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## Research Article

# The Effect of Tai Chi on quality of life in seniors

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## Abstract

**Objective:** This study investigates the effect of Tai Chi exercise on the quality of life of seniors from a demographic perspective.

**Methods:** The SF-36 Quality of Life Scale questionnaire was administered to 224 seniors in Wuhan, divided into an experimental group ( $n = 134$ , seniors who had participated in Tai Chi exercise for three years or more) and a control group ( $n = 90$ , seniors who had not received Tai Chi exercise). An independent samples t-test, one-way Analysis of Variance (ANOVA), and dummy regression analysis are conducted using multivariate statistics.

**Results:** (1) The quality of life scores for seniors who participated in Tai Chi exercise were significantly different from those who did not ( $p < 0.01$ ), mainly in the dimensions of Physical Functioning, Social Functioning, General Health, Vitality, and Health Transition; (2) The quality of life scores of the Tai Chi exercise group differed significantly ( $p < 0.05$ ) between the genders, with women being higher than men, but not between the age groups, residence patterns and pre-retirement occupations ( $p > 0.05$ ); (3) Highly significant differences in quality of life scores between the 61-90 minutes Tai Chi group and the <60 minutes and >90 minutes Tai Chi groups ( $F = 5.43$ ,  $p < 0.01$ ); (4) There was a highly significant difference in quality of life scores between the Tai Chi group exercising 5-6 times a week or every day and the Tai Chi group exercising less than 4 times a week ( $F = 5.28$ ,  $p < 0.01$ ), but not between the group exercising 5-6 times a week Tai Chi and the group exercising every day Tai Chi ( $t = -1.403$ ,  $p > 0.05$ ).

**Conclusion:** Practicing Tai Chi Chuan can improve the quality of life of seniors, but the effect is influenced by gender and the length and frequency of exercise.

## Introduction

Population aging is inevitable, with many countries and regions throughout the world currently going through an aging phase [1,2]. By 2050, it is predicted that there will be 1.6 billion seniors (aged 60 and above) worldwide; at that point, the elderly population will comprise 21% of the total population in 94 countries, and 28% or more in 39 countries [3]. By the end of 2018, the senior population in China had reached 249 million (17.9% of the total population). Hao Fuqing, et al. concluded that the rate at which China's population is currently aging is very fast and leading to a population imbalance between the young and the old." [4]. This has put pressure on social security and public services in China, affecting intergenerational harmony.

Moreover, this stress has had a detrimental effect on seniors' mental health and overall quality of life (QoL) [5-7]. Quality of life is defined by the World Health Organization (WHO) as the experience of individuals concerning their goals, expectations, standards, and concerns [8]. Currently, the health of older adults is a major social concern. Moreover, under the influence of China's inadequate health care system and traditional culture, elderly people still mainly age at home, and family members take the main responsibility of caring for them. The quality of life of the elderly is the main symbol of a country's economic and social development level and the degree of social civilization [9]. Improving and enhancing the QoL of seniors is a crucial means of addressing the abovementioned social problems facing a rapidly aging society [10].



The American College of Sports Medicine's position that "exercise is good medicine" is broadly understood by scholars to suggest that exercise is often among the best ways to prevent disease [10-13]. Likewise, China has formulated strategic national policies emphasizing the importance of exercise, such as "Healthy China" and "Strong Sports Nation", by promoting the concept of "Healthy Aging". In pursuing these policies, China has similarly argued that exercise and health are linked, stating: "Sports: It is about people's happiness and the future of the nation" [14,15]. Hence, as the population of seniors continues to increase, they have been encouraged to build exercise habits to maintain their physical and mental health. One of the most effective forms of exercise for improving the quality of life of seniors is aerobic exercise [16], one form of which is Tai Chi (alternatively Tai Chi Chuan, or taijiquan). Tai Chi is a popular form of physical and mental exercise among the middle-aged and elderly in China [17-19], combining aerobic exercise, positive thinking, and abdominal breathing. Tai Chi is often used to prevent and regulate negative emotions [20], in addition to regulating physical health. The gentle, slow movements of Tai Chi are effective in clearing the meridians, regulating yin and yang, and soothing the blood and qi [17]. Nocera, et al. [21], concluded a 16-week trial of Tai Chi interventions for quality of life in patients with Parkinson's disease (PD), which demonstrated a positive effect on the total quality of life scores and emotional well-being. Li, et al. [22], compared Tai Chi exercise, stretching, and resistance training over a six-month period and found that the Tai Chi group's outcomes were superior to those of the stretching group and resistance group in terms of total quality of life scores. Finally, Shen-Ting Lin, et al. [23], found that the effect of the Tai Chi exercise intervention was moderated by demographic variables (age, gender) and the length and frequency of the intervention.

Following previous work, through comparative analysis, this study explores whether Tai Chi exercise improves the quality of life of the elderly. Notably, we also conduct further analysis of the demographic (gender, age, living ways, occupation before retirement) and regimen-related (exercise length and frequency) variables that potentially moderate the effect of Tai Chi exercise on quality of life. Tai Chi exercise has many health benefits for the elderly, and the study of the effect of Tai Chi exercise on the quality of life of the elderly can strengthen the promotion of Tai Chi exercise in the elderly population, inherit Taiji culture, improve people's quality of life, enhance subjective well-being, and realize "healthy aging".

## Study design

**Data sources:** This survey research was approved by the Institutional Review Board (IRB) of Wuhan Sports University. This study used the SF-36 scale, which has been confirmed by several studies to have good reliability and validity in evaluating the quality of life of our elderly population and can be used to evaluate the quality of life of different elderly populations and to evaluate the effectiveness of various interventions. A questionnaire containing demographic variables and the SF-36 (a scale used to measure the quality of life) was administered to seniors aged 55 years and older in Wuhan, China. The scale has been validated by several studies

and can be used to evaluate the quality of life of different elderly populations and to evaluate the effectiveness of various interventions. The questionnaire was targeted at two groups: (1) seniors who have regularly participated in any kind of Tai Chi exercise for more than three years and (2) seniors who had never participated in or acknowledged Tai Chi exercise. The first group (the Tai Chi group) was mainly assembled from Tai Chi classes in senior colleges, folk martial arts groups, and retired workers, whereas the second group (the control group) was mainly assembled from nursing institutions and the community. This study conducted a questionnaire survey of residents of the Zhuodaoquan community nursing home and the Jiangxingyuan community in Hongshan District, Wuhan. A total of 250 questionnaires were distributed in this study, of which 150 were for the Tai Chi group and 100 were for the control group; 134 valid questionnaires were returned for the Tai Chi group and 90 for the control group, for a total of 224, with a valid recovery rate of 89.6%

The questionnaires were distributed and collected in two ways. First, a paper-based questionnaire was randomly distributed by the surveyor to seniors in the streets, communities, and nursing institutions. Second, the questionnaire was also distributed using the "Questionnaire Star" app, which was specifically aimed at designated groups of retired teachers and cadres. The questionnaires were mainly self-administered, but those seniors who could not complete the questionnaires independently were assisted by surveyors. The completed questionnaires were quality assured via on-site quality control.

## Measurement of variables

**Dependent variables:** Studies have found that quality of life—a vital indicator of standard of living—fluctuates depending on whether the subject practices Tai Chi or not and that this fluctuation depends at least in part on other factors. Therefore, this study uses the quality of life as the dependent variable. We used the SF-36 scale (the Short Form of Health Survey), a universal measurement scale developed by the Medical Outcomes Study (MOS) of the United States Bureau of Medicine, to evaluate the quality of life. This survey includes items related to Physical Functioning (PF), Physiological Functioning (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), General Health (GH), and Social Functioning (SF). Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Emotional Functioning (RE), Emotional (RE), Mental Health (MH), and Health Transition (HT) comprise nine of its dimensions, consisting of 36 items, all rated on a scale of 2 to 7. Each question has been reverse-scored so that options and scores are proportional, with higher scores adding together to a better quality of life.

**Control variables:** The experimental data were influenced by demographic and regimen-related variables. Therefore, the following demographic variables were used as control variables in this paper: (1) gender; (2) age (55–60 years; 61–65 years; 66–70 years; 71–75 years; and 75+ years); (3) occupation before retirement; (4) residence mode; (5) frequency of exercise per



week (1 = 1-2 times/week, 2 = 3-4 times/week, 3 = 5-6 times/week, 4 = exercise every day); and (6) duration of each exercise session (1 = less than 30 minutes, 2 = 31-60 minutes, 3 = 61-90 minutes, 4 = 91-120 minutes, 5 = more than 120 minutes).

**Statistical methods**

We used SPSS 25.0 statistical analysis software for the descriptive analysis of the basic characteristics of seniors. We used an independent samples t-test to compare and analyze the differences between the experimental and control groups in terms of total quality of life scores across its various dimensions. Specifically, we conducted an ANOVA to determine whether there was a significant effect of Tai Chi exercise on the quality of life of older people, controlling for demographic variables. We also used virtual regression analysis to explore how Tai Chi exercise can enhance the quality of life of seniors.

**Results**

**Analysis of subject characteristics**

A descriptive analysis of the data showed that there were 134 (59.8%) seniors in the experimental group and 90 (40.2%) in the control group. There were more women (67%) than men. The number of seniors in the "61-65 years old" group was the largest (86 - 38.4%). The most common residence style was "living with spouse", with 116 (51.8%), and the most common pre-retirement occupation was "enterprise employees", with 97 (43.3%). Most participants exercised every day (76% - 33.9%), and the most common exercise duration was "31-60 minutes" with 102 (45.5%) (Table 1).

**Effect of Tai Chi exercise on various dimensions of quality of life**

The test of normality on the data showed that the overall distribution was normal (Figure 1).

The results of the independent samples t-test for each dimension of the SF-36 scale showed that Tai Chi exercise had a significant effect on the QoL of seniors ( $p < 0.05$ ). Additionally, we found that seniors who practiced Tai Chi had higher QoL scores than those who did not practice Tai Chi, mainly in the dimensions of PF, SF, VT, GH, and HT (Table 2).

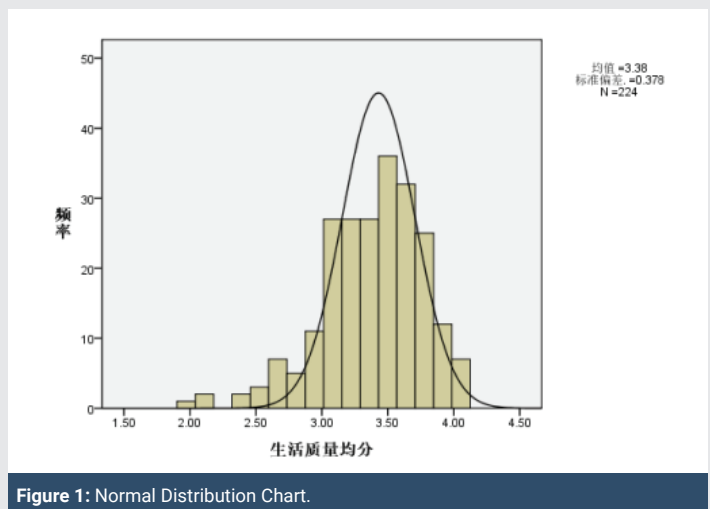
**The impact of Tai Chi on the quality of life of seniors under demographic variables**

To investigate whether the effects of Tai Chi exercise on seniors' QoL were affected by demographic variables, independent sample t-tests, and one-way ANOVAs were conducted on 134 subjects in the experimental group related to gender, age, mode of residence, and pre-retirement occupation.

First, we examined whether gender affected the relationship between Tai Chi and QoL. We conducted an additional independent samples t-test across different latitudes of the QoL and the mean and total QoL scores of the experimental group for seniors of different genders. We found that the QoL of seniors who practiced Tai Chi was affected by gender ( $t = -2.24, p < 0.05$ ), mainly in the dimensions of PF ( $t = -2.069, p$

**Table 1:** Basic Characteristics of Participants (n = 224).

| Variable name                 | Variable description           | Number of People | Present (%) |       |
|-------------------------------|--------------------------------|------------------|-------------|-------|
| Group                         | Experimental                   | 134              | 59.8%       |       |
|                               | Control                        | 90               | 40.2%       |       |
| Gender                        | Male                           | 74               | 33%         |       |
|                               | Female                         | 150              | 67%         |       |
| Age                           | 55-60 years old                | 57               | 25.4%       |       |
|                               | 61-65 years old                | 86               | 38.4%       |       |
|                               | 66-70 years old                | 44               | 19.6%       |       |
|                               | 71-75 years old                | 21               | 9.4%        |       |
|                               | over 75 years old              | 16               | 7.1%        |       |
| Residence Style               | Living with spouse             | 116              | 51.8%       |       |
|                               | Living alone                   | 13               | 5.8%        |       |
|                               | Living with children           | 87               | 38.8%       |       |
|                               | Living in nursing institutions | 8                | 3.6%        |       |
| Pre-retirement occupation     | Farmers                        | 2                | 0.9%        |       |
|                               | Teachers                       | 61               | 27.2%       |       |
|                               | Enterprise employees           | 97               | 43.3%       |       |
|                               | Medical staff                  | 11               | 4.9%        |       |
|                               | Government officials           | 19               | 8.5%        |       |
|                               | Self-employed                  | 3                | 1.3%        |       |
|                               | Freelance                      | 14               | 6.3%        |       |
|                               | Other                          | 17               | 7.6%        |       |
|                               | Exercise Frequency per week    | 0 times/week     | 3           | 1.3%  |
|                               |                                | 1-2 times/week   | 23          | 10.3% |
| 3-4 times/week                |                                | 69               | 30.8%       |       |
| 5-6 times/week                |                                | 53               | 23.7%       |       |
| exercise every day            |                                | 76               | 33.9%       |       |
| Exercise Duration per session | 0 minutes                      | 3                | 1.3%        |       |
|                               | below 30 minutes               | 7                | 3.1%        |       |
|                               | 31-60 minutes                  | 102              | 45.5%       |       |
|                               | 61-90 minutes                  | 78               | 34.8%       |       |
|                               | 91-120 minutes                 | 20               | 8.9%        |       |
|                               | Over 120 minutes               | 14               | 6.3%        |       |



**Figure 1:** Normal Distribution Chart.



< 0.05), MH ( $t = -2.909, p < 0.05$ ). In both dimensions, women have a higher quality of life scores than men.

Next, we examined whether differences in age, residence, or occupation had any effect on this relationship. We conducted a one-way ANOVA on the experimental group according to these three factors and found that none moderated the effect of practicing Tai Chi on senior QoL ( $p > 0.05$ ) Tables 3–6.

### Test for differences in quality-of-life scores by length and frequency of Tai Chi exercise in the test group

**One-way ANOVA:** We next examined whether the relationship between practicing Tai Chi and senior QoL was moderated by the length or frequency of the exercise regimen. To explore this, we conducted one-way ANOVAs on the QoL scores of the experimental group for different exercise frequencies and durations. These analyses produced two main findings. First, the QoL scores of the experimental group were significant and

**Table 2:** Analysis of the QoL scores in different dimensions between the experimental and control groups.

| Variables | Dimensionality | Experimental group (M ± SD) | Control group (M ± SD) | t       |
|-----------|----------------|-----------------------------|------------------------|---------|
| QoL       | PF             | 2.61 ± 0.47                 | 2.74 ± 0.24            | -2.61** |
|           | RP             | 1.78 ± 0.33                 | 1.78 ± 0.37            | -0.15   |
|           | RE             | 1.82 ± 0.35                 | 1.82 ± 0.36            | -0.13   |
|           | SF             | 4.81 ± 0.94                 | 4.48 ± 0.96            | 2.52*   |
|           | BP             | 4.12 ± 0.97                 | 4.02 ± 0.73            | 0.81    |
|           | VT             | 4.85 ± 0.74                 | 4.60 ± 0.78            | 2.37*   |
|           | MH             | 4.67 ± 0.71                 | 4.83 ± 0.70            | -1.65   |
|           | GH             | 3.89 ± 0.76                 | 3.56 ± 0.80            | 3.17**  |
|           | HT             | 4.05 ± 0.79                 | 2.99 ± 0.63            | 10.60** |

Note: \* $p < 0.05$ , \*\* $p < 0.01$

**Table 3:** Significant differences in quality of life by gender in the experimental group.

|                       | Gender | n  | M ± SD         | t       |
|-----------------------|--------|----|----------------|---------|
| PF                    | Male   | 50 | 2.52 ± 0.45    | -2.069* |
|                       | Female | 84 | 2.67 ± 0.36    |         |
| RP                    | Male   | 50 | 1.73 ± 0.37    | -1.233  |
|                       | Female | 84 | 1.80 ± 0.31    |         |
| RE                    | Male   | 50 | 1.76 ± 0.38    | -1.388  |
|                       | Female | 84 | 1.85 ± 0.32    |         |
| SF                    | Male   | 50 | 4.66 ± 1.00    | -1.422  |
|                       | Female | 84 | 4.90 ± 0.90    |         |
| BP                    | Male   | 50 | 4.12 ± 0.90    | 0.005   |
|                       | Female | 84 | 4.12 ± 1.02    |         |
| VT                    | Male   | 50 | 4.82 ± 0.75    | -0.384  |
|                       | Female | 84 | 4.87 ± 0.74    |         |
| MH                    | Male   | 50 | 4.44 ± 0.75    | -2.909* |
|                       | Female | 84 | 4.80 ± 0.66    |         |
| GH                    | Male   | 50 | 3.79 ± 0.81    | -1.265  |
|                       | Female | 84 | 3.96 ± 0.72    |         |
| HT                    | Male   | 50 | 3.99 ± 0.87    | -0.662  |
|                       | Female | 84 | 4.08 ± 0.74    |         |
| QoL scores on average | Male   | 50 | 3.32 ± 0.43    | -2.24*  |
|                       | Female | 84 | 3.47 ± 0.38    |         |
| Total QoL scores      | Male   | 50 | 119.52 ± 15.36 | -2.24*  |
|                       | Female | 84 | 124.98 ± 12.51 |         |

Note: \* $p < 0.05$ , \*\* $p < 0.01$

**Table 4:** Test for differences in quality of life by age in the Tai Chi group.

|                   | n  | M ± SD         | F    | p    |
|-------------------|----|----------------|------|------|
| 55-60years old    | 41 | 120.90 ± 16.13 | 1.68 | 0.16 |
| 61-65years old    | 52 | 125.88 ± 12.17 |      |      |
| 66-70years old    | 24 | 120.96 ± 13.33 |      |      |
| 71-75years old    | 15 | 123.67 ± 11.50 |      |      |
| Over 75 years old | 2  | 106.5 ± 17.68  |      |      |

**Table 5:** Test for differences in quality of life by occupation before retirement in the Tai Chi group.

|                      | n  | M ± SD         | F    | P     |
|----------------------|----|----------------|------|-------|
| Farmers              | 2  | 140.5 ± 3.54   | 1.29 | 0.261 |
| Teachers             | 20 | 119.2 ± 18.93  |      |       |
| Enterprise employees | 77 | 121.88 ± 13.58 |      |       |
| Medical staff        | 4  | 126.25 ± 7.93  |      |       |
| Government officials | 10 | 129 ± 12.36    |      |       |
| Self-employed        | 3  | 119 ± 1.73     |      |       |
| Freelance            | 12 | 124.83 ± 10.78 |      |       |

**Table 6:** Test for differences in quality of life between different residence styles in the Tai Chi group.

|                                | n   | M ± SD         | F     | p    |
|--------------------------------|-----|----------------|-------|------|
| Living with spouse             | 116 | 121.28 ± 13.83 | 2.533 | 0.58 |
| Living alone                   | 13  | 120.92 ± 14.14 |       |      |
| Living with children           | 87  | 123.34 ± 12.17 |       |      |
| Living in nursing institutions | 8   | 109.88 ± 13.62 |       |      |

greatly different depending on exercise frequency ( $p < 0.01$ ). The QoL scores of the group exercising Tai Chi every day were significantly higher than those of the group exercising 1–2 or 3– times per week, but not significantly different from those of the group exercising 5–6 times per week. Second, the QoL scores of the experimental group were significant and greatly different depending on exercise duration ( $p < 0.01$ ). The quality of life of the 61–90 minutes Tai Chi group was significantly higher than that of the less than 60 minutes Tai Chi group, but was not significantly different from that of the 91–120 and greater than 120 minutes Tai Chi groups Table 7.

### Virtual regression analysis

We used virtual regression analysis to further study the effects of the frequency and duration of Tai Chi exercise on quality of life. The duration of each exercise session was divided into five levels: numerical code 1 for "less than 30 minutes", numerical code 2 for "31–60 minutes", numerical code 3 for "61–90 minutes", numerical code 4 for "91–120 minutes" and numerical code 5 for "more than 120 minutes". The reference group was set to 3 and compared with 1, 2, 4, and 5 respectively, and numerical code 3 was found to be significantly different from 1 and 2 ( $p < 0.05$ ) but not from 4 and 5 ( $p > 0.05$ ) Table 8.

We divided exercise frequency into four levels: letter code A for "1–2 times/week", letter code B for "3–4 times/week", letter code C for "5–6 times/week" and letter code D for "every day". The reference group was set as D and compared with A, B, and C. We found a significant difference between code D and codes A and B ( $p < 0.05$ ), while there was no significant difference with codes C, D. This indicates that the QoL scores of the exercise every day Tai Chi group were higher than that of the exercise fewer than 4 times a week Tai Chi group and



**Table 7:** Test of the variability of exercise frequency per week and exercise duration per session on quality of life.

| Dependent variable | Control variables                    | N  | M ± SD      | F      | Post Hoc Tests |
|--------------------|--------------------------------------|----|-------------|--------|----------------|
| QoL                | <b>Exercise Frequency per week</b>   |    |             | 5.43** | C,D>A,B        |
|                    | A. 1-2 times/week                    | 13 | 3.23 ± 0.37 |        |                |
|                    | B. 3-4 times/week                    | 36 | 3.27 ± 0.39 |        |                |
|                    | C. 5-6 times/week                    | 31 | 3.43 ± 0.36 |        |                |
| QoL                | <b>Exercise Duration per session</b> |    |             | 5.28** | C,D,E>A,B      |
|                    | A. below 30 minutes                  | 2  | 2.94 ± 0.12 |        |                |
|                    | B. 31-60 minutes                     | 53 | 3.27 ± 0.42 |        |                |
|                    | C. 61-90 minutes                     | 57 | 3.49 ± 0.34 |        |                |
|                    | D. 91-120 minutes                    | 13 | 3.60 ± 0.28 |        |                |
|                    | E. Over 120 minutes                  | 9  | 3.64 ± 0.26 |        |                |

Note: \* $p < 0.05$ , \*\* $p < 0.01$ ;

**Table 8:** Dummy regression analysis of the frequency of Tai Chi exercise and length of exercise per session on quality of life.

| Dependent variable | Independent variable          | Adjusted R <sup>2</sup> | F     | Standardized regression coefficient β | t        |
|--------------------|-------------------------------|-------------------------|-------|---------------------------------------|----------|
| QoL                | Exercise Frequency per week   | 0.114                   | 5.278 |                                       |          |
|                    | 1&3                           |                         |       | -0.172                                | -2.091*  |
|                    | 2&3                           |                         |       | -0.279                                | -3.169** |
|                    | 4&3                           |                         |       | 0.088                                 | 1.023    |
|                    | 5&3                           | 0.096                   | 1.113 |                                       |          |
|                    | Exercise Duration per session | 0.091                   | 5.427 |                                       |          |
|                    | A&D                           |                         |       | -0.248                                | -2.837** |
|                    | B&D                           |                         |       | -0.322                                | -3.531** |
| C&D                | -0.128                        |                         |       | -1.403                                |          |

Note: \* $p < 0.05$ , \*\* $p < 0.01$ ; 1 represents less than 30 minutes, 2 represents 31-60 minutes, 3 represents 61-90 minutes, 4 represents 91-120 minutes, 5 represents greater than 120 minutes; A represents 1-2 times/week, B represents 3-4 times/week, C represents 5-6 times/week, D represents exercise every day.

slows down, and the incidence of cardiovascular, digestive, and neurological diseases, such as hypertension, Parkinson's, and dyspepsia, increases significantly [26]. As such, it is important to continue to engage in good physical health practices, such as Tai Chi exercise, to ward off these negative effects of aging. Tai Chi movements are continuous and slow, often consisting of shifting weight from one foot to the other, while rotating the head, trunk, and limbs, promoting strength and flexibility in the neck, trunk, and upper limbs. This can improve coordination, tactile spatial acuity [27], and static and dynamic balance [28]. Tai Chi also requires a degree of hip and knee flexion to maintain a low center of gravity and to promote the strengthening of the lower limbs [29]. Tai Chi requires the practitioner to memorize the main points and sequence of movements and to coordinate the "hand-eye, body, technique and steps", strengthening the cognitive functions of the elderly such as memory and attention [30-32]. Studies have shown that prolonged Tai Chi exercise increases the contraction capacity of the ventricular muscles and output per beat, thereby increasing the heart's reserve and slowing down the aging of the heart [33-35]. Tai Chi exercises are also relaxing for the mind and body, relieving tension and eliminating fatigue, thereby lowering blood pressure [36]. Likewise, Tai Chi exercise affects T lymphocytes and their subpopulations, cytokines, and NK cells in the elderly [36], improving the body's cellular immune function [38] and thus the body's ability to fight tumors and viral infections. It can also improve the digestive system of the elderly, preventing and treating gastrointestinal indigestion, constipation, chronic gastroenteritis, and other diseases [35,39,40].

Aging also has an impact on their mental health status and social adjustment [41]. Tai Chi, which integrates "toning the body, toning the breath, and toning the mind" [42], emphasizes meditation, natural breathing, and the integration of mind and body [43]. Tai Chi exercise can reduce stress-related hormones to improve mood, increase subjective well-being, reduce levels of depression and anxiety, and improve fear, anger, pain, and fatigue-related problems [44]. Additionally, one of the most important motivations for seniors to take part in physical activity is social reasons. Group sports such as Tai Chi can contribute to the development and maintenance of social networks and social integration of seniors, movement instruction and social support from peers can also increase confidence and self-esteem.

Although there are many studies showing that Tai Chi can improve the QoL of seniors in many areas, it will take a long time to fully implement Tai Chi services for the treatment of illnesses due to the large size of the country's system and the complex grassroots network in China. For one thing, taijiquan is slow to improve health and slow down the aging process; for another, there are many different types of Tai Chi exercise, and the elderly may have difficulty in choosing the right one to practice. In addition, we should increase scientific research on taijiquan to improve theoretical and practical understanding of taijiquan to recommend taijiquan for different groups of people. At the same time, we should also increase the publicity of "healthy aging" and let people realize the importance of practicing Tai Chi to "cure diseases before they occur".

no significant difference between the exercise every day Tai Chi group and the 5-6 times a week Tai Chi group ( $p < 0.05$ ) (Table 4).

## Discussion

In this study, we find that Tai Chi exercises can improve the QoL of seniors and that the effect of the intervention is influenced by gender and the length and frequency of exercise. This has important implications for future policy, as the rapid aging of the population will lead to a significant increase in the demand for health care in the future, as well as a significant increase in the cost of health care [24]. The implementation of the "Healthy Aging" strategy in China is designed to actively and scientifically address the issues associated with an aging population. In considering the needs of an aging population, we need to shift the focus of health from disease-oriented "treating diseases" to health-oriented "preventing disease" [25].

As the body ages, its physiological functions gradually decline, its immune responses decrease, its metabolic rate



## Conclusion

We found that older adults in the Tai Chi exercise group had significantly higher QoL scores than the Control exercise group, mainly in the dimensions of PF, SF, VT, GH, and HF. After additional analysis, we presented three additional findings. First, QoL scores in the Tai Chi group differed significantly between genders, with women scoring higher than men. This suggests that QoL scores for the Tai Chi exercise intervention were influenced by gender, but not by age group, mode of residence, or pre-retirement occupation. Second, QoL scores were significantly higher in the 61–90-minute Tai Chi group than in the <60-minute and >90-minute tai chi groups. Third, we observed significantly higher QoL scores in the 5–6 times per week and daily tai chi group than in the less than 4 times per week tai chi group, but no significant differences were observed between the 5–6 times per week and daily Tai Chi exercise groups. Our findings support previous studies (e.g., Ferrar, et al.) showing that Tai Chi exercise improves QoL in older adults and that the effect of the intervention is influenced by the duration and frequency of the intervention and the gender of the participants [45–48]. However, our results showed that women had higher QoL improvement scores than men, unlike the study [48] that showed that male patients had higher QoL scores than female patients. This result may be due to the fact that women are usually responsible for more household activities than men, leaving them with less time to exercise. However, in the present study, women performed tai chi exercises for the same amount of time as men, so the results of the present study showed that women scored higher than men in terms of quality of life, a result that does not conflict with the results of previous studies.

The American College of Sports Medicine recommends a heart rate of 110–130 beats per minute for exercise in the elderly population, in line with the two principles of safety and effectiveness for exercise regimens [49]. The typical heart rate of people when doing Tai Chi falls within this optimal load range, which makes it easier for the elderly to practice Tai Chi because of the subjective pleasure they feel when doing it. Additionally, Tai Chi exercise is not only available to healthy seniors; it has also been developed for different groups of people, such as the "wheelchair Tai Chi" for seniors who lack lower limb function. Therefore, we suggest that the duration of tai chi exercise should be kept between 61–90 minutes, and the frequency of practicing tai chi exercise should be kept at 5–7 times per week.

## Limitation

There are some limitations to this study that deserve mention. Firstly the SF-36 quality of life scale used to measure the quality of life in older adults in this study is a multidimensional variable that may change over a short period of time and we did not measure it multiple times. Secondly, the questionnaire for demographics was not conducted in the process of investigating chronic diseases (e.g., diabetes, hypertension, osteoarthritis, etc.), which may affect the overall health and quality of life of older adults. Future studies need

to describe the impact of these factors on the quality of life of older adults.

## Authors' contributions

J. L. and B.J. designed and carried out the study, and analyzed and interpret the data. J.L. wrote the main manuscript, and L.T. revised the manuscript. All authors read and approved the final manuscript.

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## References

1. Shpakou A. Population aging is one of the most important challenges facing social policy and public health. *Medical Science Pulse*. 2019; 1(13):7-14.
2. Mu GZ, Zhang T. The development trend and its strategic response of population aging in China. *Journal of Central China Normal University (Humanities and Social Sciences)*. 2011; 50(5): 29-36.
3. Michel JP, Sadana R. "Healthy Aging" Concepts and Measures. *J Am Med Dir Assoc*. 2017 Jun 1;18(6):460-464. doi: 10.1016/j.jamda.2017.03.008. Epub 2017 May 4. PMID: 28479271.
4. Hao HQ, Wang TL, Bao WH. Follow the General trend and take proactive steps to confidently respond to population aging. *Macroeconomic Management*. 2019;422(02): 43-47.
5. Martin LG. Population aging policies in East Asia and the United States. *Science*. 1991 Feb 1;251(4993):527-31. doi: 10.1126/science.1990428. PMID: 1990428.
6. Andrews RM, Tan EJ, Varma VR, Rebok GW, Romani WA, Seeman TE, Gruenewald TL, Tanner EK, Carlson MC. Positive Aging Expectations Are Associated With Physical Activity Among Urban-Dwelling Older Adults. *Gerontologist*. 2017 Aug 1;57(suppl\_2):S178-S186. doi: 10.1093/geront/gnx060. PMID: 28854610; PMCID: PMC5881692.
7. Lim KC, Kayser-Jones JS, WATERS C. Aging, Health, and Physical Activity in Korean Americans. *Geriatric Nursing*. 2007; 28(2): 112-119.
8. Felce D, Perry J. Quality of life: its definition and measurement. *Res Dev Disabil*. 1995 Jan-Feb;16(1):51-74. doi: 10.1016/0891-4222(94)00028-8. PMID: 7701092.
9. Boggatz T. Quality of life in old age - a concept analysis. *Int J Older People Nurs*. 2016 Mar;11(1):55-69. doi: 10.1111/opn.12089. Epub 2015 Jun 29. PMID: 26118350.
10. Zhang ZJ, Wang ZZ, Yu HJ. Current research focus and progress on Physical Activity Promotion: Reviews on ACSM's 65th Annual Meeting. *Journal of Beijing Sport University*. 2018; 41(08): 77-81.
11. Jennen C, Uhlenbruck G. Exercise and Life-Satisfactory-Fitness: Complementary Strategies in the Prevention and Rehabilitation of Illnesses. *Evid Based Complement Alternat Med*. 2004 Sep 1;1(2):157-165. doi: 10.1093/ecam/neh021. PMID: 15480441; PMCID: PMC516454.
12. Steven NB, William L. physical activity epidemiology and the public health: a symposium in honor of dr. ralph s. paffenbarger's 70th birthday. *525. anales del instituto de investigaciones estéticas*. 1992;30(13): b70.
13. American College of Sports Medicine Position Stand. Exercise and physical activity for older adults. *Med Sci Sports Exerc*. 1998 Jun;30(6):992-1008. PMID: 9624662.



14. Wang LD. The opportunities and challenges of "Health China 2030". *Science & Technology Review*. 2018;36:No.556(22): 10-13.
15. Shu SF. China sports in building a socialist modernization country in all aspects in one hundred years: two periods and six phases. *Journal of Tianjin University of Sport*. 2019(4).
16. El-kader S, al-jiffri OH. Aerobic exercise improves quality of life, psychological well-being and systemic inflammation in subjects with Alzheimer's disease. *African Health Sciences*. 2016; 16(4): 1045.
17. Chen WS, chen J. The influence of taijiquan and body-building qigong Baduanjin on blood lipid and quality of life in the middle-aged and elderly. *Chinese Journal of Gerontology*. 2015; 35(019): 5612-5613.
18. Ngai SP, Jones AY, Tam WWS. Tai Chi for chronic obstructive pulmonary disease (COPD). *Cochrane Database of Systematic Reviews*. 2016.
19. Wang C, Bannuru R, Ramel J. Tai Chi on psychological well-being: systematic review and meta-analysis[J]. *BMC Complementary and Alternative Medicine*,10,1(2010-05-21). 2010; 10(1): 23.
20. Yao Y, GE L, YU Q. The Effect of Tai Chi Chuan on Emotional Health: Potential Mechanisms and Prefrontal Cortex Hypothesis. *Evidence-based Complementary and Alternative Medicine*. 2021; (3): 1-12.
21. Shinichi Amano JRN, Vvallahajosula CJHS. Tai Chi Exercise to Improve Non-Motor Symptoms of Parkinson's Disease. *Journal of Yoga & Physical Therapy*. 2013; 3(3).
22. Li F, Harmer P, Yu L e. A Randomized Controlled Trial of Patient-Reported Outcomes With Tai Chi Exercise in Parkinson's Disease. *Movement Disorders*. 2014: 29(4).
23. Lin ST, xu ZY, wang JJ. Effect of exercise and dietary interventions on metabolic syndrome in children. *Chinese Journal of Epidemiology*. 2012;33(2): 135-139.
24. Wu D. The deterioration of human health and the limits of self-rescue by Taijiquan. *Journal of Beijing Sport University*. 2020;(7): 8.
25. feng J, yu YY, lou PY. Health care demand and health care cost growth in China - A perspective based on urban-rural differences in health care expenditure among the elderly. *Social Sciences in China*. 2015;(03): 85-103.
26. zeng Y, chen HS, wang ZL. Analysis of trends in changes in the cost of elderly family care needs in the first half of the 21st century. *Economic Research Journal*. 2012;(10): 134-149.
27. Zhao WF. Progress in the study of fine motor control of the hand in the elderly. *Chinese Journal of Gerontology*. 2012;(15): 3348-3349.
28. Kerr CE, Shaw J R, Wasserman RH . Tactile acuity in experienced Tai Chi practitioners: evidence for use dependent plasticity as an effect of sensory-attentional training. *Experimental Brain Research.experimentelle Hirnforschung.expérimentation Cérébrale*. 2008; 188(2): 317-322.
29. Murphy L, Singh BB. Effects of 5-Form, Yang Style Tai Chi on older females who have or are at risk for developing osteoporosis. *Physiother Theory Pract*. 2008 Sep-Oct;24(5):311-20. doi: 10.1080/09593980701884790. PMID: 18821438.
30. Wolfson L, whipple R, derby C . Balance and strength training in older adults: intervention gains and Tai Chi maintenance. *Journal of the American Geriatrics Society*. 1996; 44(5): 498-506.
31. Wang QB, sheng Y. Effect on Tai Chi on memory and executive function on older adults with mild cognitive impairment. *Journal of Shandong Sport University*. (3): 68-72.
32. Yang J, cheng S. A study on the current situation and countermeasures on the popularity of Taijiquan. *Chinese Journal of Health Education*. 2019; 35(10): 61-64.
33. Wang XQ. Research advancement of Tai Chi Quan on physiology and medicine. *China Sport Science and Technology*. 2011;(4): 113-120.
34. Wang JJ. A comparative analysis of cardiac aging indices in an elderly population exercising Taijiquan versus a normal elderly population. *Wuhan Sports University*. 2019.
35. Zhang L. Effect of Tai Chi as an exercise prescription on STI and haemodynamic parameters in elderly people before and after the PWC<sub>130</sub> test. *Chinese Journal of Sports Medicine*. 1994;(3): 167-170.
36. Deng M. Attempting to discuss the fitness effects of Taijiquan. *Journal of Southwest China Normal University(Natural Science Edition)*. 2008;(03): 168-172.
37. Liu SH, zhang H. The research on the effect of Tai Chi exercise on lymphocyte and NK cells. *China Sport Science and Technology*. 2002; 038(004): 50-52.
38. Zhao Y, yu DH. Current research on the effects of Taijiquan on the immune system. *Chinese Journal of Sports Medicine*. 2011; 030(003): 312-316.
39. Hu JQ, lin F. Fitness and therapy machanism of shadow boxing to the aged. *Journal of Wuhan Institute of Physical Education*. (5): 45-46.
40. Ren LJ. The role of Taijiquan exercise in the health care of the elderly. *Chinese Journal of Tissue Engineering Research*. 2006;010(047): 25-28.
41. Zhao XF. Research on medical-nursing care modes on the background of health aging. *Lanzhou Academic Journal*. 2014;(9): 129-136.
42. Dai ZP. A study on the operation mechanism of sports for the elderly from the perspective of home care services. *Suzhou University*. 2015.
43. Qiu PX, Tian XJ. A study on the sense of general harmony of shadowboxing. *Journal of Physical Education*. 2005; 12(3): 70-72.
44. Liu T, huang QT, Liu WZ. Effect of Tai Chi exercise on blood pressure, blood rheology and long-term quality of life in elderly patients with hypertension. *Chinese Journal of Gerontology*. 2018; 38(06): 121-123.
45. Zhu M, Zhang Y, Pan J. Effect of simplified Tai Chi exercise on relieving symptoms of patients with mild to moderate Parkinson's disease. *The Journal of Sports Medicine and Physical Fitness*. 2019; 60(2).
46. Yan Q, Xian Z, A Y. The effect of wheelchair Tai Chi on balance control and quality of life among survivors of spinal cord injuries: A randomized controlled trial. *Complementary Therapies in Clinical Practice*. 2018; 33: 7-11.
47. Ferrara P E, Salini S, Maggi L. Evaluation of quality of life and static balance in postmenopausal osteoporosis women after Tai Chi Chuan practice: an observational randomized case control study. *Journal of biological regulators and homeostatic agents*. 2019; 33(2 Suppl. 1): 163-169.
48. LI A, Sc B, Gw A. Tai Chi chuan exercises improve functional outcomes and quality of life in patients with primary total knee arthroplasty due to knee osteoarthritis - ScienceDirect. *Complementary Therapies in Clinical Practice*. 2019; 35: 121-125.
49. Chen YX. Exploring the characteristics and countermeasures of exercise and fitness for the elderly. *Journal of Fuqing Branch of Fujian Normal University*. 2002;(02): 98-101.