Infection and Drug Resistance Dovepress

Open Access Full Text Article ORIGINAL RESEARCH

The Impact of Traditional Chinese Herbal Decoctions Combined with Rehabilitation Therapy on Pulmonary Function and Respiratory Muscle Strength in COVID-19 Recovery Patients

Li Luo[1], Xi-Jiao Liu[2], Dong-Ling Chen[1], Xiao-Ya Deng[1], Yong-Hong Pan[1], Sheng Li[1]

[1]Department of Respiratory Medicine, Shapingba Hospital affiliated to Chongqing University (Shapingba District People's Hospital of Chongqing), Chongqing, Shapingba District, 400040, People's Republic of China; [2]Bishan Hospital of Chongqing Medical University (Bishan Hospital of Chongqing), Chongqing, Bishan District, 402760, People's Republic of China

Correspondence: Sheng Li, Email linwo3696347@163.com

Objective: This study aims to evaluate the clinical efficacy of integrated traditional Chinese and Western medicine rehabilitation treatment during the recovery period of COVID-19, providing a scientific basis for developing more effective rehabilitation protocols.

Methods: The study included 120 COVID-19 (novel coronavirus) recovery patients treated at our hospital from November 2021 to April 2022. After registration, patients were randomly divided into two groups, namely the study group and the control group. The control group received conventional rehabilitation treatment, while the study group underwent integrated traditional Chinese and Western medicine rehabilitation treatment, with 60 cases in each group. The clinical observation indicators in this study include the results of the 6-minute walk test (6MWT), respiratory and circulatory parameters, pulmonary function, changes in respiratory muscle strength, and quality of life in both groups of patients.

Results: The 6MWT distance increased significantly in both groups, with the study group showing a larger improvement ($P < 0.05$). SpO2 and PaO2 values improved significantly in both groups, with greater increases in the study group ($P < 0.05$). Lung function parameters (FEV1 and FEV1/FVC) improved significantly in the study group compared to the control group ($P < 0.05$). Diaphragmatic thickness and mobility were also significantly higher in the study group ($P < 0.05$). The SF-36 quality of life scores were significantly better in the study group ($P < 0.05$).

Conclusion: Integrated traditional Chinese and Western medicine rehabilitation treatment has achieved significant efficacy during the recovery period of COVID-19. The complementary use of traditional Chinese medicine's differential diagnosis and treatment and modern medical approaches from Western medicine provides patients with comprehensive and personalized rehabilitation services, offering new ideas and methods to improve the quality of patient recovery.

Keywords: COVID-19, novel coronavirus, recovery period, integrated traditional Chinese and Western medicine rehabilitation treatment, efficacy

Introduction

Since its outbreak in 2019, COVID-19 has become a major global public health crisis.[1] While acute phase treatment has received widespread attention, many COVID-19 patients continue to face numerous issues during the recovery phase, such as respiratory dysfunction, chronic fatigue, and reduced exercise tolerance. Studies have shown that over 20% of recovering patients still exhibit abnormal pulmonary function, and more than half experience varying degrees of chronic symptoms. These "long COVID" symptoms have a profound impact on their quality of life.[2,3]

Although modern medicine has made progress in the acute treatment of COVID-19, there is currently no specific drug available to fully restore the patients' physical function.[4] In contrast, traditional Chinese medicine (TCM) has unique advantages in regulating the body, restoring lung function, and enhancing immunity. TCM classifies this disease as an

Received: 4 July 2024
Accepted: 9 October 2024
Published: 23 October 2024

"epidemic disease" and believes that strengthening the body's defenses and nourishing the lungs and vital energy (Qi) can effectively help patients recover normal function. Previous studies have demonstrated that TCM has shown promising efficacy in the prevention and treatment of COVID-19, particularly in promoting lung function recovery and relieving fatigue.[5,6]

During the recovery phase, TCM employs therapeutic strategies such as tonifying Qi, benefiting the lungs, promoting blood circulation, and resolving blood stasis to effectively promote the absorption and repair of lung inflammation, reduce post-inflammatory adhesions, and improve patients' respiratory and exercise function. Moreover, individualized treatment based on patients' specific syndromes (eg, lung-spleen Qi deficiency or Qi and Yin deficiency) has been shown to significantly enhance therapeutic efficacy.[7] In past practice, integrated Chinese and Western medicine treatment has not only been widely applied in the rehabilitation of respiratory diseases but has also demonstrated significant efficacy in the recovery of cardiovascular and neurological diseases, providing strong support for its application in COVID-19 recovery.[8,9]

Respiratory rehabilitation training has been proven to enhance the strength and endurance of respiratory muscles, particularly the recovery of diaphragm function, which is crucial for improving respiratory function and exercise capacity. This study aims to evaluate the impact of a combined Chinese-Western rehabilitation program on respiratory function, exercise tolerance, and quality of life in patients recovering from COVID-19.

Materials and Methods

General Information

This study included 120 COVID-19 (novel coronavirus) recovery-phase patients treated at our hospital from November 2021 to April 2022. After excluding subjects who did not meet the comprehensive inclusion criteria, a total of 120 cases were included. All patients were registered and enrolled, and they were grouped according to the principle of random allocation into the study group and the control group, with 60 patients in each group. Patients in the control group received routine rehabilitation treatment, while patients in the study group received integrated traditional Chinese and Western medicine rehabilitation treatment. All patients were informed about this study and voluntarily signed informed consent forms. All the methods were carried out in accordance with the Declaration of Helsinki. The protocol was approved by the Ethics Committee of Shapingba Hospital, affiliated with Chongqing University.

Inclusion and Exclusion Criteria

Inclusion criteria: All patients included in the study met the diagnostic criteria for COVID-19 as outlined in the *Diagnosis and Treatment Protocol for Novel Coronavirus Pneumonia (Trial Version 5, Revised)*. They presented with fever and respiratory symptoms, with pneumonia confirmed by chest imaging. After receiving combined Chinese and Western medicine treatment, their condition improved and they met the discharge criteria. All patients provided signed informed consent and were able to actively cooperate with rehabilitation treatment.

Exclusion criteria: Patients with mental disorders or those using anti-anxiety, sedative, or similar drugs before admission; patients with severe cardiovascular diseases or malignant tumors; individuals with mental disorders, limited cognitive abilities, and disabilities as defined by law; pregnant or lactating women; patients with congenital neurological abnormalities, and others.

Methods

The control group patients received standard Western medicine treatment and rehabilitation training. The standard Western treatment included the following aspects: ① Bed rest with adequate caloric intake to maintain water, electrolyte, and internal environmental stability, while monitoring vital signs and oxygen saturation; ② Nasal cannula, face mask, or high-flow oxygen therapy based on the patient's condition; ③ Antiviral therapy with ribavirin, arbidol, and α-interferon, with the addition of moxifloxacin if bacterial infection was present; ④ Short-term use of methylprednisolone for patients with excessive inflammatory responses; ⑤ Immunoglobulin therapy for patients with weakened immune function. Individualized rehabilitation training included exercise rehabilitation, breathing exercises, and supportive care. The exercise rehabilitation followed a personalized plan, initially focusing on gentle exercises such as Tai Chi and slow

walking, for 20 minutes once a day. As the patient's condition improved, physical training such as chest expansion, bending, and uphill walking (aerobic exercise) was gradually increased to 10–20 minutes per session, four times a day, with moderate intensity to avoid excessive fatigue. Breathing exercises were performed under the guidance of a doctor, including diaphragmatic breathing and pursed-lip breathing, with three sets of six repetitions daily for each exercise. Supportive care involved dietary and psychological support, focusing on the supplementation of vitamins and proteins while ensuring sufficient hydration. Psychological care included conversations, role modeling, and enhanced communication via platforms like WeChat to reduce patient anxiety and impatience, boosting their confidence in recovery and treatment effectiveness.

The treatment group received individualized traditional Chinese medicine (TCM) therapy in addition to the treatments provided to the control group. TCM treatment was prescribed based on syndrome differentiation: for patients with lung-spleen qi deficiency, characterized by shortness of breath, fatigue, poor appetite, loose stools, pale and swollen tongue with a white greasy coating, they were given a formula containing 20g of Codonopsis (Dangshen), 20g of Astragalus (Huangqi), 10g of Atractylodes (Baizhu), 10g of Poria (Fuling), 10g of Pinellia (Banxia), 6g of Tangerine peel (Chenpi), 15g of Chinese yam (Shanyao), 15g of walnut kernel (Hetao), 6g of Perilla (Zisu), 15g of Job's tears (Yiyiren), and 5g of licorice (Gancao). For patients with qi and yin deficiency, characterized by fatigue, shortness of breath, dry mouth, palpitations, dry cough with little sputum, dry tongue with scant fluid, and a weak or thready pulse, they were given a formula containing 20g of Codonopsis (Dangshen), 20g of Chinese yam (Shanyao), 15g of lily (Baihe), 10g of Ophiopogon (Maidong), 15g of Glehnia (Beishashen), 6g of Tangerine peel (Chenpi), 10g of roasted Atractylodes (Baizhu), 10g of Poria (Fuling), 10g of Houttuynia (Yuxingcao), 15g of Albizia (Hehuanpi), and 5g of licorice (Gancao). All herbal medicines were decocted in 400 mL of water and administered twice daily, in the morning and evening, over a course of 14 days.

Outcome Measures

Patients were evaluated before and after treatment using the 6-Minute Walk Test (6MWT). In this test, patients were instructed to walk along a flat, 30-meter straight path at the fastest pace they could tolerate. After 6 minutes, the walking distance was recorded. Respiratory and circulatory parameters, as well as lung function, were assessed before and after treatment. These assessments included oxygen saturation (SpO2), forced expiratory volume in one second (FEV1), partial pressure of arterial oxygen (PaO2), and the FEV1/forced vital capacity (FVC) ratio. In addition, respiratory muscle strength was measured with a DP10 portable ultrasound device, with comparisons of diaphragm thickness and mobility made before and after treatment. Finally, patient quality of life was assessed using the Short Form Health Survey (SF-36), which covers domains such as physical functioning, bodily pain, general health, social functioning, emotional roles, vitality, and mental health. Higher scores indicated better quality of life.

Data Analysis

GraphPad Prism 8 was used for image processing. Data organization and statistical analysis were performed using SPSS 26.0 software. Measurement data were expressed as mean ($\bar{x}$ ± standard deviation), and *t*-tests were employed to compare statistical differences. Count data were expressed as percentages (%), and chi-square tests ($\chi 2$) were used to compare statistical differences. A significance level of $P < 0.05$ was considered statistically significant.

Results

Clinical Data

The study group consisted of 60 patients, with 27 males and 33 females, an age of (42.18±11.73) years, BMI of (22.24 ±2.07) kg/m2, 32 smokers, 28 drinkers, 29 cases of lung-spleen qi deficiency, and 31 cases of qi-yin dual deficiency. The control group included 60 patients, with 25 males and 35 females, an age of (41.76±12.28) years, BMI of (22.11±2.35) kg/m2, 33 smokers, 29 drinkers, 28 cases of lung-spleen qi deficiency, and 32 cases of qi-yin dual deficiency. There were no significant differences in general data between the two groups, demonstrating comparability (P>0.05). Refer to Table 1.

Table 1 Comparison of Clinical Data Between the Two Groups

		Research Group	Control Group	t	P
Number of Cases	–	60	60	–	–
Gender	Male	27	25	–	–
	Female	33	35	–	–
Age	Mean	42.18±11.73	41.76±12.28	0.192	0.848
BMI	Mean	22.24±2.07	22.11±2.35	0.322	0.748
Smoking	–	32	33	–	–
Drinking	–	28	29	–	–
Lung spleen deficiency syndrome	–	29	28	–	–
Qi and Yin deficiency syndrome	–	31	32	–	–

Comparison of 6-Minute Walk Test (6MWT) Before and After Treatment

The pre-treatment comparison of 6MWT results between the two groups showed no statistically significant differences. However, after treatment, both groups demonstrated an improvement in 6MWT distance, with the study group showing a significantly greater increase than the control group ($P < 0.05$), as shown in Figure 1.

Comparison of Respiratory and Circulatory Parameters Before and After Treatment

Before treatment, there were no significant differences in SpO2 or PaO2 between the two groups ($P > 0.05$). After treatment, both groups showed significant increases in SpO2 and PaO2 compared to their pre-treatment values ($P < 0.05$). Moreover, the study group showed significantly higher improvements than the control group ($P < 0.05$), as shown in Figure 2.

Comparison of Lung Function Parameters Before and After Treatment

Before treatment, no statistically significant differences were observed between the two groups in FEV1 and FEV1/FVC ($P > 0.05$). After treatment, both groups exhibited significant improvements in FEV1 and FEV1/FVC compared to their pre-treatment values ($P < 0.05$), with the study group showing significantly greater improvements than the control group ($P < 0.05$), as illustrated in Figure 3.

Comparison of Diaphragm Thickness and Mobility

Before treatment, no significant differences were found between the two groups in diaphragm thickness and mobility ($P > 0.05$). After treatment, the study group showed significantly greater improvements in both diaphragmatic mobility and thickness compared to the control group ($P < 0.05$), as depicted in Figure 4.

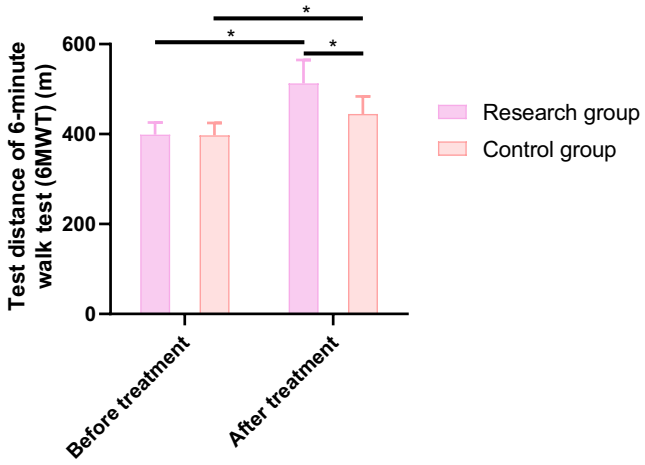

Figure 1 Comparison of post-treatment 6MWT results between the two groups.
Note: * indicates $P < 0.05$.

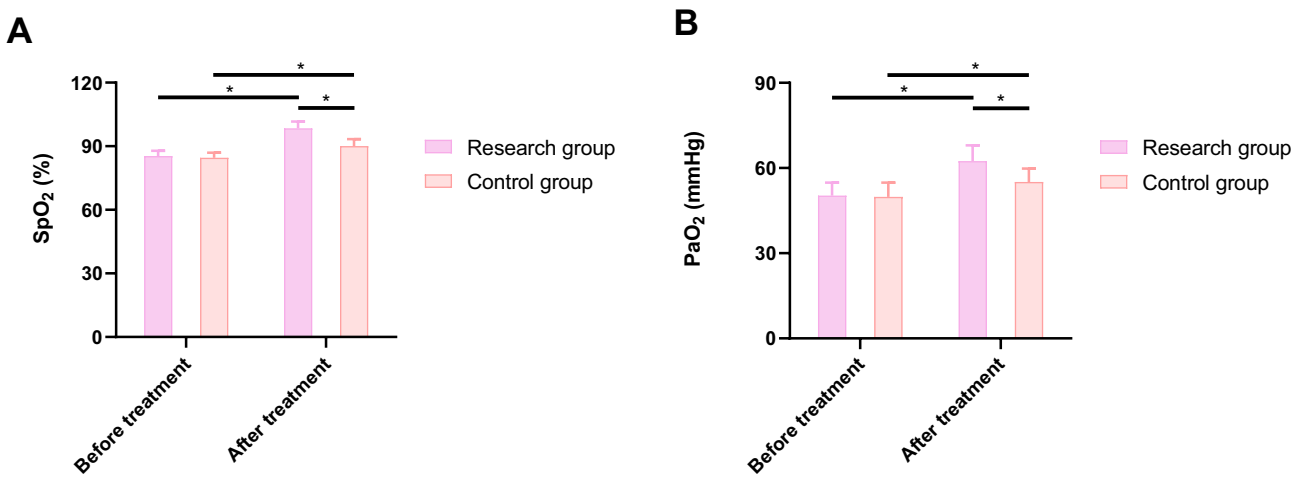

Figure 2 Comparison of respiratory and circulatory parameters before and after treatment. (**A**) SpO2, (**B**) PaO2.
Note: * indicates P < 0.05.

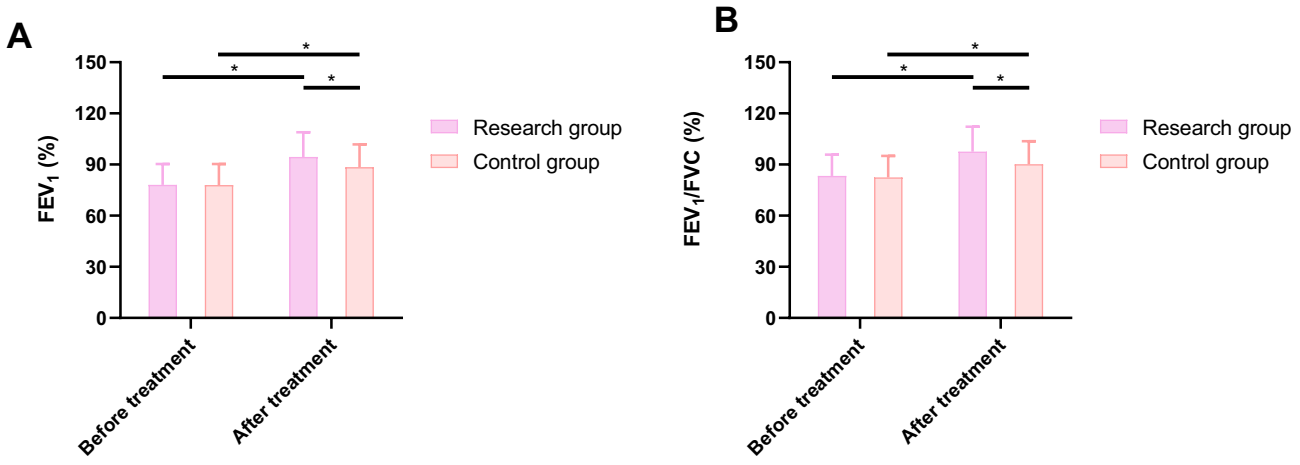

Figure 3 Comparison of lung function parameters before and after treatment. (**A**) FEV1, (**B**) FEV1/FVC.
Note: * indicates P < 0.05.

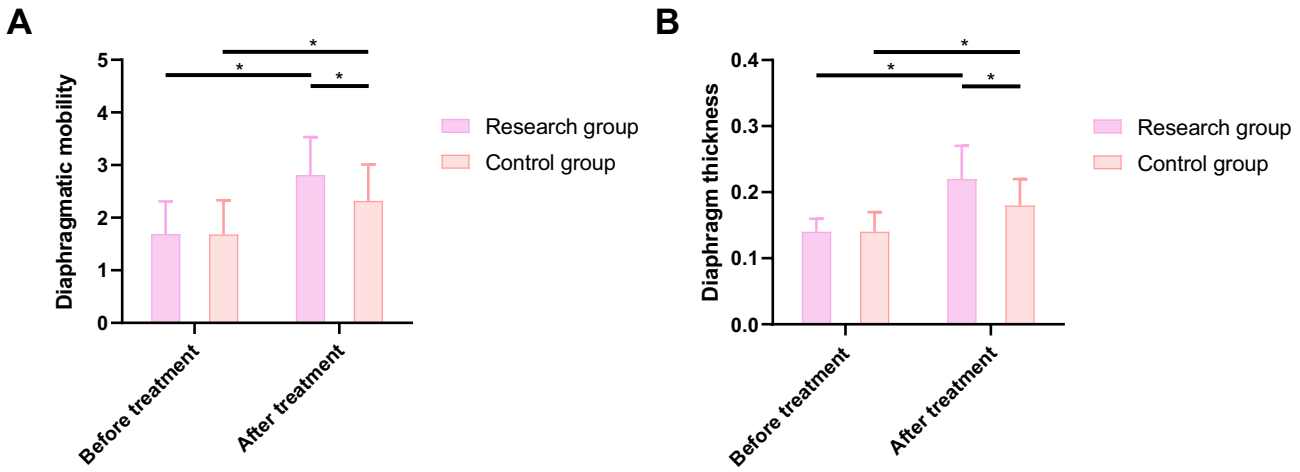

Figure 4 Comparison of diaphragm thickness and mobility between the two groups. (**A**) Diaphragmatic mobility, (**B**) Diaphragm thickness.
Note: * indicates P < 0.05.

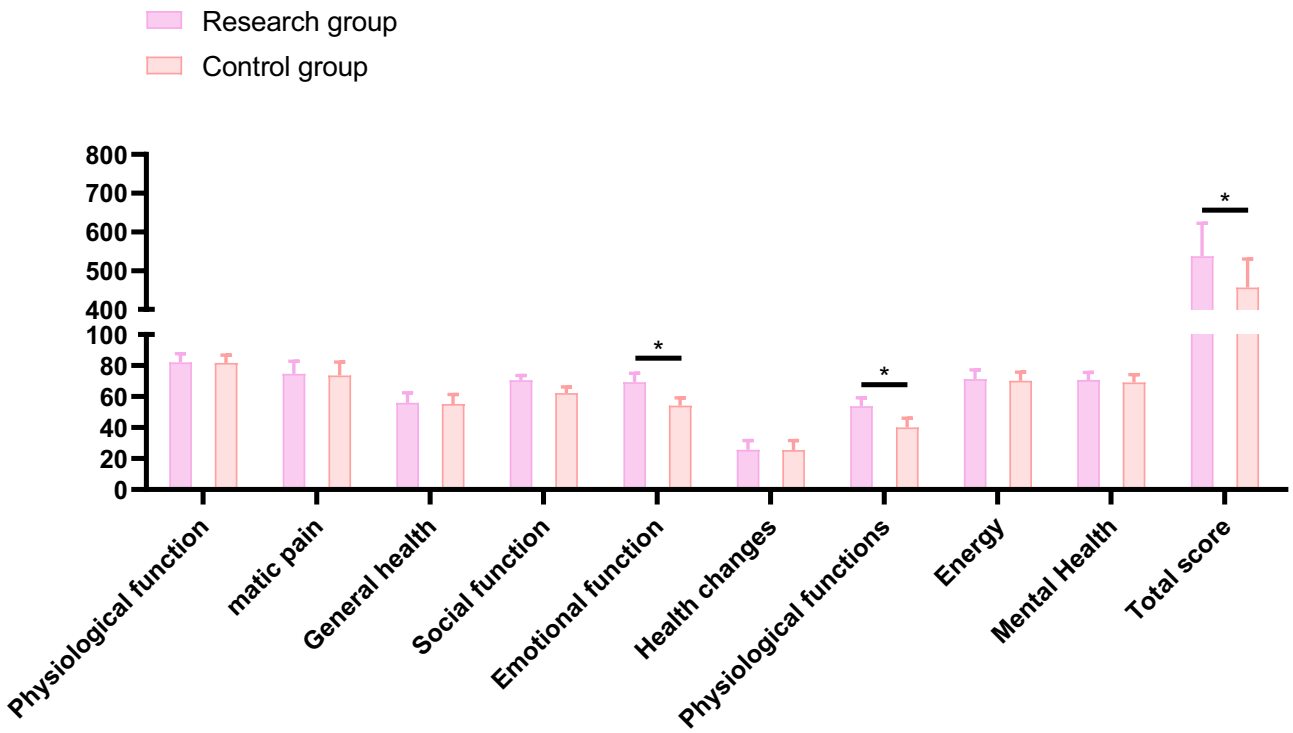

Figure 5 Comparison of various scores and total scores of the SF-36 scale after treatment between the two groups.
Note: * indicates P < 0.05.

Quality of Life

After treatment, the total score of the SF-36 scale in the study group (537.56±85.14) was higher than that in the control group (456.89±73.26), with a significance level of P<0.05. Refer to Figure 5.

Discussion

This study assessed the efficacy of integrative traditional Chinese medicine (TCM) and Western rehabilitation in improving respiratory function, exercise tolerance, and quality of life in patients recovering from COVID-19. The results demonstrated that the study group outperformed the control group in the 6-minute walk test (6MWT), respiratory and circulatory parameters, lung function, and quality of life. These findings indicate that the combination of TCM and Western rehabilitation offers significant clinical benefits for patients in the recovery phase of COVID-19.

First, the 6MWT results showed a significant increase in walking distance for patients in the study group. This improvement can be attributed to the lung-strengthening and energy-boosting effects of the TCM regimen. Herbs like Codonopsis (Dangshen) and Astragalus (Huangqi) were used to tonify the lungs and spleen, alleviating symptoms such as fatigue and shortness of breath, thus enhancing the patients' exercise tolerance. This is consistent with Bourqui's findings,[10] where integrative medicine significantly improved 6MWT distance and enhanced patients' physical performance.

Second, the study revealed significant improvements in oxygen saturation (SpO2) and arterial oxygen pressure (PaO2) in the study group. This may be due to the use of herbs in the TCM formula that boost energy and resolve phlegm. Codonopsis, Astragalus, and Poria (Fuling) not only enhance oxygen absorption and lung ventilation but also boost immune function, improving the oxygenation status of patients.[11,12] Modern pharmacological studies have confirmed the anti-inflammatory and immune-enhancing effects of these herbs, facilitating faster recovery in patients.

In terms of lung function (FEV1 and FEV1/FVC), the study group showed significantly better results than the control group. This can be attributed to the phlegm-resolving herbs, such as Pinellia (Banxia) and Tangerine Peel (Chenpi), which reduce airway mucus and improve ventilation, leading to better lung function.[13,14] Moreover, the inclusion of

respiratory training in the rehabilitation protocol improved lung elasticity and diaphragmatic strength, further enhancing lung function.[15,16]

Additionally, the study found that TCM combined with rehabilitation significantly improved diaphragmatic thickness and mobility. The diaphragm, as the primary respiratory muscle, plays a crucial role in respiratory recovery. Through the use of herbal treatment and exercise rehabilitation, diaphragmatic strength increased, and both mobility and thickness improved significantly in the study group. This aligns with the improvements seen in lung function and respiratory parameters.[17,18]

Modern pharmacology supports the mechanisms behind these herbal treatments. For example, Codonopsis enhances spleen function, generates fluids, and relieves symptoms of fatigue and shortness of breath associated with Qi and Yin deficiency. Astragalus strengthens Qi and immune function, while Atractylodes (Baizhu) and Poria improve spleen and stomach function and aid in water metabolism. Pinellia, which resolves phlegm and stops vomiting, improves airway conditions. The combination of these herbs with respiratory and physical training creates a unique advantage for integrative medicine, effectively improving patients' physiological markers.[19,20]

Furthermore, the study's findings are consistent with existing literature. Previous research indicates that integrative lung rehabilitation brings significant benefits to patients with respiratory diseases.[21] Lung rehabilitation, including physical training, breathing exercises, and education, significantly enhances lung function, exercise capacity, and quality of life. In this study, the study group's quality of life scores were notably higher than those of the control group ($P < 0.05$), demonstrating the positive effect of integrative rehabilitation on overall quality of life. This is especially important for COVID-19 recovery patients who have been bedridden or physically inactive for extended periods, suggesting that integrative rehabilitation may offer a valuable approach to promoting faster recovery.

Study Limitations: While this study applied TCM's individualized treatment principles—prescribing specific herbal formulas based on syndrome differentiation (lung-spleen Qi deficiency or Qi-Yin deficiency)—we did not conduct separate analyses for patients with different syndromes. As a result, we could not determine the specific response of each syndrome type or the independent efficacy of each herbal formula. This limitation restricts the precision of evaluating the TCM intervention. Future studies should further refine research design to analyze patients based on their syndrome type and explore their specific responses to integrative rehabilitation. Additionally, the short observation period limits our ability to assess the long-term effects of this treatment. Future research should extend follow-up times to evaluate the sustainability of the benefits.

Conclusion

In summary, integrative rehabilitation combining TCM and modern therapy, including herbal formulas that tonify the lungs and resolve phlegm, alongside modern rehabilitation exercises, produced significant improvements in respiratory function, exercise capacity, and quality of life for COVID-19 recovery patients. These findings further support the clinical value of integrative rehabilitation for COVID-19 recovery and provide a useful reference for future clinical practice in this field.

Funding

This study was supported by the 2022 Chongqing Science and Technology Bureau Technology Innovation and Application Development (Key Project) (No.: CSTB2022TIAD-YJX0001).

Disclosure

The authors report no conflicts of interest in this work.

References

1. Yang L, Wang Z. Bench-to-bedside: innovation of small molecule anti-SARS-CoV-2 drugs in China. *Eur J Med Chem*. 2023;257:115503. doi:10.1016/j.ejmech.2023.115503
2. Wang Z, Yang L. Chinese herbal medicine: fighting SARS-CoV-2 infection on all fronts. *J Ethnopharmacol*. 2021;270:113869. doi:10.1016/j.jep.2021.113869

3. Umakanthan S, Sahu P, Ranade AV, et al. Origin, transmission, diagnosis and management of coronavirus disease 2019 (COVID-19). *Postgrad Med J*. 2020;96(1142):753–758. doi:10.1136/postgradmedj-2020-138234
4. Habas K, Nganwuchu C, Shahzad F, et al. Resolution of coronavirus disease 2019 (COVID-19). *Expert Rev Anti Infect Ther*. 2020;18 (12):1201–1211. doi:10.1080/14787210.2020.1797487
5. Alsharif W, Qurashi A. Effectiveness of COVID-19 diagnosis and management tools: a review. *Radiography*. 2021;27(2):682–687. doi:10.1016/j.radi.2020.09.010
6. Zhang X, Zhang X-F, Wang L, et al. Analysis of clinical efficacy of traditional Chinese medicine in recovery stage of stroke: a systematic review and meta-analysis. *Cardiovasc Ther*. 2020;2020:7172052. doi:10.1155/2020/7172052
7. An X, Duan L, Zhang YH, et al. The three syndromes and six Chinese patent medicine study during the recovery phase of COVID-19. *Chin Med*. 2021;16(1):44. doi:10.1186/s13020-021-00454-x
8. Safiabadi Tali SH, LeBlanc JJ, Sadiq Z, et al. Tools and techniques for severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2)/COVID-19 detection. *Clin Microbiol Rev*. 2021;34(3). doi:10.1128/CMR.00228-20
9. Ilkhani H, Hedayat N, Farhad S. Novel approaches for rapid detection of COVID-19 during the pandemic: a review. *Anal Biochem*. 2021;634:114362. doi:10.1016/j.ab.2021.114362
10. Zhao ZH, Zhou Y, Li W-H, et al. Analysis of traditional Chinese medicine diagnosis and treatment strategies for COVID-19 based on " the diagnosis and treatment program for coronavirus disease-2019 " from Chinese authority. *Am J Chin Med*. 2020;48(5):1035–1049. doi:10.1142/S0192415X20500500
11. Bourqui A, Rodondi P-Y, El May E, et al. Practicing traditional Chinese medicine in the COVID-19 pandemic in Switzerland - an exploratory study. *BMC Complement Med Ther*. 2022;22(1):240. doi:10.1186/s12906-022-03715-w
12. Cao LX, Chen Z-Q, Jiang Z, et al. Rapid rehabilitation technique with integrated traditional Chinese and Western medicine promotes postoperative gastrointestinal function recovery. *World J Gastroenterol*. 2020;26(23):3271–3282. doi:10.3748/wjg.v26.i23.3271
13. Zhang XR, Li T-N, Ren -Y-Y, et al. The important role of volatile components from a traditional Chinese medicine Dayuan-Yin against the COVID-19 pandemic. *Front Pharmacol*. 2020;11:583651. doi:10.3389/fphar.2020.583651
14. Shi Q, Xia F, Wang Q, et al. Discovery and repurposing of artemisinin. *Front Med*. 2022;16(1):1–9. doi:10.1007/s11684-021-0898-6
15. Xu H, Li S, Liu J, et al. Bioactive compounds from Huashi Baidu decoction possess both antiviral and anti-inflammatory effects against COVID-19. *Proc Natl Acad Sci U S A*. 2023;120(18):e2301775120. doi:10.1073/pnas.2301775120
16. Jiang L, An X, Duan Y, et al. The pathological mechanism of the COVID-19 convalescence and its treatment with traditional Chinese medicine. *Front Pharmacol*. 2022;13:1054312. doi:10.3389/fphar.2022.1054312
17. Chen S, Xue S. Association between COVID-19 and osteoporosis: a bidirectional Mendelian randomization study. *Clin Mol Epidemiol*. 2024;1:8. doi:10.53964/cme.2024008
18. Zhao L, Tian C, Yang Y, et al. Practice and principle of traditional Chinese medicine for the prevention and treatment of COVID-19. *Front Med*. 2023. doi:10.1007/s11684-023-1040-8
19. Waddington GS. Covid-19, mental health and physical activity. *J Sci Med Sport*. 2021;24(4):319. doi:10.1016/j.jsams.2021.02.009
20. Kalin NH. COVID-19 and stress-related disorders. *Am J Psychiatry*. 2021;178(6):471–474. doi:10.1176/appi.ajp.2021.21040371
21. Stasi C, Fallani S, Voller F, et al. Treatment for COVID-19: an overview. *Eur J Pharmacol*. 2020;889:173644. doi:10.1016/j.ejphar.2020.173644