 million people and died nearly 2.2 million so far. Post-COVID-19 infection cases were reported fatigue pain, and muscle weakness. COVID-19's exact mechanism of action on patients is unknown (Aubert et al., 2021). Nevertheless, necrosis and atrophy of muscles have also been reported. In hypermetabolic conditions, proinflammatory cytokines are overproduced as a result of oxidative stress produced by the virus, which causes severe damage to myocytes (Fraser et al., 2021; Leung et al., 2005; Moradian et al., 2020).

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It has been found that COVID-19 interacts with the cardiovascular system, leading to acute injury of the lung, heart, and endothelial cells(Madjid et al., 2020), primarily through its interaction with the ACE-2 receptor, Despite the absence of clinical features of respiratory disease, cardiac damage has been observed, COVID-19 patients with preexisting cardiac illnesses suffer from worse respiratory symptoms, but they are more likely to develop new-onset cardiac dysfunction(Hoffmann et al., 2020; C. Huang et al., 2020; Wang et al., 2020). As a result of severe COVID-19, many patients developed acute respiratory distress syndrome (ARDS) and respiratory muscle failure(Severin et al., 2022). It has been estimated that 14% of COVID-19 cases require hospitalization, and 5% are critical cases with airway failure, septic shock, and/or multiorgan dysfunction(Wu & McGoogan, 2020).

There is a piece of evidence that COVID-19 patients have skeletal muscle dystrophic injuries that might reduce physical health and life quality (Pitscheider et al., 2021).

COVID-19 patients have been recently found to develop mental health problems, In addition, these patients suffering from high levels of anxiety, stress, and reduced sleep disorders after discharge from the hospital, in addition, Immune system function and psychological changes can be negatively affected by the previous factors (Saladino et al., 2020).

Recently, evidence proposed that Exercise can improve physical, psychological, and functional health, as well as restore quality of life among post-infection COVID-19 patients. In addition, Exercise therapy was lead to reduced risk of complications related to COVID-19 (Bo et al., 2021; Halabchi et al., 2020; Tavakol et al., 2021).

Due to the physical and psychological complications of COVID-19 patients, we aimed to investigate and analyze the randomized trials that reported the efficacy of therapeutic exercises on physical, psychological, and life quality outcomes among COVID-19 patients.

METHODS

Search strategy

Web of Science, MEDLINE, ProQuest, SCOPUS, CINAHL, Science Direct, Google Scholar, and PEDRO was used in the search by keywords “therapeutic exercises”, “Resistance training”, “Resistance Exercise”, “Strength training”, “Muscle strength”, “Aerobic training”, “Aerobic Exercise”, “respiratory Exercise”, “Muscle strength”, “Mobility” or coronavirus disease OR SARS-CoV-2) OR “COVID-19 and physical capacity ” OR “COVID-19 and quality of life ” “COVID-19 and psychological well-being”

To Search from January 2020 until may 2023 in the English language. Rayyan QCRI software for systematic reviews was used for screening eligibility (Johnson & Phillips, 2018).

Initially, three reviewers (A.A ,I. A ,and A. E) screened for eligibility criteria(Table 1). This method is an effective way to facilitate selection and find duplicates that were used in previous work (Hussein et al., 2020).

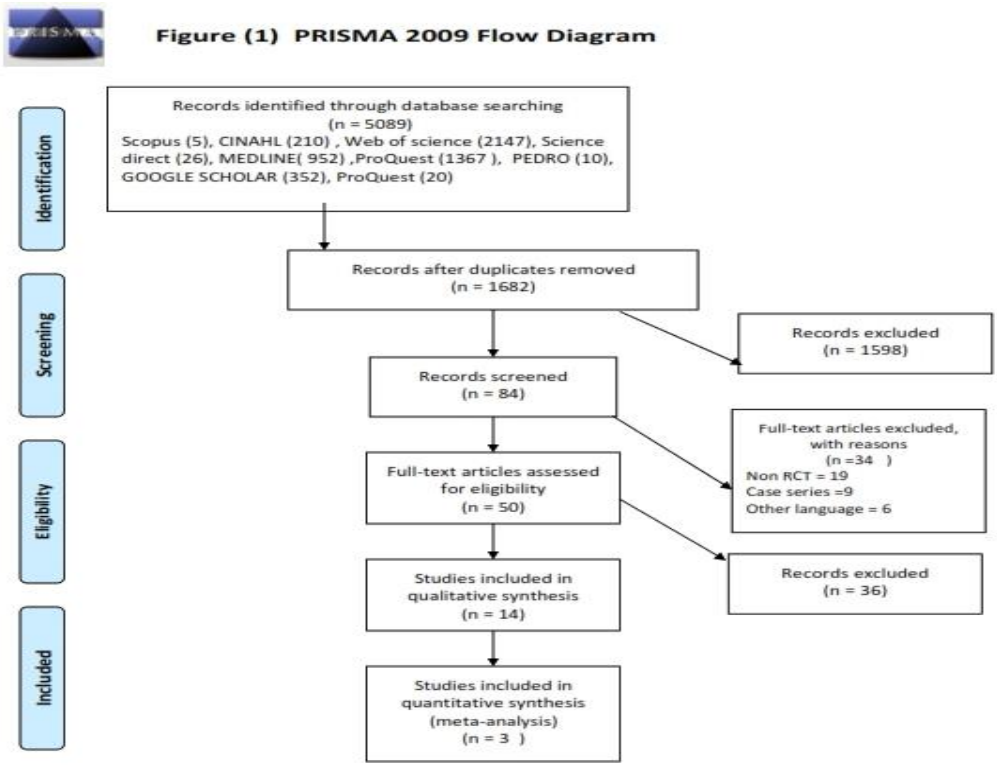
Selection criteria

We concluded all randomized trials which studied the effect of any therapeutic exercise training and assessed the functional capacity, pulmonary functions, and psychological well-being, anxiety, depression, and life quality of post COVID-19 patients.

Three independent reviewers (H.H, S.A, and S.M) assessed the trial titles and abstracts of the Trials that were considered eligible and then exposed to detailed revision. Studies based on animals, non-English languages publication, and study designs other than RCT were excluded.

Table 1. The inclusion criteria of the study

Design	Randomized controlled trials(RCTs). Published from January 2020 until august 2022 in English language.
Participants	Applied on single or both genders of age ≤ 80
Intervention	Any Exercises training (aerobic , resisted ex and respiratory ex)
Out come measures	quality of life using scales of Quality of Life QOL 36 or 1.3 functional capacity through the 6-minute walk test or 3 min walk test or shuttle walk test Pulmonary function test psychological wellbeing Hand grip strength Anxiety and depression measures
Comparison	Exercises training (aerobic , resisted ex and respiratory ex) versus control



Data extraction

independently data extraction was done by 3 reviewer (F.A,S.A,and R.A), and the selected studies characteristics were summarized in a Microsoft excel table, including: (1) authors and publication year; (2); the number of patients included (3) the age range of the selected participants ; (4) diagnosis; (5) exercise protocol ; (6) outcome measures; and (7) main findings.

Quality assessment

the PEDro scale was used for quality assessment of the included studies (Maher et al., 2003). a PEDro score of 9–10 indicated excellent quality, a 6–8 score indicated good, a score of 4–5 fair, and less than 4 indicated poor. Three reviewers (A.I, F.A, and S.A) evaluate the included studies quality, and a third reviewer (H.H) resolved any conflict. (Ibrahim et al., 2021), Based on the reviewer results, the Modified Sackett Scale was used to interpret them (Straus et al., 2005).

RESULTS

Study selection

Initially, 5089 studies were found after the primary investigation by the following databases: Scopus (5), CINAHL (210), Web of science (2147), Science direct (26), MEDLINE (952), ProQuest (1367), PEDRO (10), GOOGLE SCHOLAR (352), ProQuest (20). After removing duplicates, 1682 hits remained. Screening of abstract and Title resulted in exclusion of additional 1598 studies. 84 studies were analyzed for inclusion criteria, 34 studies were excluded for the following reasons Non-RCT (19) Case series (9) , Other languages (6), and 50 Full-text articles study were Full-text articles assessed for eligibility then after that 36 paper were exclude, Finally, fourteen studies were included for this review(Adly et al., 2021; Fereydounnia et al., 2022; Gonzalez-Gerez et al., 2021; Jimeno-Almazán et al., 2022; Li et al., 2022; K. Liu et al., 2020; S. Liu et al., 2021; Y. Liu et al., 2022; Mohamed & Alawna, 2021a; Nambi et al., 2022a; Pehlivan et al., 2022; Puterman et al., 2022; Rodriguez-Blanco et al., 2021b; Xia et al., 2022), PRISM checklist was used to create the flow diagram for study search and selection(Page et al., 2021) and presented in figure 1.

Study characteristics

The included trails were summarized in (Table 2). A total of 1473 patients were evaluated, the sample ranged from 30 to 387, and their ages ranged from 18 to 80 years. Patients in Six studies started exercise training post-hospital discharge (Jimeno-Almazán et al., 2022; Li et al., 2022; Nambi et al., 2022a; Pehlivan et al., 2022; Puterman et al., 2022; Xia et al., 2022). In the other eight studies, patients started exercise during the covid-19 infection (Adly et al., 2021; Fereydounnia et al., 2022; Gonzalez-Gerez et al., 2021; K. Liu et al., 2020; S. Liu et al., 2021; Y. Liu et al., 2022; Mohamed & Alawna, 2021a; Rodriguez-Blanco et al., 2021b).

The included studies were used different exercise protocol , Five studies used social media (telerehabilitation) (Adly et al., 2021; Gonzalez-Gerez et al., 2021; Pehlivan et al., 2022; Rodriguez-Blanco et al., 2021b; Xia et al., 2022),nine studies used other exercise training such as Baduanjin exercise (Li et al., 2022; Y. Liu et al., 2022), high-intensity training and yoga (Puterman et al., 2022), Nambi et al., 2022 used high-intensity training and low-intensity aerobic training (Nambi et al., 2022a), Adly et al., 2021 were used manipulative respiratory therapy versus oxygen therapy with bilevel positive airway pressure(Adly et al., 2021), Mohamed & Alawna, 2021 and Jimeno-Almazán et al., 2022 were used moderate aerobic

exercise intensity (Jimeno-Almazán et al., 2022; Mohamed & Alawna, 2021a). pulmonary rehabilitation were used in five of the included studies (Fereydounnia et al., 2022; Gonzalez-Gerez et al., 2021; K. Liu et al., 2020; Y. Liu et al., 2022; Pehlivan et al., 2022). The period of the exercise intervention ranged from one week to twelve weeks.

Table 2. Published Exercise Interventions in Covid 19 patient (January 2020- august 2022). RCT randomized control study

Reference	Sample	Age	Diagnosis	Exercise Protocol	Measurement	Main Results
(Li et al., 2022)	387	20-30	Post covid 19 Anxiety	• G1 12 week -5 times -45 min Baduanjin exercise • G2 control	Nordic musculoskeletal questionnaire (NMQ) The coronavirus anxiety scale (CAS) Psychological well-being scale (PWBS)	Improved all measurement
(Puterman et al., 2022)	334	18-64	Post covid 19 depression	• G1 6 week/4 time /20 min HIT high intensity training • G2 6 week /4 time /20 min yoga • G3 6 week /4 time /20 min HIT & yoga • G4 6 week /4 time /20 min WLC waitlist control Home based exercise	depressive symptoms by 10-item Center for Epidemiological Studies Depression Scale (CESD)	depressive symptoms Improved
(Nambi et al., 2022b)	76	60-80	Post covid sarcopenia	• G1 8 week/4 times /30 min LIT (low intensity aerobic training) • G2 HIT (high intensity aerobic training)	muscle strength and mass Hand grip strength psychological kinesiophobia quality of life	LIT are more effective than HIT
(Y. Liu et al., 2022)	70	20-60	patients with mild COVID-19	• G1 psychological intervention combined with pulmonary rehabilitation ex(Baduanjin ex) • G2 control One-week	(SAI)and (PQSI)	significant advantages over conventional nursing methods to mitigate anxiety and sleep disorders for the patients with mild COVID-19 infections
(Pehlivan et al., 2022)	34	30-60	Post discharge covid 19n	-G1 tele rehabilitation -G2 control breathing and ROM exercises, active cycle of breathing technique, and aerobic training 3 days a week for 6 weeks	-mMRC) -(SPPB) -(SGRQ)	Telerehabilitation exercise program with less technical equipment is a good alternative treatment method for COVID-19 subjects, which improves the quality of life and symptomatic status of subjects.
(Fereydounnia et al., 2022)	50	30-60	Covid19	-G 1 Respiratory Physiotherapy Plus Myofascial Release • G 2 Respiratory Physiotherapy three sessions (on three consecutive days)	-Heart rate, systolic and diastolic blood pressure, respiration rate, oxygen saturation, - chest expansion, and ease of breathing -Dyspnea borg and fatigue perception -6MWT	Addition of myofascial release to respiratory physiotherapy program did not make significant changes in the recovery of patients with COVID-19
(Jimeno-Almazán et al., 2022)	38	30-50	post-COVID-19	G1: completed a 3 days-a-week/ 8 weeks concurrent training routine: 2 days of resistance training combined with moderate	- (SF-12) - (GAD-7) - (PHQ-9) - (mMRC)	Concurrent training at low and moderate intensity for both resistance and

				intensity and 1 day of light intensity continuous training G2: Aerobic exercise for 20– 30 min was recommended, 5 days a week / 3 weekly sessions	- Fatigue Scale (CFQ-11) - (FSS) - (DSQ-14 short form - sit-to-stand test, handgrip pulmonary function;	endurance training is a more effective, safe, and well-tolerated intervention in post-COVID-19 conditions.
(Xia et al., 2022)	120	18-75	post-COVID-19	G1: Unsupervised home-based 6- to 28 week exercise program comprising breathing control and thoracic expansion, aerobic exercise and limb exercise G2: educational instructions at baseline	-6MWT. -pulmonary function; - (SF-12) -mMRC-dyspnoea.	The telerehabilitation programme in post-discharge COVID-19 patients program was superior over no rehabilitation with regard to functional exercise capacity, and quality of life.
(Mohamed & Alawna, 2021b)	30	24-45	Mild to moderate covid19	• G1 2 weeks /3 times/40 min of moderate-intensity aerobic exercise • G2 control	-blood immune markers (Leucocytes, Lymphocytes, Interleukin-6, Interleukin-10, Immunoglobulin-A, and TNF-a) - (WURSS)	Exercise group improved
(Rodriguez-Blanco et al., 2021a)	36	18–75	Mild to moderate covid19	• G1 1 week/7 time/30 min Non-Specific Conditioning Exercise Program (NTEP) -resistance and strength (tele rehabilitation) • G2 control	-6MWT -30 STS - Borg Scale	improvement between groups ($p < 0.05$) in favor of the experimental group
(Adly et al., 2021)	60	21-40	Pneumonia Covid 19	• G1 oxygen therapy with bilevel positive airway pressure (BiPAP) • G2 osteopathic manipulative respiratory and physical therapy techniques Tele rehabilitation	Arterial blood gases chest computed tomography	home-based oxygen therapy with BiPAP can be a more effective prophylactic treatment approach than osteopathic P T techniques
(Gonzalez-Gerez et al., 2021)	38	18–75	COVID-19 patients in the acute stage	• G1 pulmonary tele rehabilitation • G2 control One-week	- 6MWT , Dyspnoea-12, 30-Se Sit-To-Stand - Borg Scale	respiratory exercises is effective, safe, and feasible in COVID-19 patients with mild to moderate symptomatology in the acute stage
(S. Liu et al., 2021)	128	20-80	Sever Covid19	• QARP (qigong exercise and acupressure rehabilitation program)plus standard therapies or standard therapies alone	- (mMRC) dyspnea scale, - (MBS), fatigue Scale-14 (FS-14), - (PHQ-9), -duration of respiratory symptoms, and vital signs	QARP may be considered an effective treatment option for patients with severe COVID-19.
(K. Liu et al., 2020)	72	≥ 65	Covid19	• G1 respiratory rehabilitation (2 sessions per week for 6 weeks), once a day for 10 min • G2 control	-pulmonary function tests -6MWT Quality of life SF-36 - FIM scores), and mental status tests (SAS anxiety	Six-week respiratory rehabilitation can improve respiratory function, QoL and anxiety of elderly patients with

					and SDS depression scores).	COVID-19, but it has little significant improvement on depression in the elderly

CAS : coronavirus anxiety scale , CESD: Center for Epidemiological Studies Depression Scale, DSQ-14 short form: DePaul Symptom Questionnaire Short Form , FS-14: fatigue Scale-14, FSS: Fatigue Severity Scale, GAD-7: General Anxiety Disorder Questionnaire-7, mMRC: modified Medical Research Council(dyspnea), MBS: modified Borg dyspnea scale, NMQ:Nordic musculoskeletal questionnaire , PWBS : Psychological well-being scale, PQSI: Pittsburgh sleep quality index, PHQ-9: patient health questionnaire-9, SF-12: 12-item Short Form Survey , SAI : stat anxiety questionnaire, 6MWT:6-minute walking, WURSS: Wisconsin Upper Respiratory Symptom Survey

The selected studies assessment parameters were explained in Table 2. The functional capacity was evaluated by 6MWT in five studies(Fereydounnia et al., 2022; Gonzalez-Gerez et al., 2021; K. Liu et al., 2020; Rodriguez-Blanco et al., 2021a; Xia et al., 2022). Strength-related changes were measured by using the handgrip strength test in two studies(Jimeno-Almazán et al., 2022; Nambi et al., 2022b) and the sit-to-stand in three studies(Gonzalez-Gerez et al., 2021; Jimeno-Almazán et al., 2022; Rodriguez-Blanco et al., 2021a). Four studies assessed patient quality of life with different scales (SF-36, SF-12, and SarQol)(Jimeno-Almazán et al., 2022; K. Liu et al., 2020; Nambi et al., 2022b; Xia et al., 2022). Five studies assessed the patient anxiety and depression pre and post-intervention using different questionnaires (CAS, SAI , GAD-7, CESD, and SAS anxiety and SDS depression scores)(Jimeno-Almazán et al., 2022; Li et al., 2022; K. Liu et al., 2020; Y. Liu et al., 2022; Puterman et al., 2022). Across all studies, improvements were proved in the measured parameters after exercise interventions.

Table 3. PEDro scores for articles included in the systematic review

Author /year	PEDRO SCALE											TOT score
	1	2	3	4	5	6	7	8	9	10	11	
(Li et al., 2022)	✓	✓	✓	✓	✓	✓	-	✓	✓	-	✓	8
(Puterman et al., 2022)	✓	✓	-	✓	-	-	-	✓	✓	✓	✓	6
(Nambi et al., 2022b)	✓	✓	✓	✓	-	✓	-	✓	-	✓	✓	7
(Y. Liu et al., 2022)	✓	✓	-	✓	-	-	-	✓	-	✓	✓	5
(Pehlivan et al., 2022)	✓	✓	✓	✓	-	-	-	-	-	✓	✓	5
(Fereydounnia et al., 2022)	✓	✓	✓	✓	-	-	-	✓	-	✓	✓	6
(Xia et al., 2022)	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓	8
(Jimeno-Almazán et al., 2022)	✓	✓	-	✓	-	✓	✓	-	-	-	✓	5
(Mohamed & Alawna, 2021b)	✓	✓	-	✓	-	-	-	✓	✓	✓	✓	6
(Rodriguez-Blanco et al., 2021a)	✓	✓	-	✓	-	-	✓	✓	✓	✓	✓	7
(Adly et al., 2021)	✓	✓	✓	-	-	-	✓	✓	✓	✓	✓	7
(Gonzalez-Gerez et al., 2021)	✓	✓	✓	✓	-	✓	-	✓	✓	✓	✓	8
(S. Liu et al., 2021)	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓	7
(K. Liu et al., 2020)	✓	-	-	✓	-	-	-	✓	-	✓	✓	4

Quality assessment

Based on the PEDro scale and Modified Sackett Scale, the selected studies were Four studies were fair quality with an evidence level of 2b (Limited)(Jimeno-Almazán et al., 2022; K. Liu et al., 2020; Y. Liu et al., 2022; Pehlivan et al., 2022), and ten studies were good quality with an evidence level of 1b (Moderate)(Adly et al., 2021; Fereydounnia et al., 2022; Gonzalez-Gerez et al., 2021; Li et al., 2022; S. Liu et al., 2021; Mohamed & Alawna, 2021a; Nambi et al., 2022a; Puterman et al., 2022; Rodriguez-Blanco et al., 2021b; Xia et al., 2022). See (Table 3)

Liu et al., 2020, and Gonzalez-Gerez et al., 2021 (Gonzalez-Gerez et al., 2021; K. Liu et al., 2020) adopted the same intervention (pulmonary rehabilitation for covid 19 patients) results showed improvement significantly in functional capacity using 6MWT, the overall effect (Z = 3.07) (P = 0.002) (see Table 4).

Rodriguez-Blanco et al., 2021 and Gonzalez-Gerez et al., 2021 (Gonzalez-Gerez et al., 2021; Rodriguez-Blanco et al., 2021b)used Tele rehabilitation for covid 19 patients, Results showed improvement in the 30 STS and the overall effect (Z = 3.73 (P = 0.0002) (see Table 5).

Table 4. Weighted mean difference (95% CI) of effect of Respiratory exercise versus control on 6 min walk test in covid 19 pt

Study	Respiratory exercise G			Control G			weight	mean difference
	mean	SD	total	mean	SD	total		IV, random, 95% CI
Gonzalez-Gerez et al., 2021	487.6	133.4	18	399.0	126.07	18	41.9%	0.67 [-0.01, 1.34]
K. Liu et al., 2020	212.3	82.5	25	157.7	71.7	25	58.1%	0.70 [0.12, 1.27]
Total (95% CI)			44			44	100.0%	0.68 [0.25, 1.12]
Heterogeneity: Tau^2 = 0.00; Chi^2 = 0.00, df = 1 (P = 0.95); I^2 = 0%								
Test for overall effect: Z = 3.07 (P = 0.002)								

Table 5. Weighted mean difference (95% CI) of effect of Tele rehabilitation on functional capacity using 30 STS test for covid 19 pt

Study	Tele rehabilitation G			control G			weight	mean difference
	mean	SD	total	mean	SD	total		IV, random, 95% CI
Gonzalez-Gerez et al., 2021	14.0	5.47	19	11.11	3.78	19	24.7%	2.89 [-0.10, 5.88]
Rodriguez-Blanco et al., 2021	12.44	2.88	18	9.63	2.33	18	75.3%	2.81 [1.10, 4.52]
Total (95% CI)			37			37	100.0%	2.83 [1.34, 4.31]
Heterogeneity: Tau^2 = 0.00; Chi^2 = 0.00, df = 1 (P = 0.96); I^2 = 0%								
Test for overall effect: Z = 3.73 (P = 0.0002)								

DISCUSSION

The COVID-19 infection is characterized by impaired both lung function and peripheral muscle integrity and so it had a negative effect on physical and quality of life (Y. Huang et al., 2020).

A significant reduction in physical capacity is highly expected during COVID-19-specific conditions. Due to social distancing, group exercise was prohibited or limited, however, a high level of social support is associated with more participation in physical exercises (Bauman et al., 2012). It is estimated that the majority of infected subjects with COVID-19 experience prolonged symptoms, which manifest as overall weakness, fatigue, and reduced physical capacity(Vaes et al., 2021)

Generally, exercise rehabilitation could improve physical and psychological health, in addition, rehabilitation programs could be used to alleviate the large health impact of COVID-19 through tertiary prevention and Reducing disease burden(Nieman, 2021; Xia et al., 2022)

The Current review was designed to examine the impact of physical rehabilitation on COVID-19 patients' physical, psychological, and life quality. According to the results of the included studies, Exercise rehabilitation has generally been found to be beneficial for COVID-19 patients' physical, psychological, and life quality.

Six-minute walk test (6MWT) was used to evaluate Functional capacity in four studies(Fereydounnia et al., 2022; Gonzalez-Gerez et al., 2021; K. Liu et al., 2020; Rodriguez-Blanco et al., 2021b), Strength was measured using handgrip strength in two studies(Jimeno-Almazán et al., 2022; Nambi et al., 2022a), sit-to-stand in three studies(Gonzalez-Gerez et al., 2021; Jimeno-Almazán et al., 2022; Rodriguez-Blanco et al., 2021a), and Quality of life was assessed in four studies with different scales(Jimeno-Almazán et al., 2022; K. Liu et al., 2020; Nambi et al., 2022a; Xia et al., 2022), Our analysis showed Improvements in these measurements were seen after using different types of exercise intervention(respiratory ex, resistance, moderate and light intensity training).

This is accepted by Halabchi et al.,'s review which approved that physical and psychological status were improved by exercise rehabilitation in general, they conclude Any form of exercise was included in rehabilitation programs regardless of the time from onset to completion, and physical or psychological factors were reported as outcomes. (Halabchi et al., 2022).

In addition, our results agreed with Soril et al., 2022's review of the literature, which stated that pulmonary rehabilitation can reduce and prevent post-COVID complications, All included studies found positive effects in exercise capacity and lung function (Soril et al., 2022). Also, the prospective observational cohort study on SARS-CoV-2 patients observed significant improvements in exercise capacity, and life quality (Hughes et al., 2022).

COVID-19 patient's rehabilitation can include education, breathing exercises, therapeutic exercise, and anxiety management. the study by Baker-Davies et al.,2021 and Kokhan et al.,2021 stated that It is feasible and effective to develop a cardiorespiratory rehabilitation program for COVID-19 patients to prevent and manage long-term disability and return them to

a normal functional capacity after their illness (Kokhan et al., 2021; O'Sullivan et al., 2021).

During covid 19 pandemic, quarantine and social isolation had already been successful. However, studies have shown that populations affected by these measures have higher levels of anxiety and depressive disorders, as well as a higher suicide rate(Brooks et al., 2020; Lee et al., 2007). physical activity has been proved to maintain physical psychological health (Kajtna & Vučković, 2022).

Regarding anxiety and depression measurement, the current review included five studies that assessed the patient anxiety and depression using different scales, and improvements in all studies were seen after exercise interventions, These findings are supported by Wolf et al's 2021 review which showed that patients who performed physical activity regularly with high volume and frequency, showed less depression and anxiety symptoms (Wolf et al., 2021).

To the best of our knowledge, the systematic review approved the positive effect of any type of exercise on physical, psychological, and life quality outcomes in COVID-19 patients.

The limitation of the current study, first there was a huge degree of heterogeneity among the studies included. In addition to different exercise components, the outcomes measured were different in each study.

It is necessary to conduct future studies with high quality, larger sample sizes, and other outcomes such as functional independence, patient satisfaction, mortality, and costs to understand the role of different exercise programs in COVID-19 management.

CONCLUSION

Based on the current systematic review, we can conclude that post-COVID-19 rehabilitation programs including any type of exercise (aerobic, resisted, and respiratory ex.) are effective in improving the patient's functional capacity, Psychological status, and life quality in post-COVID-19-patients.

Ethics Approval

Not Applicable

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Conflict of Interest

The Authors Declare That They Have No Competing Interest

Informed Consent

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Authorship contributions

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