Effects of Tai Chi soft ball training on health-related quality of life of older adults with functional limitations

ORIGINAL ARTICLE

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ABSTRACT

Background. This study investigated the effects of 10 weeks of Tai Chi Soft Ball (TCSB) training on health-related quality of life (HRQoL) of institutionalised older adults.

Methods. 66 older adults aged 65 to 75 years from private institutions were included; 34 were assigned to the training group (2 one-hour sessions per week) and 32 to the control group. HRQoL was measured using the SF-36. Two-way ANOVA/ANCOVA (with repeated measures in one factor) was used to examine the testing factor (pre-test and post-test of training) and the effect of groups (training and control groups) as well as their interaction effects.

Results. In the training group, significant within-group training effects were noted on physical component summary (PCS) [$F=28.06$, $p<0.01$] and mental component summary (MCS) [$F=17.85$, $p<0.01$] of the SF-36. In the controls, significant within-group deterioration of PCS ($F=4.89$, $p<0.05$) was noted. The differences of PCS ($F=549.09$, $p<0.01$) and MCS ($F=4.11$, $p<0.05$) between the training and control groups increased significantly after 10 weeks of TCSB training.

Conclusion. TCSB was effective in improving HRQoL and in decelerating the deterioration of HRQoL of older adults with functional limitations.

Key words: Aged; Institutionalization; Quality of life; Tai Ji

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INTRODUCTION

Quality of life (QoL) involves happiness and satisfaction with life as a whole.[1] It was categorised into: generic, disease-specific, individual, socio-economic, and dimension-specific QoL.[2] This study focused on the generic QoL, as the recruited older adults were from different centres and had different background, abilities, needs, and chronic diseases. It was difficult to measure their QoL in a specific area. Health was always ranked by older adults as a major component of generic QoL.[3,4] Health-related (HR) QoL is multi-dimensional and encompasses the physical, emotional, and social components that are associated with an illness. It was interchangeable with QoL in a lot of professions, especially in health care.

Ageing, chronic diseases (hypertension, osteoporosis, sciatica, etc), and functional decline (in bathing, dressing, toileting, etc) inevitably affect older adults.[5] These hinder their activities of daily living (eating, bathing, using phone, going places, shopping, preparing meals, doing housework, etc).[6] Finally, they are incapable of taking care of themselves and become institutionalised, hospitalised, and die. In Hong Kong, the percentage of ageing population will surpass the mean percentage of the world

(16.2% in 2050), and the population of ≥65 years is expected to increase from 12.2% in 2010 to 26% in 2036.[7] Owing to limited resources, the functional health of institutionalised older adults is worse than that of non-institutionalised older adults.[8]

Functional status is the most important aspect of physical well-being and general QoL.[9] Functional health is a determinant of QoL or HRQoL,[10-13] and therefore is heavily loaded in the Medical Outcomes Study SF-36 survey.[14]

Regular activities (strength training, endurance training, walking, flexibility training, and Tai Chi) have positive effects on HRQoL of older adults.[15,16] Nonetheless, of 16 studies about exercise and HRQoL in older adults, 7 showed that the physical activity training had no effect on HRQoL.[17]

Tai Chi may maintain and rectify physical function and HRQoL of older adults.[18,19] In a Taiwanese study about the Tai Chi and HRQoL in older adults,[20] 7 out of 8 domains (except the bodily pain scale) of the SF-36 were significantly improved after the Tai Chi training. The Tai Chi Soft Ball (TCSB) involves elements of Tai Chi (Yin and Yang, circularity, continuity, evenness, softness, gentleness, and cultivating internal energy rather than external strength) and the racquet sport skills.[21] There are more than one million participants in China, and it has spread to Europe, other parts of Asia, Australia, and America.[21] TCSB is an effective instrument for improving functional health of older adults, as it involves manipulative skills and hand-eye coordination. It increases upper and lower body flexibility and balance,[22] which are essential for daily activities and self care.[23] This study investigated the effects of 10 weeks of TCSB training on HRQoL of institutionalised older adults with functional limitations.

METHODS

This study was approved by the Institutional Thesis Committee of Hong Kong Baptist University. It was a quasi-experimental trial with a control group. 66 older adults aged 65 to 75 years from private institutions were included; 34 were assigned to the training group and 32 to the control group. To maintain the homogeneity of the 2 groups, factors affecting HRQoL (age, gender, number of chronic diseases, and activities of daily living) were strictly controlled.

Instrumentation

The SF-36 is a valid and reliable generic measure of HRQoL.[24,25] The Chinese version (Hong Kong) has been verified and validated.[25] It comprises 2 scales: physical component summary (PCS) and mental component summary (MCS) and 8 sub-scales (35 questions): physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role-emotional (RE), and mental health (MH). Each scale score ranges from 0 to 100; higher scores indicate better HRQOL. An additional question "How health is now compared to 1 year ago" forms an extra scale of health transition (HT). To avoid insouciance and dishonesty, 10 reverse-coding questions were made. The discriminant validity was tested and 100% scaling success was indicated in the Hong Kong SF-36; the correlation between items and its hypothesised scale was >0.4. The factor analysis with varimax rotation on the Chinese SF-36 generated 2 principal component factors (physical and mental) with eigenvalues >1.0 from the 8 sub-scales. These 2 components explained 59% of the total variance of the SF-36. The internal consistency and the test-retest reliability of all the 8 sub-scales ranged from 0.66 to 0.89, which is even higher than the recommended standard of 0.7.

Procedure

A pilot test was conducted by a registered coach and research assistants in a private institution for older adults to check the testing method, rundown, coaching skill, content, and intensity of the training.

Invitation letters were sent to 40 private institutions[26] for older adults. Those interested were asked to complete a questionnaire of self-perception of physical functional health and a Chinese translated Physical Activity Readiness Questionnaire (PAR-Q). Those who had ≥1 acute illness or were not recommended to do exercise were excluded. Participants could leave the programme at any stage without any reason. The procedure of the tests and training and the ethical concerns were explained.

The SF-36 and demographics (gender, age, education level, and marital status) were recorded for all participants before and after the TCSB training in November 2010 and February 2011.

A male certified TCSB coach with 2 assistants from the Hong Kong TCSB Association conducted the training. A registered enrolled nurse supervised the entire training and testing process. A 10-week training course (2 one-hour sessions per week) was provided for 34 older adults of the training group in an uncovered playground from November 2009 to January 2010. Basic TCSB skills were instructed including basic movement skills, patterns and cooperative techniques. The intensity of exercise was approximately 70% of VO_2 max every 15 minutes.[27] No exercise training was provided for controls. No intensive physical activities were provided for participants in both groups. The training was in the early afternoon, and changes in humidity, temperature, and ultraviolet index were small, and there were no rains during training.

Statistical analysis

Participants who could not meet the 80% attendance rate or who engaged in other activities >60 minutes a week were excluded. A conservative, intention-to-treat approach was used, as excluding non-compliant subjects could bias the training evaluation. The last available measurement after dropout was used to analyse the missing result.[28]

The PCS and the MCS of the SF-36 were computed.[29] The computed norms of PCS and MCS in Hong Kong[25] and in USA were used to compare the results of this study. A 2-way ANOVA with repeated measures in one factor was conducted to examine the testing factor (within group effect: pre-test and post-test of training) and the effect of groups (between group effect: training and control groups) as well as their interaction effects on HRQoL. A 2-way ANCOVA with repeated measure in one factor was conducted to the previous parameter if unequal baseline measures were noted.[30]

RESULTS

There were 12 male and 22 female participants in the training group; 18 were aged 65 to 69 (mean, 67.45; SD, 1.27) years and 16 were aged 70 to 75 (mean, 74.12; SD, 0.79) years. There were 15 male and 17 female controls; 10 were aged 65 to 69 (mean, 66.34; SD, 1.38) years and 22 were aged 70 to 75 (mean, 72.59; SD, 1.31) years. Respectively for the training and control groups, the mean numbers of chronic diseases were 3 and 2.66, whereas the mean numbers of activities of daily living were 17.53 and 16.82. Three in the training group and one in the control group dropped out owing to hospitalisation. All drop-outs were treated as failed cases and included in the analysis.[28]

According to the manual for the SF-36,[29] the computed means of PCS and MCS for the US population aged 65 to 75 years were 47.69 and 51.49, respectively. The computed means of PCS and MCS in Hong Kong were 42.35 and 54.33, respectively.[25] The computed mean scores of pre-training PCS and MCS in the training group were lower than the norms for USA and Hong Kong. After TCSB training, both the mean PCS and MCS scores were close to the norms for USA and Hong Kong (PCS=47.23, MCS=51.49) [**Table 1**].

All the variances in HRQoL were homogenous, so parametric analysis was performed. As there were only 2 levels on both factors (testing factor and group factor), the sphericity assumed was the choice in Mauchly's test (to check the equality of the variances between levels of the repeated measures factor), so the Greenhouse-Geisser epsilon value of 1.000 and simply a '.' for the significance level of Mauchly's test was noted.

Table 1
Computed physical component summary (PCS) and mental component summary (MCS) scores of the SF-36 by age (65-75 years)

Parameter	PCS	MCS
Population mean of USA	47.69	51.49
Population mean of Hong Kong	42.35	54.33
Pre-test mean of training group	40.71	44.34
Post-test mean of training group	47.23	51.49
Pre-test mean of control group	46.38	44.11
Post-test mean of control group	41.09	42.55

Significant interaction effects (testing factor x effect of groups) were noted in all 8 sub-scales and 2 component scales: PF (F(1,1)=45.49, p<0.01), RP (F(1,1)=43.88, p<0.01), BP (F(1,1)=33.47, p<0.01), GH (F(1,1)=48.03, p<0.01), VT (F(1,1)=31.70, p<0.01), SF (F(1,1)=18.04, p<0.01), RE (F(1,1)=30.46, p<0.01), MH (F(1,1)=17.62, p<0.01), PCS (F(1,1)=49.60, p<0.01), and MCS (F(1,1)=19.42, p<0.01). The HRQoL of the training group boosted up after the training, whereas that of controls deteriorated (**Table 2**).

Significant mean differences in within group effects were noted on PF (F(1,1)=14.83, p<0.01), BP (F(1,1)=32.33, p<0.01), GH (F(1,1)=3.99, p<0.05), VT (F(1,1)=8, p<0.01), MH (F(1,1)=8.52, p<0.01), PCS (F(1,1)=30.46, p<0.01), and MCS (F(1,1)=7.99, p<0.01). The effect sizes, partial eta squared were all >0.06 (PF=0.19, BP=0.34, GH=0.06, VT=0.11, MH=0.11, PCS=0.33, and MCS=0.11), which was a moderate-to-high effect in the Cohen's guideline. To distinguish the within group effects on the training and control groups, one-way repeated measure ANOVA was performed. In the training group, significant differences in within group effects were noted on PF (F(1,1)=27.53, p<0.01), BP (F(1,1)=27.50, p<0.01), GH (F(1,1)=35.45, p<0.01), VT (F(1,1)=7.95, p<0.01), MH (F(1,1)=20.12, p<0.01), PCS (F(1,1)=28.06, p<0.01), and MCS (F(1,1)=17.85, p<0.01). In the control group, significant differences in within group effects were noted on BP (F(1,1)=6.5, p<0.05), GH (F(1,1)=14.22, p<0.01), VT (F(1,1)=7.36, p<0.05), and PCS (F(1,1)=4.89, p<0.05). There was no significant difference in within group effects on RP (F(1,1)=0.72, p=0.4), SF (F(1,1)=0.43, p=0.52), and RE (F(1,1)=3.91, p=0.52). Therefore, pre-training and post-training were not significantly different. The performance of RP, SF, and RE slightly strengthened after training, whereas that for all items weakened in the control group (**Table 2**).

Significant mean differences in between group effects were noted on PF (F(1,1)=595.31, p<0.01), BP (F(1,1)=553.41, p<0.01), GH (F(1,1)=7.05, p<0.01), PCS (F(1,1)=549.09, p<0.01), and MCS (F(1,1)=4.11, p=0.05). Therefore, the training and control groups were significantly different after TCSB training. The effect sizes, partial eta squared were all >0.14 (PF=0.09, BP=0.89, GH=0.99, PCS=0.90, and MCS=0.60), which was a large effect in the Cohen's guideline. However, there was no significant difference in between group effects on RP (F(1,1)=0.09, p=0.77), VT (F(1,1)=2.78, p=0.10), SF (F(1,1)=3.13, p=0.82), RE (F(1,1)=61.88, p=0.10), and MH (F(1,1)=1.22, p=0.27). Therefore, the training and control groups after TCSB training were not significantly different. The performance of RP, VT, SF, RE, and MH slightly strengthened in the training group, whereas that for all items weakened in the control group (**Table 3**). The effect sizes and partial eta squared were all <0.14 (RP=0.00, VT=0.10, SF=0.05, RE=0.03, and MH=0.02), which was a moderate-to-small effect by the Cohen's guideline (**Table 3**).

Table 2
One-way ANOVA/ANCOVA with repeated measure in one factor on within-group differences of selected SF-36 items between training and control groups

Item	Pre-test		Post-test		Within group difference	Pre-test		Post-test		Within group difference
	Training group		Training group			Control group		Control group		
	Mean	SD	Mean	SD	F (1)	Mean	SD	Mean	SD	F (1)
Physical functioning	2.15	0.46	2.52	0.34	27.53†	2.46	0.52	2.26	0.54	0.27
Role physical	3.33	1.26	3.98	1	-	3.84	0.91	3.34	0.82	-
Bodily pain	3.52	1.42	4.29	1.05	27.50†	4.16	0.93	3.71	0.92	6.50*
General health	3.08	0.78	3.73	0.61	35.45†	3.17	0.75	2.82	0.64	14.22†
Vitality	3.10	0.78	3.78	0.84	7.95†	3.27	0.78	3.04	0.65	7.36*
Social functioning	3.72	1.12	4.15	0.89	-	3.73	0.71	3.42	0.77	-
Role emotion	3.66	1.17	4.27	0.89	-	3.80	0.88	3.51	0.91	-
Mental health	3.51	0.91	4.11	0.62	20.12†	3.74	0.62	3.57	0.65	1.22
Physical component summary	40.71	10.42	47.22	7.61	28.06†	46.38	8.75	41.09	8.34	4.89*
Mental component summary	44.34	12.80	51.49	9.07	17.85†	44.11	8.75	42.55	8.70	2.66

* p<0.05
† p<0.01

Table 3
Two-way ANOVA/ANCOVA with repeated measure in one factor on selected SF-36 items between training and control groups

Item	SS	df	MS	F	p Value
Physical functioning					
Between groups	22.95	1	22.95	595.31	<0.001
Within group	0.57	1	0.57	14.83	<0.001
Interaction	1.75	1	1.75	45.49	<0.001
Role physical					
Between groups	0.16	1	0.16	0.09	0.77
Within group	0.18	1	0.18	0.72	0.40
Interaction	10.85	1	10.85	43.88	<0.001
Bodily pain					
Between groups	121.40	1	121.40	553.41	<0.001
Within group	7.10	1	7.10	32.33	<0.001
Interaction	7.34	1	7.34	33.47	<0.001
General health					
Between groups	5.50	1	5.50	7.05	<0.01
Within group	0.68	1	0.68	3.99	<0.05
Interaction	8.20	1	8.20	48.03	<0.001
Vitality					
Between groups	2.68	1	2.68	2.78	0.10
Within group	1.72	1	1.72	8	<0.01
Interaction	6.83	1	6.83	31.70	<0.001
Social functioning					
Between groups	4.17	1	4.17	3.13	0.82
Within group	0.11	1	0.11	0.43	0.52
Interaction	4.5	1	4.5	18.04	<0.001
Role emotion					
Between groups	3.16	1	3.16	61.88	0.10
Within group	0.88	1	0.88	3.91	0.52
Interaction	6.82	1	6.82	30.46	<0.001
Mental health					
Between groups	1.08	1	1.08	1.22	0.27
Within group	1.96	1	1.96	8.25	<0.01
Interaction	4.18	1	4.18	17.62	<0.001
Physical component summary					
Between groups	7800.15	1	7800.15	549.09	<0.001
Within group	432.69	1	432.69	30.46	<0.001
Interaction	704.63	1	704.63	49.60	<0.001
Mental component summary					
Between groups	692.58	1	692.58	4.11	0.05
Within group	257.20	1	257.20	7.99	<0.001
Interaction	625.10	1	625.10	19.42	<0.001

DISCUSSION

TCSB was effective in improving HRQoL of older adults; 5 of the 8 sub-scales of SF-36, especially physical health, improved significantly after training. When compared to the control group, although significant differences were not noted on 4 sub-scales, especially of MCS, significant differences were noted on the PCS and MCS after the training. Significant interactions were noted on all sub-scales as well as PCS and MCS. Pre-training scores of the training group were lower than those of the norms for USA and Hong Kong, but the scores were close to those norms after TCSB training.

Although some studies reported that physical activities failed to deal with the HRQoL,[17] this study showed the effectiveness of TCSB in older adults. This was consistent with a Taiwanese study on Tai Chi reporting significant improvement in 7 out of 8 sub-scales as well as PCS and MCS after training.[20]

For the control group, significant decreases were noted on 2 out of the 4 sub-scales of PCS as well as the PCS itself. The perception of physical QoL was affected by the lack of exercise or being sedentary. The mean of PCS dropped below the norms for USA[29] and Hong Kong.[25] This may be due to fading of novelty during post-test testing, the lack of motivation to put in all efforts, or simply ageing. The ageing process decreases HRQoL in older adults with a sedentary lifestyle.[5,11,15] Thus, health practitioners may use TCSB as training for older adults with functional problems.

Limitations of this study were that it was non-randomised, and that assessors were not blinded. Moreover, there were more younger older adults in the training group than in the control group. Although the baseline of HRQoL was adjusted, HRQoL of younger older adults may have boosted faster than in the older older adults after TCSB training.[31] This age effect may have contributed to the training effects. Gender, socio-economic, and marital effects were not analysed, which might have affected the effectiveness of TCSB Training. Male and married older adults with higher economic status had a higher HRQoL.[31] Owing to financial limitations, the confounders of maturity, and any history of exercise during the training period were not reported. A randomised controlled trial is suggested for the future studies.

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