

## REVIEW

# Effects of Tai Chi Chuan on the Physical and Mental Health of the Elderly: A Systematic Review

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**Background:** Many studies revealed that the elderly people are more susceptible to respiratory infections including the Novel Coronavirus (COVID-19) Pneumonia. The outbreak of the Novel Coronavirus has caused serious psychological and physical damage to the elderly. Tai Chi chuan is both rigid and flexible, with unique breathing and movement rhythms, and has a positive effect on the mental and physical health of the elderly. Related research is scattered in the literature.

**Research purposes:** This article summarizes and analyzes the effects of Tai Chi chuan on the Psychological and Physiological Health of the elderly and its mechanism, and provides corresponding methods of Tai Chi chuan practice for reference when practicing. Provide a reference for the health promotion of the senior citizens under the normalized prevention and control of the epidemic.

**Methods:** literature systematic evaluation, through Google Scholar, Web of Science, PubMed and other databases to search the literature on the effects of Tai Chi chuan on the health of the elderly, sort out the research progress at home and abroad, and determine the relevant literature for analysis according to the inclusion and exclusion criteria of this study.

**Results:** Through the preliminary screening of literature titles and abstracts, 84 articles were obtained, 64 articles were excluded according to the elimination criteria, and 20 articles were obtained; 15 articles were excluded according to the final criteria, 1 article included based on reference searching, and finally 6 articles were included in the study.

**Conclusion:** Tai Chi chuan has a potential effect on the prevention, treatment and rehabilitation of COVID-19. Its potential mechanisms include reducing anxiety, relieving depression and stress, enhancing pulmonary and cardiovascular function, enhancing immunity and improving quality of life.

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**Keywords:** COVID-19; Systematic evaluation; Health promotion

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## Introduction

December 2019 The emergence of “unexplained viral pneumonia” in Wuhan City, Hubei Province has brought great disaster to the whole world. As of June 18, 2020, the global number of confirmed cases was 8,242,999 and the number of deaths was 445,535. (Zu et al. 2020). The Chinese Center for Disease Control and Prevention conducted a detailed epidemiological analysis of 72,314 cases of COVID-19 (COVID-19) in China (Song et al., 2020). The crude case fatality rate of COVID-19 confirmed cases was 2.3% (Novel. et al. 2019). The crude case fatality rate of 60-year-old, 69-year-old, 3.6%, 70-year-old, 79-year-old, 8.0%, of which the elderly over 80 years old reached 14.8%. Among these deaths, the crude fatality rate of patients with common diseases such as cardiovascular disease, diabetes, respiratory infectious diseases, hypertension and cancer occupies the top five (G.-h. Zheng et al., 2019). The above common diseases have the highest incidence, especially among the elderly, while deaths from patients aged 60 and above account for more than 80%. The immune ability of the elderly is low, and they are high-risk groups and susceptible to infectious diseases. Most of the critically ill people in this epidemic are the elderly (G. Zheng, Li, et al., 2015).

China officially entered an aging society in 2000, and the degree of aging is deepening. The sudden outbreak of COVID-19 brings a great threat to the health of the elderly. During the outbreak of novel

coronavirus, the whole country entered the home isolation period (Niu, He, Luo, & Hu, 2014; G. Zheng, Huang, et al., 2015). Due to the narrowing of the scope of activities and the lack of exercise, the elderly people are more likely to have depression and low immunity. Pneumonia caused by novel coronavirus is caused by SARS-CoV-2 infection. The severity of the disease is related to the amount of virus-infected and its immune function. In the process of treatment, most patients can be cured by eliminating viruses and repairing inflammatory injury through autoimmune function under adjuvant therapy (Lan, Chen, Lai, & Wong, 1999). A few patients with low immunity are seriously ill or even die. Because of its physiological characteristics and poor prognosis, the elderly population has become a high-risk group.

Chinese traditional sports are the representative of Chinese excellent culture (C. Wang, Collet, & Lau, 2004). Scientific research shows that such as Tai Chi chuan, Baduanjin, Yijin Jing, traditional Qigong and so on can play a role in health promotion (Liao, Chong, Tan, & Chua, 2019). Among them, Tai Chi chuan can promote all systems of the human body. Tai Chi chuan is soft and easy to practice, so it is widely loved by the elderly. Studies have shown that Tai Chi chuan can relieve anxiety (Chang, Yeh, Chu, Wu, & Huang, 2013) and depression (Liu et al., 2018) of the elderly, reduce the morbidity and mortality of cardiovascular and cerebrovascular diseases, improve the quality of life (G.-h. Zheng et al., 2019) and improve immunity (Y. Wang, 2013) of the elderly. Tai Chi chuan is of positive significance to the health of the elderly, and can play a positive role in improving the health level of the elderly in the later stage of the epidemic (Ross & Presswalla, 1998; Schaller, 1996).

In order to clarify the effective ways of Tai Chi chuan to improve the health level of the elderly, and provide reference and ideas for the health protection of the elderly in the post-epidemic era, the purpose of this paper is to explore the positive role of Tai Chi chuan in improving the health level of the elderly, and to summarize the effects of Tai Chi chuan on emotion, basic diseases, respiration and immunity of the elderly since 2010.

## Methods

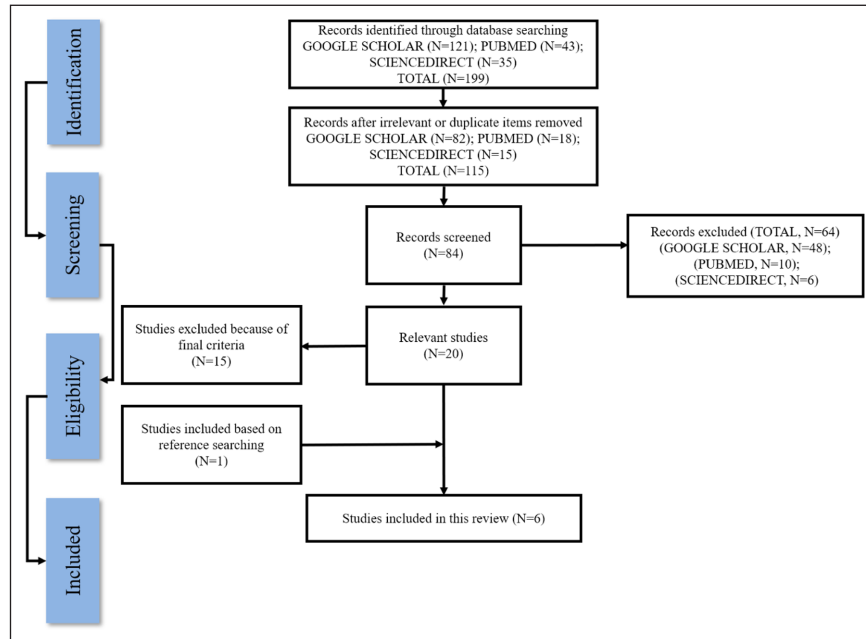
The study on the effect of Tai Chi chuan on the health of the elderly was searched through Google Scholar, Science Direct and PubMed databases. The literature was published from January 2010 to May 2020. The keywords are Older Adults, Older people, The Elderly, Tai-Chi, Tai Chi, Inflammation, Psychology, Psychological, Mind, Emotion, mood, immune, breathe, rehabilitation, Cardiovascular disease. Exclusion criteria: (1) conference papers (2) review papers (3) case studies (4) Not peer-reviewed research papers (5) non-elderly (6) languages other than English. Final criteria: the above 64 articles were screened according to the following criteria: (1) emotion and psychology of the elderly (2) respiration (3) immunity (4) cardiovascular (5) rehabilitation therapy; systematic collation of the above literature was finally included in 6 articles.

## Results and Discussion

Flow diagram of the literature inclusion and exclusion process is shown in **Figure 1**. Based on the above keywords, 199 articles were obtained by searching the Chinese and English databases. Through the preliminary screening of literature titles and abstracts, 84 articles were obtained, 64 articles were excluded according to the elimination criteria, and 20 articles were obtained; 15 articles were excluded according to the final criteria, 1 article included based on reference searching, and finally 6 articles were included in the study. **Table 1** concluded and showed the characteristics of all full-text in the previous studies.

### Effects of Tai Chi chuan on the heart and mental health of the elderly

Various schools of Tai Chi chuan can reduce the anxiety level of the elderly and have a good impact on the mental health of the elderly. Chang et al., 2013 (Chang et al., 2013; Hsu, Moyle, Cooke, & Jones, 2016; Liao et al., 2019; Liu et al., 2018) and others found that when the subjects were healthy elderly, after long-term systematic Tai Chi chuan training (Tai Chi chuan/Chen's/Yang style and other), the anxiety level and depression score of the elderly in the TaiChi group showed a very significant downward trend, but there was no significant change in the control group. In an experiment on the elderly women, it was found that after six months of 24-style Tai Chi chuan training, the scores of obsessive-compulsive symptoms, interpersonal relationships, depression, paranoia and hostility decreased significantly, while the above indexes did not change significantly in the control group (Liao et al., 2019; Liu et al., 2018). In the elderly with mild or moderate depression, it was found that long-term Tai Chi chuan practice could significantly reduce the depression score. Yang's Tai Chi chuan combined with traditional folk music accompaniment can also significantly improve the quality of life of the elderly with depression, including social, psychological, environmental, physical and sports self-efficacy. Besides, the longer the practice of Tai Chi chuan, the more obvious the improvement of depression. At the same time, most of the exercise programs provided in the



**Figure 1:** Flow diagram of the Literature Inclusion and Exclusion Process.

**Table 1:** Influence of Tai-Chi on Physical and Mental Health of Old Adult.

	Participants	Simple size	Ages	Study design	Results
Chang et al., 2013	Elderly	133	EG:56.45 ± 8.51 CG:62.26 ± 12.91	EG: Chen style Taijiquan, three times a week, each time lasts 60 minutes, a total of 12 weeks; CG: maintain daily activities	Compared with CG, EG: Anxiety level after 12 weeks ↓(β = -7.02, P = 0.01), DBP↓ (β = -7.02, P < 0.001); After six and twelve weeks, SBP↓, BMI↓, WC↓.
Liu et al., 2018	Depressed elderly	60	TC:60.90 ± 4.28 CG:61.72 ± 3.54	TC: Tai Chi exercises for 60 minutes each time, three times a week for 24 weeks; CG: maintain the original lifestyle	TC group, depression score ↓, M-HRT↓, LF norm ↓(p < 0.05), RMSSD↑, HF↑, HF norm ↑(p < 0.05); CG group, the above indicators have no significant difference
Hsu et al., 2016	Elderly people using wheelchairs	60	EG:80.73 ± 9.68 CG:81.77 ± 6.32	EG: Chen style sitting Tai Chi, 3 times a week, 40 minutes each time, 26 weeks CG: Maintain daily activity habits	Compared with CG, EG: POMS-SF↓(p < 0.05), SEE↑(p < 0.05)
Liao et al., 2019	Elderly people with mild to moderate depression	112	EG:71.72 ± 7.331 CG:71.87 ± 8.002	EG: 24 Yang style Taijiquan combined with traditional Chinese folk music accompaniment, 50 minutes each time, three times a week for three months; CG: regular health education.	Compared with CG, EG group QOL↑ (body ↑ F = 25.145, P < 0.001, hp2 = 0.435, psychological ↑ F = 18.696, P < 0.001, hp2 = 0.364, society ↑ F = 17.473, P < 0.001, hp2 = 0.348, surroundings ↑ F = 29.576, P < 0.001, hp2 = 0.475.

(Contd.)

	Participants	Simple size	Ages	Study design	Results
Sun et al., 2019	Elderly	120	65.8 ± 9.6	TC: Regularly receive 24-style Tai Chi training; CG: Daily activities and lifestyle remain unchanged	Compared with the CG group, the TC group decreased in systolic blood pressure, diastolic blood pressure, waist circumference, hip circumference, body weight and body mass index ( $p < 0.01$ ); Heart index $\uparrow$ ( $p < 0.05$ ); Total incidence of complications and mortality $\downarrow$ ( $p < 0.01$ ); The incidence of cardiovascular and cerebrovascular diseases (16.67%) was significantly lower than that of the CG group (38.33%)
Wang et al., 2013	Elderly	100	Male: 61.6 ± 3.8 Female: 58.5 ± 4.1	EG: 4 times a week, each time lasts 45 minutes, a total of 24 weeks of Tai Chi exercise; blank group: no exercise	Test group: Male, CD8 $\downarrow$ ( $P < 0.01$ ), CD4 + CD8 + ratio $\uparrow$ ( $P < 0.05$ ); Female: NK Cell viability $\uparrow$ ( $P < 0.05$ ), CD4 $\uparrow$ ( $P < 0.05$ ), CD8 $\downarrow$ , CD4 + CD8 $\uparrow$ ( $P < 0.01$ ).

*Note:* EG (experimental group) = experimental group, CG (control group) = control group, SBP (Systolic blood pressure) = systolic blood pressure, BMI (Body mass index) = body mass index, WC (Waist circumference) = waist circumference, TC = Tai Chi group, M-HRT = average heart rate, RMSSD = root mean square of the difference between adjacent RR intervals, HF = high-frequency power, LF norm = standardized low-frequency power, HFnorm = standardized high-frequency power, SAS = anxiety Self-rating scale, HAMD = Hamilton Depression Scale, PSQI = Pittsburgh Sleep Quality Index, MLHF = Minnesota Heart Failure Quality of Life Questionnaire, POMS-SF = Concise Mood Scale, SEE = exercise self-efficacy, QOL = quality of life, IgG = most antibacterial antibiotics and antiviral antibodies, IgM = in the body to prevent bacteremia.

literature (**Table 1**) are 30–50 minutes three times a week, in which the exercise frequency of one study is 5 times per week and the other is 7 times per week, which is in line with the guiding principle of moderate aerobic exercise intensity. By studying the effects of different intensity aerobic exercise on the physiological and psychological indexes of patients with myocardial infarction, it is concluded that both low-intensity and medium-intensity exercise can improve the level of anxiety and depression of patients, especially after moderate-intensity exercise, when the index of left ventricular ejection fraction is improved, the level of anxiety score of patients also decreases significantly (Yan et al., 2013). Besides, when the heart rate recovery index was improved, the scores of anxiety and depression decreased significantly. Therefore, at least five times a week Tai Chi chuan practice can have a good impact on the mental health of the elderly.

### Effects of Tai Chi chuan on the physiological health of the elderly

Tai Chi chuan exercises (24-Style/24-Style/Taiji breathing exercises, etc.) can systematically promote the physical health of the elderly. Sun et al. study the effects of Tai Chi chuan on cardiovascular function and heart rate variability in the elderly (Sun, Zhuang, Li, Zheng, & Wu, 2019). The combination of these three forms of Tai Chi chuan exercises not only improves the vagus nerve activity of the elderly, enhances the cardiovascular regulation and control ability, and the results of nonlinear indicators also show that the ability of the elderly to regulate bad emotions has been improved. In order to explore the effect of 24-style Tai Chi chuan on the prevention of cardiovascular disease and the improvement of cardiopulmonary function in obese elderly people, 120 obese elderly people were randomly divided into TC group and CG group, and the subjects were followed up for six years. Finally, it is found that compared with the CG group,

systolic blood pressure, diastolic blood pressure, waist circumference, hip circumference, body weight and body mass index decreased significantly, the cardiac index increased significantly, and the total incidence of complications and mortality of underlying diseases decreased significantly in TC group. At the same time, the incidence of cardiovascular and cerebrovascular diseases (16.67%) was also much lower than that in the CG group (38.33%). Tai Chi chuan is a kind of aerobic exercise of medium and small intensity, in the process of exercise, it emphasizes deep breathing, slow movement, relaxing the spirit and regulating the state of neural activity, so as to slow down the pressure on the central brain of the autonomic nerve during exercise (Kwak, 2013). reduce the release of norepinephrine from nerve endings, promote the myocardial secretion of inhibin, stabilize cardiovascular motor nerves, improve cardiovascular elasticity and smooth muscle, and increase cardiac output. Reduce peripheral resistance and enhance cardiovascular diastolic capacity during diastole (Sun et al., 2019). Tai Chi chuan plays a positive role in improving the cardiovascular function of the elderly, but there are relatively few studies on the effects of Tai Chi chuan on the basic diseases of the elderly, which can be further discussed in the future.

Wang et al. discussed the effect of Tai Chi chuan on immune regulation and found that 24-style simplified Tai Chi chuan exercise can enhance the erythrocyte immune adhesion function of the elderly, which is not only conducive to the full play of cellular immune function but also enhance the ability of cells to resist virus attacks and enhance antioxidant function (Y. Wang, 2013). The long-term practice of Tai Chi chuan can improve the activity of NK cells, enhance the natural immunity of the body, and reduce the incidence of various diseases. The above studies show that long-term systematic Tai Chi chuan exercise can enhance the natural immunity of the elderly by improving the activity of various immune cells, so as to prevent the invasion of various diseases and infections (Yan et al., 2013). The enhancement of immunity of the elderly can also increase the ability to resist COVID-19.

### **Suggestions for the elderly to exercise Tai Chi chuan**

The practice of Tai Chi chuan does not need a large place and is suitable for practice alone or at home, which is of positive significance to the health promotion of the elderly (Liu et al., 2018). Tai Chi chuan is very suitable for improving the health level of the elderly to help prevent and control the epidemic under the condition of normal prevention and control of the epidemic, but the practice of Tai Chi chuan should follow the movement law and step by step. The beginners can follow the online video teaching to first practice Taiji relaxing exercises, Taiji round exercises, Taiji virtual exercises and Taiji coordination exercises. With the mastery of the basic movements of Tai Chi, combined with video science and professional teachers to guide the practice of 24-style simplified Tai Chi chuan, 32-style Tai Chi chuan and 42-style Tai Chi chuan. It should be noted that elderly people who are ill or at risk of falling should practice under the guidance of experienced expert teachers to prevent accidents.

Exercise intensity and frequency are directly related to the effect of exercise, and excessive exercise causes varying degrees of damage to the human body. According to the latest research (Holmes et al., 2016), a total of 150 minutes of aerobic exercise should be guaranteed every week. Therefore, the elderly should ensure that Tai Chi chuan should be practiced five times a week, and the interval should not exceed two days, in order to ensure the continuous accumulation of exercise effect, and the longer the number of years of exercise, the greater the health benefits (Jimenez, Melendez, & Albers, 2012). Cooper, the father of aerobic exercise, believes that the most suitable exercise intensity should be between 65% and 75%, and the suitable exercise heart rate for people aged 20–40 should be 140,160bpm; for people aged 41–60, the exercise heart rate should be 120,140bpm; for people over 60 years old, the exercise heart rate should be kept at 100,120bpm. Due to the degradation of some functions of the body, the elderly people are prone to accidents when they are in the exercise state of excessive heart rate for a long time, while Tai Chi chuan belongs to the range of medium and small exercise intensity, which not only reduces the probability of danger but also ensures the effect of fitness (G. Zheng, Li, et al., 2015). However, the specific exercise intensity and time should be adjusted at any time according to the health status of the elderly, and they should devote themselves to exercise, fully warm-up and stretch, to prevent the occurrence of sports injury (Table 2).

### **Conclusion**

All schools of Tai Chi chuan can improve the bad emotional psychology of the elderly, which is beneficial to the mental health of the elderly. Enhance the natural immunity of the body, prevent a variety of bacterial, viral infections and epidemic diseases. Strengthen respiratory muscle strength, improve lung function, and reduce the occurrence of respiratory infectious diseases. It is beneficial to cardiovascular function and plays a significant role in reducing the incidence and mortality of cardiovascular disease. These effects of Tai

**Table 2:** Tai-Chi exercise methods of the elderly at different ages.

Ages	Types of Tai-Chi	Exercise intensity	Exercise frequency	Heart rate
40~50 years old	24-style Tai Chi chuan, 32-style Tai Chi chuan, 42-style Tai Chi chuan	60%~80%VO2max	60min/5 times/per week	120~140
51~60 years old	24-style Tai Chi chuan, 32-style Tai Chi chuan, 42-style Tai Chi chuan	40%~60%VO2max	50min/5 times/per week	110~130
Over 60 years old	24-style Tai Chi chuan, 32-style Tai Chi chuan, 42-style Tai Chi chuan	30%~50% VO2max	30~40min/5 times/per week	100~120

Chi chuan have a potential role in the elderly to deal with novel coronavirus infection, prevention and treatment. In this context, future research can further confirm the effectiveness of Tai Chi chuan and provide more clinical evidence. Future studies on the elderly and Tai Chi chuan should pay more attention to the elderly with basic diseases, such as hypertension, respiratory tract infection, coronary heart disease, etc., to minimize the mortality of the elderly. Besides, more attention should be paid to the research on the role of Tai Chi chuan in the illness of the elderly and even in the process of postoperative rehabilitation.

### Competing Interests

The authors have no competing interests to declare.

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