Tai Chi versus brisk walking in reducing cardiovascular risk factors: a randomised controlled trial (abridged secondary publication)

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KEY MESSAGES

1. Tai chi was more effective than brisk walking in reducing levels of blood pressure, blood glucose, and glycated haemoglobin and in sustaining these positive effects at 9 months among Chinese adults with cardiovascular risk factors.
2. Exercise-only interventions without diet modification was not as effective as a combination of both in regulating blood lipid profiles and lowering the body mass index.
3. Tai Chi was effective in improving general health status and psychosocial wellbeing in adults with cardiovascular risk factors.

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Introduction

Cardiovascular disease (CVD) is the leading cause of death worldwide. Individuals with CVD risk factors have increased risks of death and developing CVD. This imposes a considerable health burden on society. Physical inactivity is a major risk factor for CVD. Staying physically active is recommended to lower the risk of CVD. Tai Chi has a higher compliance rate than other exercise types. Tai Chi is safe and requires similar energy expenditure as brisk walking.[1] This study aimed to evaluate the benefits of Tai Chi versus brisk walking in reducing CVD risk factors in patients with CVD risk factors.

Methods

This three-arm parallel randomised controlled trial was approved by the Joint Chinese University of Hong Kong – New Territories East Clinical Research Ethics Committee and the Kowloon West Cluster Research Ethics Committee. Informed consent was obtained from each participant. Participants were recruited from two outpatient clinics in Hong Kong. Inclusion criteria were those having hypertension and two to three CVD risk factors including diabetes, dyslipidaemia, overweight, physical inactivity, and smoking. Those were excluded if they had CVD, severe sensory or cognitive impairment, difficulty or inability to walk, or had participated in any Tai Chi programme within 6 months.

Based on previous studies,[2,3] 61 participants per arm would be needed to achieve a power of 80% at a significant level of 5%. Assuming a potential attrition rate of 25%, 246 participants were recruited and randomly allocated in a 1:1:1 ratio to Tai Chi, brisk walking, or usual care (n=82 per group).

Participants in the Tai Chi group practised 24-form Yang-style Tai Chi for 60 minutes twice a week for 3 months. The class was led by an experienced Tai Chi instructor. Participants were advised to self-practice at home for 30 minutes per day for ≥5 days a week. The weekly frequency and duration of self-practiced Tai Chi were recorded using a logbook. A compliance rate of ≥80% was considered as adherence.

Participants in the brisk walking group performed brisk walking (5 to 6 km/h) for 30 minutes every day for ≥5 days per week. A pulse oximetry was used to measure the heart rate during the brisk walking. Participants were advised to reach the individualised heart rate equal to moderate-intensity exercise based on their age. Their heart rate, frequency, and duration of brisk walking were recorded using a logbook. Participants were contacted by phone every week to encourage adherence to the prescribed frequency.

Participants in the usual care control group were advised to continue their routine care. All participants continued their prescribed medical treatments. Medications could be modified by their physicians according to their health conditions. Participants in the brisk walking and control groups were asked to participate in non-exercise community activities weekly for three months for social interaction.

Systolic and diastolic blood pressure (SBP and DBP) was measured in a seated position after resting for 10 minutes. Blood sample was collected after fasting for 8 to 10 hours using a finger-stick. Levels of total cholesterol, triglyceride, high-density

TABLE 1. Sociodemographic characteristics of participants

Characteristic	Control (n=82)*	Brisk walking (n=82)*	Tai Chi (n=82)*	P value
Sex				0.288
Male	38	42	32	
Female	44	40	50	
Age, y	65.13±10.22	63.22±11.11	64.70±7.59	0.422
Marital status				0.745
Single	6	12	7	
Married	56	54	57	
Separated	5	4	3	
Widower	15	12	15	
Job status				0.087
Full-time	25	25	11	
Part-time	8	10	11	
Retired	37	27	45	
Housewife	10	15	12	
Unemployed	2	5	3	
Financial support				
Self	38	38	26	0.090
Family	27	33	41	0.083
Allowance	17	11	15	0.454
Monthly income, HK$				0.064
≤10 000	46	38	51	
10 001-20 000	15	20	6	
20 001-30 000	8	6	6	
≥30 001	2	9	9	
Missing	11	9	10	
Living arrangement				0.792
Alone	13	12	10	
Live with others	69	70	72	
Housing				0.527
Public	67	64	61	
Private	15	18	21	
Religion				0.772
No	52	57	53	
Christianity	10	9	8	
Catholicism	3	4	2	
Buddihism	16	9	17	
Taoism	1	3	2	
Regular exercise				0.134
Yes	51	60	62	
No	31	22	20	
Smoking habit				0.292
Smokers	13	5	8	
Ex-smokers	13	12	10	
Non-Smokers	56	65	64	
Drinking habit				0.686
Drinkers	19	16	19	
Ex-drinkers	2	6	6	
Non-drinkers	61	60	57	
Change of diet in last 3 months				0.936
Yes	19	20	21	
No	63	62	61	
Weekly exercise frequency, days	3.14±2.89	3.33±2.84	3.79±2.93	0.338
Mean duration of exercise, mins	34.35±44.08	42.65±40.67	32.93±28.23	0.219
Hypertension				0.999
Yes	82 (100.0)	82 (100.0)	82 (100.0)	
No	0 (0.0)	0 (0.0)	0 (0.0)	
Type 2 diabetes mellitus				0.385
Yes	50 (61.0)	51 (62.2)	43 (52.4)	
No	32 (39.0)	31 (37.8)	39 (47.6)	
Dyslipidaemia				0.286
Yes	56 (68.3)	48 (58.5)	47 (57.3)	
No	26 (31.7)	34 (41.5)	35 (42.7)	

* Data are presented as mean ± standard deviation or No. (%) participants

lipoprotein, low-intensity lipoprotein, fasting blood sugar, glycated haemoglobin were assessed. The perceived stress scale was used to measure perceived stress level.

Data were collected at baseline and at 3, 6, and 9 months after intervention. Analyses were conducted using SPSS (Windows version 23; IBM Corp, Armonk [NY], US). A P value of <0.05 was considered statistically significant. The three groups were compared using Chi-squared test or one-way analysis of variance. Generalised estimating equation models were used to compare the differential changes of the outcomes across time and between the three groups based on the intention-to-treat principle.

Results

A total of 246 participants were recruited. The three groups were comparable in terms of baseline characteristics (Table 1). Treatment adherence was 90% in the Tai Chi group and 88% in the brisk walking group.

Compared with the control group, the Tai Chi group achieved greater reduction in SBP and DBP levels at 3 months and 9 months (all P<0.005, Table 2). There was no significant difference in the changes in SBP and DBP levels at all three time points between the brisk walking and control groups. The reduction in SBP and DBP levels was greater in the Tai Chi group than in the brisk walking group at 3 months (all P<0.001) and 9 months (all P<0.005).

Significant reduction in the fasting blood sugar level was observed at 9 months in the Tai Chi group only (P=0.002). Significant reduction in glycated haemoglobin level was observed at 9 months in the Tai Chi (P=0.002) and brisk walking (P=0.028) groups, compared with the control group. The Tai Chi group showed greater reduction in the levels of fasting blood sugar and glycated haemoglobin at 6 months (all P<0.007) and 9 months (all P<0.003), compared with the brisk walking group. Tai Chi group showed a significant increase in high-density lipoprotein level at 3 months (P=0.013), compared with the control group.

Compared with the control group, the Tai Chi group achieved a greater reduction of perceived stress levels at 6 months (P=0.022) and 9 months (P=0.005). The reduction in perceived stress at 9 months was greater in the Tai Chi group than in the brisk walking group (P=0.027).

Discussion

From baseline to 9 months, Tai Chi achieved a reduction of 12.4 mmHg in SBP and a reduction of 4.8 mmHg in DBP. On a population level, even a small reduction of 2 mmHg in DBP would result in a 17% decrease in hypertension prevalence and a 6% reduction in the risk of coronary heart disease,[4]

TABLE 2. Generalised estimating equation models comparing control and intervention groups across time

	Controls (n=82)*	Brisk walking × time (n=82)*	P value	Tai Chi × time (n=82)*	P value
Systolic blood pressure, mmHg					
3 months	-2.02 (-6.82 to 2.78)	5.00 (-1.79 to 11.80)	0.15	-10.28 (-16.47 to -4.09)	0.001
6 months	-2.32 (-7.35 to 2.70)	2.11 (-4.51 to 8.72)	0.53	1.19 (-6.03 to 8.41)	0.75
9 months	0.87 (-4.79 to 6.54)	3.37 (-3.72 to 10.47)	0.35	-13.33 (-20.53 to -6.12)	<0.001
Diastolic blood pressure, mmHg					
3 months	1.54 (-1.66 to 4.73)	2.08 (-2.22 to 6.38)	0.34	-6.56 (-10.66 to -2.47)	0.002
6 months	2.26 (-0.55 to 5.07)	-1.04 (-4.90 to 2.82)	0.60	-1.04 (-5.19 to 3.10)	0.62
9 months	1.41 (-1.82 to 4.63)	-1.16 (-5.38 to 3.07)	0.59	-6.45 (-10.84 to -2.05)	0.004
Fasting blood sugar, mmol/L					
3 months	0.36 (-0.071 to 0.80)	-0.032 (-0.92 to 0.28)	0.30	-0.20 (-0.70 to 0.31)	0.44
6 months	0.046 (-0.36 to 0.45)	-0.043 (-0.68 to 0.59)	0.89	-0.25 (-0.72 to 0.22)	0.30
9 months	0.26 (-0.13 to 0.64)	-0.18 (-0.96 to 0.59)	0.65	-0.72 (-1.18 to 0.26)	0.002
Glycated haemoglobin, %					
3 months	0.006 (-0.13 to 0.14)	-0.17 (-0.39 to 0.054)	0.14	-0.021 (-0.23 to 0.18)	0.84
6 months	0.067 (-0.11 to 0.24)	-0.19 (-0.45 to 0.07)	0.15	-0.24 (-0.49 to 0.014)	0.06
9 months	0.087 (-0.072 to 0.25)	-0.29 (-0.54 to 0.032)	0.028	-0.39 (-0.64 to -0.15)	0.002
Total cholesterol, mmol/L					
3 months	-0.21 (-0.55 to 0.13)	-0.25 (-0.72 to 0.22)	0.30	0.12 (-0.29 to 0.54)	0.57
6 months	-0.14 (-0.47 to 0.19)	-0.30 (-0.76 to 0.16)	0.20	-0.11 (-0.52 to 0.31)	0.62
9 months	-0.26 (-0.58 to 0.72)	-0.27 (-0.75 to 0.21)	0.27	-0.27 (-0.68 to 0.15)	0.21
Triglycerides, mmol/L					
3 months	-0.14 (-0.37 to 0.090)	-0.056 (-0.34 to 0.23)	0.70	0.11 (-0.17 to 0.39)	0.44
6 months	-0.12 (-0.32 to 0.070)	-0.052 (-0.35 to 0.25)	0.73	0.088 (-0.16 to 0.34)	0.49
9 months	-0.059 (-0.23 to 0.12)	-0.12 (-0.39 to 0.14)	0.36	0.12 (-0.14 to 0.39)	0.36
High-density lipoprotein, mmol/L					
3 months	-0.076 (-0.17 to 0.021)	-0.021 (-0.16 to 0.12)	0.77	0.16 (0.035 to 0.29)	0.013
6 months	-0.036 (-0.14 to 0.068)	-0.03 (-0.20 to 0.14)	0.73	0.090 (-0.05 to 0.23)	0.21
9 months	0.00 (-0.092 to 0.093)	-0.039 (-0.19 to 0.11)	0.60	0.091 (-0.041 to 0.22)	0.18
Low-density lipoprotein, mmol/L					
3 months	-0.077 (-0.32 to 0.16)	0.062 (-0.25 to 0.37)	0.69	-0.050 (-0.34 to 0.25)	0.74
6 months	-0.14 (-0.39 to 0.11)	0.070 (-0.27 to 0.41)	0.69	-0.17 (-0.48 to 0.15)	0.30
9 months	-0.32 (-0.60 to -0.042)	0.091 (-0.25 to 0.43)	0.60	-0.21 (-0.54 to 0.13)	0.22
Body mass index, kg/m^2					
3 months	-0.25 (-0.44 to -0.068)	0.12 (-0.17 to 0.41)	0.42	0.063 (-0.18 to 0.30)	0.61
6 months	-0.57 (-0.86 to -0.29)	0.14 (-0.22 to 0.51)	0.44	0.13 (-0.24 to 0.50)	0.49
9 months	-0.60 (-0.85 to -0.36)	0.08 (-0.26 to 0.42)	0.65	0.13 (-0.31 to 0.57)	0.56
Waist circumference, cm					
3 months	0.32 (-0.80 to 1.43)	-1.07 (-3.15 to 1.01)	0.31	-1.14 (-2.67 to 0.39)	0.14
6 months	-1.48 (-2.61 to -0.34)	0.39 (-1.27 to 2.06)	0.65	0.26 (-1.27 to 1.79)	0.74
9 months	-1.79 (-2.93 to -0.65)	0.46 (-1.27 to 2.20)	0.60	-0.54 (-2.18 to 1.10)	0.52
Perceived stress					
3 months	0.67 (-0.77 to 2.11)	-1.85 (-3.77 to 0.073)	0.06	-1.69 (-3.78 to 0.41)	0.11
6 months	0.64 (-0.78 to 2.05)	-1.04 (-3.03 to 0.96)	0.31	-2.30 (-4.28 to -0.33)	0.022
9 months	0.53 (-1.21 to 2.26)	-1.14 (-3.39 to 1.12)	0.32	-3.22 (-5.48 to -0.97)	0.005

* Data are presented as B (95% confidence interval)

whereas a reduction of 2 mmHg in SBP would result in 10% lower stroke mortality and about 7% lower mortality from ischaemic heart disease or other vascular causes.[5] These highlight the clinical significance of small reduction in resting blood pressure. However, our findings did not support the effect of brisk walking on blood pressure. These were in contrast to those of previous study that CVD risk decreases incrementally with high levels of walking (in terms of frequency, duration, distance, and energy expenditure, particularly high walking intensity or pace).[3] The differences might be due to over-reporting of walking activity by our participants or walking at a slower pace or shorter duration than prescribed. Tai Chi was more effective than brisk walking in reducing blood pressure among Chinese adults with CVD risk factors.

Both Tai Chi and brisk walking decreased levels of fasting blood sugar and glycated haemoglobin but did not improve levels of total cholesterol, triglyceride, low-intensity lipoprotein, and body mass index. These findings may be due to implementation of exercise-only interventions, without any weight-reduction intervention or diet modification. A combination of both diet medication and exercise intervention is more effective in regulating blood lipid profiles and weight reduction.

Among physically inactive adults, chronic psychosocial stress may contribute to the development of cardiometabolic and emotional diseases. The reduction in perceived stress was significantly greater in the Tai Chi group than in the control group. Tai Chi is effective in promoting psychosocial well-being and general health status among adults with CVD risk factors.

One limitation to the study was reliance on the self-reported exercise logbook. Participants may have performed interventions incompletely or incorrectly at home, particularly those in the brisk walking group. The use of an objective method to monitor the intervention such as pedometer or accelerometer is recommended.

Conclusion

Preventive strategies must be implemented to minimise the risk factors for CVD development. Both Tai Chi exercise and brisk walking have substantiated positive effects on reducing levels of blood pressure, blood glucose, and glycated haemoglobin, as well as on improving psychosocial well-being.

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Disclosure

The results of this research have been previously published in:

1. Chan AWK, Chair SY, Lee DTF, et al. Tai Chi exercise is more effective than brisk walking in reducing cardiovascular disease risk factors among adults with hypertension: a randomised controlled trial. Int J Nurs Stud 2018;88:44-52.

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