

# Home-based exercise intervention for caregivers of persons with dementia: a randomised controlled trial: abridged secondary publication

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## KEY MESSAGES

1. Home-based structured exercise programme (12-step sitting Tai Chi) alleviates mild depressive symptoms among caregivers of persons with dementia.
2. Sitting Tai Chi also improves the balance ability of both caregivers and care recipients, and immediate word-list recall of care recipients.
3. As a traditional mind-body exercise widely practised by local older adults, sitting Tai Chi offers a low cost and safe treatment option for mild depressive symptoms in caregivers.

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## Introduction

In Hong Kong, around one in 10 older persons is estimated to have dementia.<sup>1</sup> Informal caregivers who provide most of dementia care experience considerable stress.<sup>2</sup> Evidence suggests that dementia caregivers are at an elevated risk of developing depression and anxiety and report poorer quality of life. They also have poorer perceived health, higher risk of hypertension, lower immunity, and elevated risk of mortality. We compared the efficacy of a home-based structured exercise programme (12-step sitting Tai Chi) for both carers and care recipients with a non-exercise social contact control group in the treatment of depression among caregivers of persons with dementia.

## Methods

This assessor-blind randomised controlled study comprised an intervention phase of 12 weeks and an extended observation phase of another 12 weeks. Participants were recruited from various district elderly community centres, neighbourhood elderly centres, and psychogeriatric and geriatric clinics in Hong Kong. Ethics approval was obtained from the institutional review boards; written informed consent was obtained from each participant. Inclusion criteria for informal caregivers were age  $\geq 50$  years, providing a substantial amount of care for the persons with dementia, having a score of  $>0$  to  $<8$  in the 15-item Geriatric Depression Scale, receiving antidepressant treatment on a steady dose for at least 3 months (if applicable), and understanding

Chinese. Inclusion criteria for care recipients were age  $\geq 60$  years, clinically diagnosed with dementia, dependence in at least one of the activities of daily living, having Mini Mental State Examination (MMSE) score of  $>10$ , and understanding Chinese. Exclusion criteria for both were having regular ( $\geq 3$  times/week) Tai Chi practice or other forms of mind-body exercise such as yoga, qigong, or mindfulness training in the past 6 months, presence of any condition that rendered participants unsuitable for physical training such as severe psychotic symptoms, imminently suicidal, significant orthopaedic problems, or unstable medical conditions.

Block randomisation was used. Team member was not involved in subsequent assessment or training. The assessors for clinical parameters were blinded to participants' randomisation status, and the trainers were blinded to the assessment results.

Intervention consisted of eight home-based sessions on 12-step sitting Tai Chi.<sup>3</sup> Each session lasted for 1 hour conducted by a Tai Chi teacher who visited the dyads in their home weekly in the first 4 weeks, followed by biweekly over the next 8 weeks. In addition, bi-weekly phone contacts were made (ie, 12 scheduled phone contacts in 24 weeks) to monitor the progress and address participants' concerns.

Because social contact may be beneficial to one's mood and may contribute to any improvement observed in the intervention group, we provided participants in the control group with a level of social contact equivalent to the intervention group. Participants in control group were visited by the

research assistant for eight times over 12 weeks. The visits involved a series of conversations related to neutral non-exercise topics that were designed according to the principles of a befriending programme. Similarly, 12 bi-weekly phone calls were made to offer a comparable level of social contact.

The primary outcome measure was the proportion of caregivers who were classified as responders by Hamilton Rating Scale for Depression (HAM-D-17). Secondary outcome measures included MMSE, digit span, immediate and delayed word-list recall, category verbal fluency test, Berg Balance Scale (BBS), exercise logbook and pedometer record, and brain-derived neurotrophic factor polymorphisms. Secondary outcome measures for caregivers only included Zarit Carer Burden Interview, Short Form-12 Health Survey (SF-12), Executive Interview, relevant items extracted from International Personality Item Pool, and qualitative data by focus group interviews.

Secondary outcome measures for care recipients only were Neuropsychiatric Inventory, Disability Assessment for Dementia, Modified Barthel Index, and Cornell Scale for Depression in Dementia.

## Results

Of 262 caregiver-care recipient dyads screened for eligibility, 46 refused to participate and 79 did not fulfil the inclusion criteria. Among the 137 dyads who met inclusion criteria, 27 (19.7%) dyads dropped out owing to time constraints (n=13), six dyads refused to continue as they were unsatisfied with the randomisation results, seven dyads left because of physical illnesses or procedures not related to exercise, and one care recipient in the control group died after a fall (Fig. 1).

The mean age of care recipients was 80.7±7.2 years. Half of them were men. Nearly 80% were illiterate or had education up to primary level. Their mean time in education was 4.4±4.4 years. Their mean MMSE score was 19.9±4.6. The overall mean Neuropsychiatric Inventory score was 5.1±9.3 and the mean Disability Assessment for Dementia score was 68.8%±24.9%. The two groups were comparable at baseline.

The mean age of caregivers was 68.2±10.7 years, and there was a female preponderance. Nearly two-thirds of the caregivers were spouses of the care recipients, and one-third were their grown-up children. Their mean time in education was 7.9±5.5 years. Their mean MMSE score was 28.6±2.1. Caregivers spent a mean of 7.6±6.3 hours daily to care. The mean length of caregiving was 4.5±3.6 years. The overall mean Geriatric Depression Scale score was 4.1±2.3. There was no significant difference in sociodemographic and clinical characteristics between the two groups. Group × time interaction on BBS scores was found at week 12 in the sitting Tai Chi group but no significant change in the control group ( $\beta=1.34, P=0.044$ , Table).

At week 12, 49.1% of the caregivers in sitting Tai Chi group achieved a reduction of ≥50% in HAM-D-17, whereas 29.6% of those in the control group had the same reduction (Table). In a multivariate model adjusted for age, sex, education, and baseline depression severity, sitting Tai Chi was associated with a reduction in caregiver depression (odds ratio=2.55, 95% confidence interval=1.09-5.97,  $P=0.031$ ). However, the beneficial effect of sitting Tai Chi did not sustain at week 24.

Linear mixed-effects analysis demonstrated significant effects of group × time interaction on HAM-D-17 scores in the sitting Tai Chi group at week 6 ( $\beta= -1.38, P=0.032$ ) and week 12 ( $\beta= -0.90, P=0.030$ ) [Fig. 2]. Group × time interaction on BBS scores was found at week 12 in the sitting Tai Chi group but no significant change in the control group ( $\beta=3.32, P=0.029$ , Table). Significant effects of

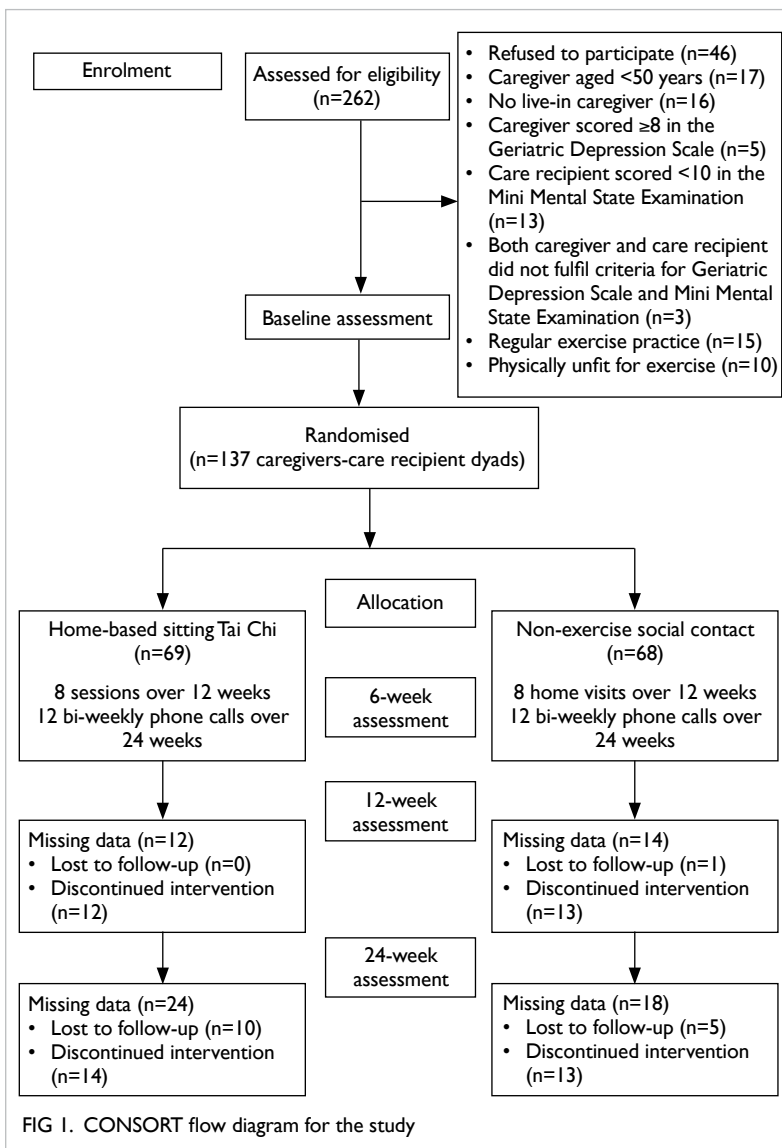
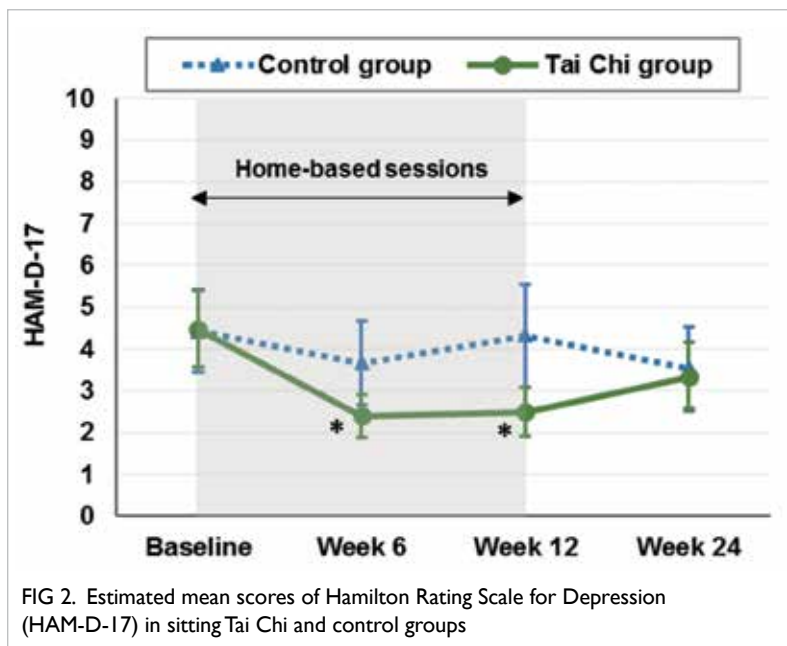


FIG 1. CONSORT flow diagram for the study

TABLE. Mood, behavioural, functional, and physical outcomes of informal caregivers and care recipients

Assessment	Sitting Tai Chi group*	Non-exercise social contact group*	Group × time interaction effects		
			Beta (SE)	95% CI	P value
Informal caregivers					
Hamilton Rating Scale for Depression					
Baseline	4.48±3.88	4.43±4.11			
Week 6	2.40±1.92	3.67±3.74	-1.38 (0.63)	-2.63 to -0.12	0.032
Week 12	2.49±2.25	4.31±4.60	-0.90 (0.41)	-1.71 to -0.09	0.030
Week 24	3.33±2.84	3.54±3.50	-0.19 (0.39)	-0.96 to 0.57	>0.05
Zarit Carer Burden Interview					
Baseline	30.57±17.81	31.49±17.09			
Week 6	26.70±15.44	27.37±13.22	-0.21 (2.16)	-4.49 to 4.08	>0.05
Week 12	29.05±17.90	29.30±18.17	0.15 (1.90)	-3.60 to 3.90	>0.05
Week 24	31.58±18.55	29.86±16.36	1.01 (0.87)	-0.71 to 2.73	>0.05
Physical Component Summary					
Baseline	46.74±9.28	45.23±9.01			
Week 12	48.90±8.90	46.21±9.22	1.08 (0.99)	-1.72 to 1.94	>0.05
Week 24	47.02±9.02	46.55±9.17	0.78 (0.67)	-1.02 to 1.65	>0.05
Mental Component Summary					
Baseline	52.22±7.34	53.01±6.66			
Week 12	54.01±7.21	53.95±6.68	0.87 (0.67)	-4.90 to 3.87	>0.05
Week 24	53.33±7.43	53.87±6.92	0.62 (0.59)	-4.46 to 3.99	>0.05
Berg Balance Scale					
Baseline	52.59±5.54	53.48±5.01			
Week 12	53.63±4.64	53.27±6.13	1.34 (0.66)	0.04 to 2.64	0.044
Week 24	53.47±4.33	53.90±4.19	0.53 (0.58)	-0.61 to 1.66	>0.05
Care recipients					
Cornell Scale for Depression in Dementia					
Baseline	0.80±1.24	1.30±2.24			
Week 6	0.50±1.30	0.93±1.61	-0.05 (0.30)	-0.64 to 0.53	>0.05
Week 12	0.46±1.44	0.57±1.10	0.12 (0.18)	-0.22 to 0.47	>0.05
Week 24	0.27±0.86	0.67±1.34	0.01 (0.14)	-0.27 to 0.30	>0.05
Neuropsychiatric Inventory					
Baseline	4.28±7.93	5.90±10.52			
Week 12	3.95±9.35	5.62±12.28	-1.63 (1.61)	-4.81 to 1.56	>0.05
Week 24	5.29±11.54	4.52±9.73	-0.27 (1.14)	-2.52 to 1.98	>0.05
Disability Assessment for Dementia					
Baseline	68.76±21.45	68.90±28.24			
Week 12	67.82±22.81	66.17±31.32	3.57 (3.09)	-2.56 to 9.71	>0.05
Week 24	67.46±26.69	70.73±25.53	0.31 (2.45)	-4.63 to 5.25	>0.05
Modified Barthel Index					
Baseline	77.96±21.58	73.37±27.58			
Week 12	75.84±24.48	70.81±28.03	1.11 (3.55)	-6.33 to 8.56	>0.05
Week 24	79.41±23.75	76.52±24.08	-0.34 (2.39)	-5.11 to 4.44	>0.05
Berg Balance Scale					
Baseline	42.06±10.80	40.69±15.67			
Week 12	46.02±8.35	43.77±12.31	3.32 (1.49)	0.35 to 6.29	0.029
Week 24	44.15±11.12	43.28±12.76	2.43 (1.31)	-0.28 to 5.15	>0.05

\* Data are presented as mean ± standard deviation



group  $\times$  time interaction on immediate word-list recall was found in the sitting Tai Chi group at both week 12 ( $\beta=0.82$ ,  $P=0.033$ ) and week 24 ( $\beta=0.62$ ,  $P=0.014$ ) [Table].

## Discussion

Our study showed that sitting Tai Chi alleviated depressive symptoms among caregivers of persons with dementia. The results are in line with the literature that physical exercise alleviates depressive symptoms. In two meta-analyses of 23 and 25 randomised controlled trials, physical exercise was proven to be an effective intervention for depression.<sup>4,5</sup> Nonetheless, most previous studies examined the efficacy of walking/running/jogging, aerobic exercise, strength training, and stationary bicycle/ergometer training, all of which may not suit the needs of older adults. Findings of the current study validated the efficacy of the sitting Tai Chi (a traditional mind-body exercise) in older adults.

Apart from the psychological benefits, sitting Tai Chi also improved balance ability among caregivers and care recipients, as exemplified by their BBS scores. This is a potentially important finding because falls is a cause of injury-related death and non-fatal injuries among those aged  $\geq 65$  years. Sitting Tai Chi, by improving participants' balancing ability, might reduce their risk of falls. Its beneficial effects on balance ability may be attributed to the fact that participants in the intervention group took up more physical activities.

Furthermore, sitting Tai Chi improved

immediate word-list recall among care recipients at the end of intervention (week 12) and extended observation period (week 24). However, there was no significant change in other cognitive domains among participants in the intervention group. It may be due to the fact that sitting Tai Chi is less intense than standard 24-step Tai Chi, and the intervention consisted of eight home-based sessions over 12 weeks only. Interventions of higher frequency and longer duration may be required to achieve improvement in other cognitive domains. Further studies will be required to determine the optimal dosage of exercise for this population.

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## Disclosure

The results of this research have been previously published in:

1. Chan WC, Lautenschlager N, Dow B, Ma SL, Wong CS, Lam LC. A home-based exercise intervention for caregivers of persons with dementia: study protocol for a randomised controlled trial. *Trials* 2016;17:460.

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