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The impact of group-based Tai chi on health-status outcomes among community-dwelling older adults with hypertension

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ABSTRACT

Objectives: To test the effects of group-based Tai chi on health-status outcomes among older adults with hypertension.
Background: A high-quality study exploring the effects of Tai chi on physical and psychosocial health for older adults with hypertension is needed in China. The long-term effects of group-based Tai chi in Chinese older adults with hypertension remain unclear.
Methods: A randomized controlled trial was conducted. The group-based Tai chi training and practice were implemented in older adults over six-month.
Results: The Tai chi (TC) group showed significantly lower blood pressure and body mass index than the usual care (UC) group. The TC group participants showed greater improvements in social support, quality of life, and reduction in depressive symptoms over a six-month intervention than UC group. TC group showed significant group-by-time interactions in these variables.
Conclusion: Group-based Tai chi is effective in the enhancement of health-status outcomes for older Chinese adults with hypertension.

Introduction

Hypertension is the most prevalent chronic disease in China; its prevalence increases from 18% to 34% in adults over 18 years during the period between 2002 and 2010.[1] There are 270 million adults diagnosed with hypertension in 2015 from Chinese Cardiovascular Diseases Report.[2] Hypertension is one of the common diseases in older adults. A recent report showed that the prevalence of hypertension was 59.5% in aged 50 years and older Chinese population.[3] The results from the study area (Tianhe District, Guangzhou) also showed the estimated prevalence of hypertension in older adults was 66.9%.[4] As we know, hypertension is a main factor influencing health outcomes for this population.

Performing regular physical activity is a possible approach to enhance the physical and psychological health of older adults with hypertension.[5] A number of studies showed that Tai chi is an optimal choice of exercise for older adults with chronic diseases.[6–10] Tai chi, which is also called Taiji, Tai chi chuan, or Taiji quan, is a multicomponent mind-body exercise grounded in the holistic model of traditional Chinese medicine.[6,9] Tai chi adopts the Chinese philosophy of health maintenance and works on a holistic level.[7] It is based on slow intentional movements, coordinated with breathing and imagery, that aims to relax the physical body and mind and improve health and personal development.[7,10] A growing body of clinical research has been conducted to evaluate the effectiveness of Tai chi as an approach to promote health for older adults with chronic diseases. The results of these studies revealed Tai chi greatly improved age-related declining systems, including pulmonary and cardiovascular function, balance, and cognitive function.[10–14] A systematic review reported that Tai chi exercise can reduce systolic blood pressure (SBP) and diastolic blood pressure (DBP) and provide psychosocial benefits for patients with cardiovascular diseases.[13]

Among patients with cardiovascular diseases, hypertensive patients also obtained favorable health outcomes by attending Tai chi exercise. For example, a study by Tsai et al. (2003) showed that a 12-week Tai chi program caused decreased blood pressure (BP), improved lipid profile, and enhanced participants' anxiety status in healthy participants with BP at high-normal or stage I hypertension.[15] A community study by Sun and Buys (2015) found that 12 months

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of Tai chi helped adults with hypertension aged from 45 to 80 years to reduce their BP and body mass index (BMI), maintain normal renal function, and improve health-related quality of life (HRQoL).[16] The results from Xu's (2016) study showed that hypertensive patients in a Tai chi group reported physical benefits (e.g., decreased BP, BMI, cholesterol, triglyceride), and psychosocial benefits (e.g., improved HRQoL, reduced anxiety, and depressive symptoms) compared to those in the control group.[17]

In China, ample studies have revealed the favorable effects of Tai chi in reducing BP and enhancing HRQoL for hypertensive patients. However, a systematic review and meta-analysis on the effects of Tai chi in adults with hypertension in China showed that most randomized controlled studies had a low quality and high risk of bias based on the evaluation criteria for Systematic Reviews of Interventions, indicating a large number of high-quality studies are needed.[18] In addition, previous studies presented a wide inconsistency in design and heterogeneity in Tai chi exercise (including types of Tai chi, training sessions and practice time).[13,14,18] For example, many studies performed short-term tai chi programs, ranging from 8 to 16 weeks, and few studies examined the long-term effects of Tai chi (e.g., more than 6 months). Tai chi practice of most studies did not meet the requirements of physical activity for hypertensive patients. The different types of Tai chi were adopted, such as Chen, Yang, Sun, and simplified Tai chi, etc.[19] Although these types of Tai chi have the same principles, they all have their own characteristics in posture, form, order, and pace. Middle-aged and older participants were all included in previous studies; few studies specifically focused on older adults. Additionally, previous studies reported that group-based intervention contributed to improve participants' social support and psychological health.[20–22] The long-term effects of group-based Tai chi in older adults with hypertension remain unclear.

Therefore, this study was developed and expected to extend the previous studies in several ways. First, the group-based Tai chi practice was conducted for six months. Second, we enrolled the older adults with hypertension to attend the study. They practiced Tai chi for 3–5 times every week for at least 60 min each time, which met the requirements of physical activity from the Chinese Hypertension Management Guideline. Third, the 24-form Tai chi was adopted because it is relatively easy to learn compared to other styles for older adults. It was hypothesized that older adults with hypertension participating in group-based tai chi would achieve the following effects compared to usual care: (1) significant reduction in BP, BMI, and waist circumference; (2) significant improvement in psychosocial outcomes, including HRQoL and social support; and (3) a marked reduction in depressive symptoms.

Methodology

Study design

A randomized controlled study design was adopted. Participants in Tai chi (TC) group received Tai chi and the usual care for hypertension, whereas those in the usual care (UC) group received the hypertension usual care. This study was carried out at two community healthcare centers in the Tianhe District, Guangzhou, China, from March 2015 to November 2016. In China, the community healthcare centers are responsible for the primary healthcare of residents within its range. These centers are usually located in a residential area; thus, it is very convenient for residents to attain healthcare. The adults with chronic diseases, such as hypertension and diabetes mellitus, go to community healthcare centers to receive prescription medication and health education and to attend rehabilitation training after hospital discharge and other healthcare services. Generally, there are no patients who are acutely ill at the community healthcare centers.

Participants

Older adults were recruited for this study if they met the following inclusion criteria: (1) 60 years of age or over; (2) diagnosed with essential hypertension by a cardiovascular physician; (3) taking antihypertensive medication; (4) living in the Tianhe District, Guangzhou; (5) and gave approval for attending the study with a willingness to adhere to six months of Tai chi. The older adults were excluded if they were: (1) individuals with musculoskeletal diseases exacerbated by physical activity; (2) secondary hypertension; and (3) participating in other physical activities. The diagnosis of participants' musculoskeletal diseases or secondary hypertension was confirmed by medical records.

Sample size, randomization and recruitment

The sample size calculation was based on the mean difference of SBP (5.01 ± 1.93) mm Hg and DBP (4.76 ± 2.24) mm Hg from a pilot study, with a power of 0.80 and a two-tailed standard test level of 0.05, 61 participants per group were necessary to achieve statistical power. A potential attrition rate of 30% was predicted;[23] therefore, we aimed at an initial recruitment target of 79 participants per group or 158 in two groups.

When the eligible participants visited the outpatient departments of the community healthcare centers, they were asked to select an opaque envelope to allocate whether they would be in the TC group or the UC group. There was one card in each envelope; the number "1" or "2" was marked on the card. Number "1" indicated that the participant was assigned to the TC group, and Number "2" implied that the participant was allocated to the UC group. All participants and healthcare professionals were masked to the group assignment.

Four nurses who worked in the outpatient departments of the community healthcare centers were invited to attend the study as research assistants. They were responsible for enlisting participants and collecting data after receiving the training. The training included an introduction of the study, inclusion/exclusion criteria, and training in the scales and methods used for data collection. Their competencies were evaluated prior to study enrollment. The recruitment strategies were used to enlist eligible participants, including: (1) referrals from physicians and nurses at the two community healthcare centers; and (2) leaflets about the study were placed in community healthcare centers and in local public places (e.g., bus stop, subway station, parks, and supermarkets).

Most participants were recruited by referral from healthcare professionals of community healthcare centers. The nurses contacted these participants and screened via face-to-face interview, telephone, or Wechat. Individuals who met the inclusion criteria were invited to join the program. The screened participants met with nurses at an appointed time at the community healthcare centers. Nurses further confirmed their eligibility, introduced the study to them in detail, obtained the informed consent form, and collected baseline data.

Interventions

Tai chi training

All participants in the TC group received group-based Tai chi training. Participants were grouped into different training groups based on their dwelling districts. Those individuals who lived near each other were allocated to the same group, making it convenient to attend the training session and group practice. There were

a total of eight groups, and each group included 8–10 participants. Tai chi training classes were held at a recreation center for older people in a community that was specifically arranged for training classes. The classes were taught by two professional trainers, who were physical education teachers in a Sport University and had Tai chi certification. Before starting the training classes, the trainers developed a teaching syllabus (teaching contents, methods, and time schedule) to ensure consistent teaching results.

Two Tai chi classes were offered per week to participants in each group for a continuous five weeks, and each class lasted 90 min. The simplified 24-form Tai chi was taught to participants to help them learn and remember it more easily. Three forms of Tai chi were taught in each session. Each session included 10 min of warm-up exercise, 70 min of trainers' teaching and trainees' practice, and 10 min of cool-down exercises. During practice, participants were asked to repeatedly replicate the motions, postures, and movement speed of the trainer until they learned the correct postures. The trainers asked all trainees to practice these postures at the end of each session, while the trainers evaluated their proficiency. After class, additional training was presented for participants who were not proficient in class, which guaranteed that every participant learned the movements. Participants also practiced what they had learned last session before beginning a new session. After the first training class, a free Tai chi video was given to each participant to facilitate daily self-practice at home.

Group exercise

After training classes, all the participants began to practice Tai chi based on what was learned in the training group. One participant was elected as the leader for each group. This person was in charge of organizing the Tai chi exercise (e.g., time, location), not instructing Tai chi practice. The park was the usual location chosen to practice Tai chi, and the time was set from 7AM to 8:30AM by most groups. The trainers were responsible for mentoring Tai chi regularly, twice a month. The exercise group was encouraged to practice at their convenience 3–5 times every week for 24 weeks for at least 60 min each time. Group practice was monitored using a group practice log, which was completed by the leader of each group. The contents of the group practice log included time, duration, location, members, and Tai chi activity. During participants' practice, research members often observed their Tai chi exercise to assess the attendance and compliance to Tai chi and to provide support to the participants.

Intervention fidelity

Compliance with the group practice was monitored by the leader of each group using attendance cards and group practice logs. The study member collected the attendance cards and the group practice logs from each leader at the end of every week according to an appointed time. If attendance cards and practice logs were not turned in punctually, the study member called the group leader within 2 days of the due date. The study member also contacted the participants who did not attend group practice for two successive times and explored their reasons for not exercising.

Usual care

Participants in the TC and UC groups received the usual care for hypertension from outpatient nurses at community healthcare centers. They usually visited doctors once a month. The nurses delivered usual hypertension care for participants after they visited the doctor. The contents of usual care included education about hypertension, medication use, dietary, exercise, lifestyle changes, and stress reduction. An educational brochure for usual care was developed to ensure consistency of care from the nurses. The educational brochure was created by three community healthcare center nurses who had provided more than ten years of community care for hypertensive patients. The brochure was also reviewed by five clinical experts with rich experience in nursing care for patients with cardiovascular diseases. The educational brochure was also given to each participant after the first hypertension usual care visit. Additionally, all participants were advised to maintain routine physical activity. No extra exercises were recommended. For the research ethics of the participants' rights, those in the UC group also obtained Tai chi training and practice after completing the study.

Data collection

The patients' data were collected in the TC and UC groups using the identical questionnaires at the same time point. The baseline data were gathered when the participants were enrolled in the study, and the second evaluation was conducted at week 24 (at the end of the intervention). Nurses who were not involved in the study took BP at two community healthcare centers for all the participants during their outpatient visits. BP was measured in the sitting position using an appropriately sized cuff and calibrated sphygmomanometer after an initial rest period of 10 minutes. Participants' waist circumferences were measured after taking their BP. Waist circumference (in centimeters) was measured at the minimum circumference between the iliac crest and the rib cage using an anthropometric tape over light clothing. Participants' height and weight were also measured using the usual height and weight scale. These objective data were measured two times; the average values of the two readings were used for participants' BP, waist circumference, height, and weight. The standard measurements of BP, waist circumference, height, and weight were provided to the nurses beforehand. All instruments were corrected before measurement.

Measurement instrument

Personal sheet

The questionnaire included two parts; the first part included participants' demographic data (age, gender, marital status, education, income, living with children), and the second part included clinical data (duration of hypertension diagnosis, medications usage, and complications related to hypertension). The objective data (BP, height, weight, and waist circumference) was collected by nurses.

Social support rating scale (SSRS)

The SSRS was developed by a Chinese scholar and used to test social support.[24] It consists of 10 items that assess three types of social support: objective support, subjective support, and support utilization. The total scores of the scale range from 12 to 65, with higher scores indicating more social support. The Cronbach's alpha of the 10 items range from 0.89 to 0.94.[25,26]

Center for epidemiologic studies depression scale (CES-D)

The CES-D was developed by Radlof (1977).[27] The CES-D includes affective, cognitive, behavioral, and somatic symptoms associated with depression.[28] It has two versions: a longer 20-item version and a shorter 10-item version. Previous studies have shown that the shorter 10-item version had good reliability and predictive accuracy when compared with the longer 20-item version.[29,30] Therefore, the shorter 10-item version was used in this study. The Cronbach's alpha for the short Chinese version CES-D was 0.80.[29]

Medical outcomes study 36-item short form (SF-36)

HRQoL was measured using the SF-36, which includes eight subscales, such as physical functioning, role physical, bodily pain, health status, vitality, social functioning, role emotional problems, and mental health. The SF-36 can also be divided into

two parts, a physical and a mental component summary scale. The psychometric properties of the SF-36 have been validated in earlier studies.[31] The internal reliability of the Chinese version SF-36 was established, with Cronbach's α ranging from 0.74 to 0.94 for the eight subscales.[32]

Ethical considerations

Ethical approval was obtained from the Research Ethics Committee of Guangzhou Medical University before study implementation. Informed consent was also attained from eligible participants. The research assistants explained the aims of the study, intervention, data collection procedures, and the benefits and possible risks of participating in the study to all the eligible participants. The participants were informed of their right to withdraw from the study at any time without any prejudice to future healthcare services.

Statistical analysis

The data were analyzed using SPSS version 19.0 (SPSS, Chicago, Illinois, USA). The analyses were conducted based on intention-to-treat, with missing values imputed based on an assumption of no change. The description statistical analyses were used to illustrate the participants' demographic characteristics and mean scores of the scales used. Baseline characteristics of the TC and UC groups were compared using *t*-tests for continuous variables and chi-square tests for categorical variables. Changes within each group were conducted by the paired *t*-tests. Between-group differences in changes of measurement variables from baseline to 24 weeks were estimated and compared using generalized estimating equation models with group-by-time interactions, after controlling for demographic and clinical variables. A *P* value of less than 0.05 indicated statistical significance.

Results

Characteristics of the participants

Two hundred and twenty-six participants were screened for eligibility to join the study; 158 participants agreed to attend the study. During the six-month intervention, 113 participants completed the program, and 45 dropped out of the study; the attrition rate was 28.5%. There were 55 participants in the TC group, 58 in the UC group. The recruitment of participants and the main reasons for attrition are presented in Figure 1.

The average age of all participants was 69 years (SD=9.37). The male participants accounted for 69.0%. There were no statistically significant differences in the demographic and clinical characteristics between the two groups (Table 1). No significant differences were found in BP, BMI, waist circumstance, depressive symptoms, social support, and HRQoL between two groups at the baseline (Tables 2, 3, and 4).

BP, BMI, waist circumference

As indicated in Table 2, SBP and DBP of the TC group decreased in comparison to the UC group; the difference values of before and after intervention were 4.27 (148.64-144.37) and 3.07 (87.60-84.53), respectively. The BMI in the TC group showed a reduction compared to that in the UC group, and the difference value of before and after intervention was 1.78 (24.23-22.45). The results revealed significant group-by-time interactions, with the TC group showing greater improvements in SBP ($P = 0.003$), DBP ($P = 0.012$), and BMI ($P = 0.017$) across the six-month intervention when compared to the UC group. No significant improvement in waist circumference was found in the two groups.

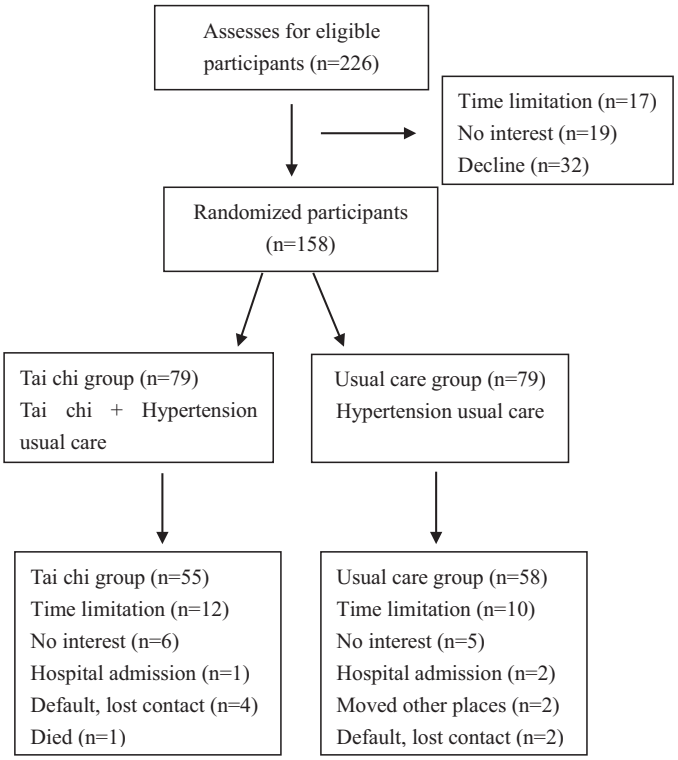

Fig. 1. Consort chart of recruitment of participants.

Social support and depressive symptoms

The total scores for social support in the TC group were higher than those in the UC group. The total scores of CES-D in the TC group were much lower than ones in the UC group across the six-month intervention. As shown in Table 3, the significant group-by-time interactions, with the TC group showing greater improvements in social support ($P = 0.029$) and reduction in depressive symptoms ($P = 0.023$) during six months of Tai chi was detected.

Health related quality of life

The scores of the SF-36 subscales, such as health status, bodily pain, vitality, and mental health in the TC group were superior to those in the UC group; the comparison of total scores in these subscales had statistically significant differences between the two groups. There was no statistical difference in the other subscales of the SF-36 between the two groups (Table 4). The total scores of physical and mental health for participants in the TC group were also higher than their peers in the UC group; the statistical differences were observed. There were significant group-by-time interactions, with the TC group revealing greater improvements in HRQoL ($P = 0.005$, $P = 0.003$).

Discussion

Previous studies showed that Tai chi plays a positive role in reducing BP values. Consistent results were also obtained in this study. Our results demonstrated that SBP and DBP of the TC group decreased compared with individuals in the UC group by Tai chi exercise; at the end of six-month, the difference values for SBP

Table 1
The demographic and clinical characteristics between two groups at baseline

Variables	Tai chi group (n = 79)		Usual care group (n = 79)		*P*
	n	%	n	%	
Age (years)					
Mean±SD	70.24 ± 10.25		69.71 ± 10.84		0.269
Sex					0.702
Male	54	68.3	55	69.6	
Female	25	31.7	24	30.4	
Marital status					0.173
Married	69	87.3	70	88.6	
Not married	10	12.7	9	11.4	
Education					
Secondary school and below	42	49.0	40	50.0	0.421
High school and above	37	51.0	39	50.0	
Income (month, Yuan)					0.965
<3000	27	24.2	26	32.9	
3000~	38	48.1	40	50.6	
≥5000	14	17.7	13	16.5	
Living with children					0.370
Yes	56	70.9	57	72.2	
No	23	29.1	22	27.8	
Duration of diagnosis (years)					0.406
<5 ~	26	32.9	28	35.4	
5 ~	34	43.0	31	39.3	
10 ~	19	24.1	20	25.3	
Number of antihypertensive tablets in each dose					0.731
1	30	38.0	31	39.2	
2	34	43.0	33	41.8	
3 or more	15	19.0	15	19.0	
Daily frequency of taking medication					0.118
1	31	39.2	32	40.5	
2	32	40.5	30	38.0	
3	16	20.3	17	21.5	
Type of antihypertensive drugs					
Angiotensin converting enzyme inhibitors					
Angiotensin-II receptor blockers	48	60.8	49	62.0	0.582
Calcium channel blockers	52	65.8	50	63.3	0.934
Beta-blockers	36	45.6	37	46.8	0.203
Diuretics	21	26.6	19	24.1	0.457
Others[a]	10	12.7	13	16.5	0.376
Hypertension-related complications					0.529
Yes	36	45.6	34	43.0	
No	43	54.4	45	57.0	

[a] Compound antihypertensive drugs, traditional Chinese medicine.

between TC and UC group were 4.27 mm Hg, and 3.07 mm Hg for DBP. Similar results were also attained in earlier studies. For example, the results from Tsai et al. (2003) showed that Tai chi exercise resulted in a SBP reduction of 15.6 mm Hg, and a DBP reduction of 8.8 mm Hg in the healthy participants with BP at high-normal or stage I hypertension.[15] The results from Wolf et al. (2006) showed that older adults' SBP reduced 7 mm Hg and their DBP for 4 mm Hg in the Tai chi group in comparison with individuals in the health education group.[33] The study from Sun and Buys (2015) demonstrated that Tai chi favorably decreased BP (SBP 10 mm Hg, DBP 7 mm Hg) for hypertensive patients in the community.[16] We found a wide variation in the reduction of BP values across studies. This may be related to the clinical characteristic of the participants and the intensity, dose, and style of the Tai chi exercise.

Additionally, we cannot ignore the role of antihypertensive drugs in exploring the effects of Tai chi on reducing BP. All the participants in the study were taking antihypertensive drugs. Although we control its impact on BP in statistical analysis, the synergistic effects of medication and Tai chi contribute to decrease BP cannot be overlooked. Some studies state that Tai chi alone or in

Table 2
Differences between at baseline and week 24 in BP, BMI, waist circumference in both Tai chi and usual care groups

Variables	Group	Baseline (Mean±SD)	Week 24 (Mean±SD)	P^a	P^b	Time	Interaction
SBP (mmHg)	TC	149.06 ± 19.51	144.37 ± 17.08	0.029*	0.013*	<0.001**	0.003**
	UC	150.19 ± 18.30	148.64 ± 19.46	0.109			
DBP (mmHg)	TC	90.74 ± 8.24	84.53 ± 8.91	0.034*	0.021*	0.007**	0.012*
	UC	89.16 ± 9.37	87.60 ± 7.78	0.078			
BMI (kg/m^2)	TC	26.01 ± 3.38	24.23 ± 3.02	0.048*	0.043*	0.029*	0.017*
	UC	25.96 ± 2.91	22.45 ± 3.79	0.069			
Waist girth (cm)	TC	76.83 ± 7.05	74.18 ± 6.37	0.357	0.142	0.316	0.825
	UC	74.59 ± 6.51	73.24 ± 5.98	0.712			

SBP = systolic blood pressure; DBP = diastolic blood pressure; BMI = body mass index; cm = centimeter; TC = tai chi; UC = usual care.
[a] Comparison within subjects in the same group.
[b] Comparison between subjects in two groups.
* $P < 0.05$, ** $P < 0.01$.

Table 3
Differences between at baseline and week 24 in social support and depressive symptoms in both Tai chi and usual care groups

Variables	Group	Baseline (Mean±SD)	Week 24 (Mean±SD)	P^a	P^b	Time	Interaction
Social support							
Objective support	TC	8.57 ± 2.19	8.89 ± 1.96	0.243	0.176	0.169	0.831
	UC	8.49 ± 2.27	8.36 ± 2.03	0.417			
Subjective support	TC	18.62 ± 4.50	21.76 ± 4.91	0.039*	0.043*	0.040*	0.037*
	UC	19.01 ± 3.82	19.45 ± 4.62	0.513			
Support utilization	TC	5.82 ± 1.53	7.01 ± 1.26	0.049*	0.392	0.325	0.472
	UC	6.03 ± 1.85	6.69 ± 1.71	0.634			
Total	TC	32.24 ± 6.41	34.90 ± 5.92	0.036*	0.030*	0.046*	0.029*
	UC	31.75 ± 5.61	32.52 ± 6.03	0.706			
Depressive symptoms	TC	10.13 ± 4.45	7.45 ± 5.04	0.025*	0.017*	0.011*	0.023*
	UC	9.98 ± 5.01	9.16 ± 4.42	0.565			

TC = tai chi; UC = usual care.
[a] Comparison within subjects in the same group.
[b] Comparison between subjects in two groups.
* $P < 0.05$.

combination with antihypertensive drugs is effective at reducing BP.[20] The effectiveness of the lone Tai chi in decreasing BP needs to be validated in hypertensive patients not taking medications.

Tai chi was effective in decreasing BMI for older adults with hypertension in this study. Sun and Buys (2015) also reported that Tai chi reduced BMI in Chinese adults.[16] A systematic review and meta-analysis by Lian et al. (2017) showed the BMI of participants in the TC group as greatly decreased compared to their peers in the UC group.[18] Based on the present and previous results, the effects on reducing BMI by participating in a Tai chi program can be supported. Tai chi was ineffective at decreasing waist circumference in the study. The result was in line with most earlier studies.[18,23] However, there are some studies that support the effectiveness of Tai chi on reducing waist circumference.

Our results revealed a significant enhancement in social support in the TC group. The improvement in social support for older adults reflected what prior studies identified as the positive effects of Tai chi on increased satisfaction with social functioning, social interaction, and decreased loneliness.[34,35] Several studies reported that participants attending Tai chi expressed strong group social support, peer encouragement, and comfort at being part of a Tai chi group. Participants described companionship and camaraderie in the group-based exercise.[6,21,34] Also, most participants intended to maintain their friendships and keep in contact with other members of their group after the program ended. Some participants suggested that they should make a regular schedule to practice group-based Tai chi in the future like they did when they attended the program.

Tai chi had an effect on the reduction of depressive symptoms in older adults with hypertension over the six-month exercise in this study. The positive changes in CES-D scores between the two groups and for the participants in the TC group did achieve statistical significance. Some evidence from prior randomized controlled trials also showed a positive association between decreased depressive symptom and Tai chi.[10,36–39] The role of Tai chi in decreasing depressive symptom may be associated with the overall philosophy of Tai chi. Tai chi combines deep breathing, relaxation, and slow, structured movements that have been described as moving meditation. It promotes the philosophy of letting go of stress and interpersonal conflicts and maintaining peace of mind and a sense of harmony.[40] Moreover, higher social supports for the participants also contribute to a reduction in depression.[41]

The older adults with hypertension in the Tai chi group had higher scores on the SF-36 scale, although the degree of difference varied across the eight components of the scale. Participants

Table 4
Differences between at baseline and week 24 in quality of life in both Tai chi and usual care groups

SF-36	Group	Baseline (Mean±SD)	Week 24 (Mean±SD)	P^a	P^b	Time	Interaction
Physical functioning	TC	53.12 ± 14.26	55.27 ± 14.06	0.046*	0.807	0.361	0.529
	UC	54.37 ± 15.11	54.69 ± 14.82	0.637			
Role physical	TC	70.18 ± 19.22	71.34 ± 21.17	0.309	0.163	0.471	0.657
	UC	70.72 ± 21.15	69.53 ± 20.91	0.772			
General health	TC	81.90 ± 22.17	86.62 ± 21.80	0.031*	0.038*	0.562	0.286
	UC	82.27 ± 22.09	83.35 ± 22.17	0.402			
Bodily pain	TC	63.46 ± 19.25	68.74 ± 18.93	0.016*	0.024*	0.007**	0.002**
	UC	64.21 ± 19.34	64.81 ± 19.02	0.776			
Vitality	TC	71.65 ± 21.36	77.82 ± 21.25	0.014*	0.023*	0.318	0.193
	UC	72.19 ± 20.74	73.66 ± 20.49	0.339			
Social functioning	TC	82.73 ± 22.63	83.64 ± 22.29	0.367	0.482	0.683	0.570
	UC	83.17 ± 23.19	83.31 ± 21.75	0.601			
Role emotional	TC	77.62 ± 21.30	81.02 ± 19.15	0.032*	0.055	0.174	0.207
	UC	78.39 ± 19.72	79.93 ± 20.64	0.163			
Mental health	TC	80.62 ± 19.35	87.01 ± 18.46	0.009**	0.010*	0.037*	0.008**
	UC	79.94 ± 18.70	81.43 ± 19.81	0.047*			
Physical total	TC	75.46 ± 14.37	82.84 ± 16.42	0.013*	0.019*	0.002**	0.005**
	UC	75.59 ± 13.04	76.63 ± 12.39	0.078			
Mental total	TC	82.74 ± 15.19	89.17 ± 18.70	0.023*	0.012*	0.001**	0.003**
	UC	81.39 ± 14.46	83.54 ± 16.28	0.376			

SF-36 = Medical outcomes study 36-item short form; TC = tai chi; UC = usual care.
[a] Comparison within subjects in the same group.
[b] Comparison between subjects in two groups.
* $P < 0.05$, ** $P < 0.01$.

in the TC group reported reduced bodily pain, improved vitality, and enhanced mental health in comparison with their peers in the UC group. These results were congruent with the findings of previous studies that participants with higher BP or elevated blood glucose demonstrated a significant improvement in quality of life by taking part in a Tai chi program.[42] The results of an enhanced quality of life by practicing Tai chi may be related to its concerted effects on muscle strength, stress reduction, and cardiovascular health.[43]

Although the attrition rate was relatively high (28.5%), it was similar with other studies. A study on the psychosocial effect of Tai chi on residents living in nursing homes reported a similar attrition rate (25.8%).[6] Liu et al. (2015) reported the dropout rate was 29.0% when Tai chi was conducted for centrally obese adults with depression symptoms.[23] We explored the reasons for dropping out of the study, and time limitation was found to be the main reason. In China, a majority of older adults take care of their grandchildren and help their children do housework after being retired.[26] Therefore, they lack time to attend other activities.

There were several limitations that should be considered when applying the results to clinical settings. The sample was restricted to one region, which may limit the generalizability of the results to other regions of China. This study only included older adults with hypertension; therefore, the results cannot be extrapolated to other populations with hypertension. Of the original participants, 28.5% dropped out of the study, and the missing cases most likely affect the assessment of the intervention.

Conclusion

Based on the results of this study, group-based Tai chi is effective in improving physical and psychosocial health for Chinese older adults with hypertension in the community. Tai chi may be a good method for hypertensive patients to prevent cardiovascular diseases and reduce the utilization of medical resources. Further studies with a larger sample size and longer follow-up are required to confirm the clinical effectiveness and long-term psychosocial benefits of Tai chi for older adults with hypertension.

In view of the significant effect of Tai chi on the health-status outcomes for older adults with hypertension in this study, it should be recommended to adults with hypertension, especially for populations of advanced age or who experience long-term discomfort due to hypertension. Tai chi training classes should be regularly held by the community committees. For older adults who have time limitations, a flexible training schedule should be set. Based on the experience of our program, Tai chi should be conducted in a group, to provide older adults with more social support, improve social interaction, and reduce loneliness.

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References

1. Ma YQ, Mei WH, Yin P, Yang XH, Rastegar SK, Yan JD. Prevalence of hypertension in Chinese cities: a meta-analysis of published studies. *PLoS ONE*. 2013;8:e58302.
2. Chen WW, Gao RL, Liu LS, et al. The synopsis of Chinese cardiovascular diseases report in 2015. *Chin Circ J*. 2016;31:521–528.
3. Lloyd-Sherlock P, Beard J, Minicuci N, Ebrahim S, Chatterji S. Hypertension among older adults in low-and middle-income countries: prevalence, awareness and control. *Int J Epidemiol*. 2014;43:116–128.
4. Liu QJ, Luo D, Ning HH, et al. The incidence of hypertension and its correlated factors for older adults in Tianhe District, Guangzhou. *South China J Prev Med*. 2017;3:284–286.
5. Brooks JH, Ferro A. The physician's role in prescribing physical activity for the prevention and treatment of essential hypertension. *JRSM Cardiovasc Dis*. 2012;1:1–9.
6. Lee LY, Lee DT, Woo J. The psychosocial effect of Tai chi on nursing home residents. *J Clin Nurs*. 2010;19:927–938.
7. Chi I, Jordan-Marsh M, Guo M, Xie B, Bai Z. Tai chi and reduction of depressive symptoms for older adults: a meta-analysis of randomized trials. *Geriatr Gerontol Int*. 2013;13:3–12.
8. Khor G. Tai Chi for Fitness Over Forty: Relaxation Exercises for Good Health. Sydney: Simon & Schuster; 2002.
9. Wang F, Lee EK, Wu T, et al. The effects of tai chi on depression, anxiety, and psychological well-being: a systematic review and meta-analysis. *Int J Behav Med*. 2014;21:605–617.
10. Siu KC, Rajaram SS, Padilla C. Impact of psychosocial factors on functional improvement in Latino older adults after Tai Chi exercise. *J Aging Phys Act*. 2015;23:120–127.
11. Verhagen A, Immink M, van der Meulen A, Bierma-Zeinstra S. The efficacy of Tai chi chuan in older adults: a systematic review. *Fam Pract*. 2004;21:107–113.
12. Tsang T, Orr R, Lam P, Comino E, Singh MF. Effects of Tai chi on glucose homeostasis and insulin sensitivity in older adults with type 2 diabetes: a randomized double-blind sham-exercise-controlled trial. *Age Ageing*. 2008;37:64–71.
13. Yeh GY, Wang C, Wayne PM, Phillips R. Tai Chi exercise for patients with cardiovascular conditions and risk factors: a systematic review. *J Cardiopulm Rehabil Prev*. 2009;29:152–160.
14. Taylor-Piliae RE, Hoke TM, Hepworth JT, Latt LD, Najafi B, Coull BM. Effect of Tai chi on physical function, fall rates and quality of life among older stroke survivors. *Arch Phys Med Rehabil*. 2014;95:816–824.
15. Tsai JC, Wang WH, Chan P, et al. The beneficial effects of Tai Chi Chuan on blood pressure and lipid profile and anxiety status in a randomized controlled trial. *J Altern Complement Med*. 2003;9:747–754.
16. Sun J, Buys N. Community-based mindeBody meditative Tai chi program and its effects on improvement of blood pressure, weight, renal function, serum lipoprotein, and quality of life in Chinese adults with hypertension. *Am J Cardiol*. 2015;116:1076–1081.
17. Xu H. Simplified 24 Forms Tai chi for blood pressure and living quality of hypertensive. *Hubei J Tradit Chin Med*. 2016;38:38–39.
18. Lian ZY, Yang LL, Bian YY, et al. Effects of Tai chi on adults with essential hypertension in China: a systematic review and meta-analysis. *Eur J Integr Med*. 2017;12:153–162.
19. Lee MS, Jun JH, Lim HJ, Lim HS. A systematic review and meta-analysis of tai chi for treating type 2 diabetes. *Maturitas*. 2015;80:14–23.
20. Chien WT, Chan SW. The effectiveness of mutual support group intervention for Chinese families of people with schizophrenia: a randomised controlled trial with 24-month follow-up. *Int J Nurs Stud*. 2013;50:1326–1340.
21. Kao JC, Johnson JE, Todorova R, Zlotnick C. The positive effect of a group intervention to reduce postpartum depression on breastfeeding outcomes in low-income women. *Int J Group Psychother*. 2015;65:445–458.
22. Quinn C, Toms G, Jones C, et al. A pilot randomized controlled trial of a self-management group intervention for people with early-stage dementia (The SMART study). *Int Psychogeriatr*. 2016;28:787–800.
23. Liu X, Vitetta L, Kostner K, et al. The effects of tai chi in centrally obese adults with depression symptoms. *Evid Based Complement Alternat Med*. 2015;879712:8.
24. Xiao SY. The development and application of social support rating scale. *J Clin Psychiatry*. 1994;4:98–100.
25. Liu JW, Li FY, Lian YL. Investigation of reliability and validity of the social support scale. *J Xinjiang Med Univ*. 2008;31:1–3.
26. Ma CH, Chen SX. The correlated relationship between social support and quality of life for patients with hypertension. *Chin J Pract Nurs*. 2013;29:54–57.
27. Radloff LS. The CES-D Scale: a self-report depression scale for research in the general population. *Appl Psychol Meas*. 1997;1:385–401.
28. Zhang J, Sun WW, Kong YY, Wang CT. Reliability and validity of the center for epidemiological studies depression scale in 2 special adult samples from rural China. *Compr Psychiatry*. 2012;53:1243–1251.
29. Lai G, Lee RPL. Market reforms and psychological distress in urban Beijing. *Int Sociol*. 2006;21:551–579.
30. Ingersoll TS, Norvilitis JM, Zhang J, Jia S Tetewsky S. Reliability and validity of the fear of intimacy scale in Chin. *J Pers Assess*. 2008;90:270–279.
31. McHorney CA, Ware JE, Lu JF. The MOS 36-item short-form health survey (SF-36): III. Tests of data quality scaling assumptions and reliability across diverse patient groups. *Med Care*. 1994;32:40–66.
32. Zhu P, Fu JF, Wang B, et al. Quality of life of male spouse caregivers for breast cancer patients in China. *Asian Pac J Cancer Prev*. 2014;15:4181–4185.
33. Wolf S, O'Grandy M, Easley K, Guo Y, Kressig R, Kutner M. The influence of intense Tai chi training on physical performance and hemodynamic outcomes in transitionally frail older adults. *J Gerontol A Biol Sci Med Sci*. 2006;61:184–189.
34. Chan AW, Yu DS, Choi KC. Effects of tai chi qigong on psychosocial well-being among hidden elderly, using elderly neighborhood volunteer approach: a pilot randomized controlled trial. *Clin Interv Aging*. 2017;12:85–96.

35. Park YJ, Park IH. Effect of tai chi exercise on loneliness, sleep pattern, and instrumental activities of daily living in elderly women. *J Muscle Jt Health*. 2010;7:151–161.
36. Frye B, Scheinthal S, Kemarskaya T, Pruchno R. Tai chi and low impact exercise: effects on the physical functioning and psychological well-being of older people. *J Appl Gerontol*. 2007;26:433–453.
37. Cho KL. Effect of Tai Chi on depressive symptoms amongst Chinese older patients with major depression: the role of social support. *Med Sport Sci*. 2008;52:146–154.
38. Wang C, Bannuru R, Ramel J, Kupelnick B, Scott T, Schmid CH. Tai chi on psychological well-being: systematic review and meta-analysis. *BMC Complement Altern Med*. 2010;10:23.
39. Rawtaer I, Mahendran R, Yu J, Fam J, Feng L, Kua EH. Psychosocial interventions with art, music, Tai Chi and mindfulness for subsyndromal depression and anxiety in older adults: a naturalistic study in Singapore. *Asia Pac Psychiatry*. 2015;7:240–250.
40. Wang J, Feng B, Yang XC, et al. Tai chi for essential hypertension. *Evid Based Complement Alternat Med*. 2013;2013:215254.
41. Tartavoulle TM. A predictive model of the effects of depression, anxiety, stress, 6-minute-walk distance, and social support on health-related quality of life in an adult pulmonary hypertension population. *Clin Nurse Spec*. 2015;29:22–28.
42. Liu X, Miller YD, Burton NW, Chang JH, Brown WJ. The effect of Tai Chi on health-related quality of life in people with elevated blood glucose or diabetes: a randomized controlled trial. *Qual Life Res*. 2013;22:1783–1786.
43. Uhlig T. Tai Chi and yoga as complementary therapies in rheumatologic conditions. *Best Pract Res Clin Rheumatol*. 2012;26:387–398.