Promoting Health Through Tai Chi: Results From A Controlled Study

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Abstract

This study examined the effects of a 6-month Tai Chi exercise program on health-related quality of life (HRQL) in older individuals. Using a randomized controlled trial, ninety-four local community-residing volunteers aged 65-96 (M age = 72.8 years, SD = 5.1) were randomly assigned to a 6-month, twice a week, Tai Chi condition or a wait-list control condition. The Short-Form General Health Survey (SF-20) was used to assess change in multiple dimensions of health status involving physical-, social-, and role-functioning, bodily pain, mental health, and health perceptions. Results showed that, compared to the control group, participants in the Tai Chi group reported significant improvements in all functional domains of HRQL over the course of the 6-month intervention. It was concluded that a 6-month Tai Chi exercise program is effective for improving HRQL among older adults. Tai Chi, a self-paced and low intensity activity appears to be an effective, low-cost approach for promoting health in older persons.

Keywords: Tai Chi, quality of life, older adults, health promotion

Introduction

Accumulating research suggests that physical exercise may be an effective strategy for optimizing health-related quality of life (HRQL) (McAuley & Katula, 1998). Several studies have demonstrated a positive relationship between physical activity and HRQL in the elderly (McMurdo & Burnett, 1992; Ruuskanen & Ruoppila, 1995; Wood et al., 1999) (for a review see King et al., 1999; McAuley & Rudolph, 1995). Whereas higher-intensity exercise programs offer significant health benefits (Fiatarone et al., 1990; King, Rejeski, & Buchner, 1998), in the later years of life such programs are more likely to be associated with increased rates of injury (Pollock et al., 1991). Additionally, many training programs require expensive and technically sophisticated equipment and highly qualified staff (Blair & Garcia, 1996). Therefore, a cost-effective and low-to-moderate intensity exercise program aimed at slowing age-related physiological and psychological decline and preventing disability should be considered for maximizing HRQL for older persons and improving long-term adherence to healthy behaviors (Centers for Disease Control & Prevention, 2001 - National Blueprint).

Tai Chi is a traditional form of Chinese exercise that can promote health and fitness, prevent disability, and maintain physical performance in later life. It is particularly suitable for older adults because it entails whole body weight-bearing conducted in a slow, controlled fashion. Its movements reflect physical skills required for useful independent locomotion including weight shifting with changing center of gravity and turning (Li, Fisher, Harmer & Shirai, 2003; Wolf et al., 1997). In addition, Tai Chi emphasizes the importance of psychosomatic integration for optimal health by integrating meditation and concentration components with the physical. Finally, from a pragmatic standpoint of cost and convenience, Tai Chi is an attractive activity because it does not require any special equipment and can be practiced any time or anywhere, once the basics have been learned (Li et al., 2003). Given the transportation and other barriers often encountered by older individuals, these features should enhance involvement and adherence.

Research to date has indicated health-related benefits of Tai Chi for older adults including improved balance control (Tse & Bailey, 1991) and reduction in the incidence of falling (Wolf et

al., 1996; Li, Fisher & Harmer, in press), improved cardiovascular fitness (Lan et al., 1998; Lan et al., 1999; Young et al., 1999), enhanced psychological well-being (Li et al., 2001a) and increased perceptions of self-efficacy (Li et al., 2001b; Li et al., in press), and physical function (Li et al., 2001c). Less is known, however, about the effects of Tai Chi on overall health-related quality of life (HRQL). Given that the most important long-term endpoint for any practical and therapeutic intervention is not just improved physical and psychological benefits for its participants but enhanced HRQL, research is needed to establish the quantitative relationships between Tai Chi exercise and HRQL in older adults.

However, only one study to date (Kutner et al., 1997) has examined the relationship between Tai Chi and HRQL measures defined by the generic Health Status Battery (Ware & Sherbourne, 1992. Also known as MOS SF-36). In a 15-week intervention program, Kutner et al. (1997) compared Tai Chi practice group with balance training and education groups and reported no significant differences between intervention groups or any differences over time in perceived health status assessed by the Health Status Battery. Given the relatively short training period (15 weeks) employed, these findings may not be surprising. Determining the long-term effects of Tai Chi interventions on HRQL is warranted.

The purpose of this study was to extend our knowledge of Tai Chi's effects on HRQL by examining its influence on multidimensional health status using a well-established medical outcome measure: the General Health Survey (Stewart et al., 1988). These self-report health survey data, which have not been previously reported, reflect participants' perceptions of their function and well-being. Specifically, we examined the effects of a 6-month Tai Chi intervention on physical-, role-, and social-functioning, bodily pain, mental health, and change in health perceptions. It was hypothesized that Tai Chi practice would enhance these HRQL measures and that these changes would be characterized by mean changes that differed between the experimental and control groups.

Methods

Participants

Participants were community-dwelling older adults recruited from a rural city in the Willamette valley, Oregon. Full details of recruitment and randomization are described elsewhere (i.e., Li et al., 2001a; Li et al., 2001c). Briefly, a total of 148 individuals responded to local newspaper advertisements and flyers at senior centers seeking volunteer participation in a longitudinal physical activity study. Inclusion criteria were: (a) aged 65 years or above, (b) low active, defined as non-involvement in a regular exercise program in the month prior to participation in the study, (c) healthy to the degree that participation in an exercise program would not exacerbate any existing health condition, and (d) willingness to be randomly assigned to a treatment condition. To screen for prior physical activity level, each respondent was interviewed by telephone using the Physical Activity Scale for the Elderly (Washburn et al., 1993).

Ninety-eight respondents (ranging from 65 to 96 years old (M age = 73.2 years, SD = 4.9), who met the inclusion/exclusion criteria and provided written informed consent before entry into the study, were randomized into the experimental conditions using a list of random numbers. Four individuals withdrew prior to the intervention. Of the remaining 94 qualified participants, 49 were assigned to the intervention group of Tai Chi practice (M age = 72.8, SD = 4.7) and 45 were assigned to a wait-list control group (M age = 72.7, SD = 5.7).

Experimental Protocol

Three Tai Chi instructors auditioned and were selected by one of the investigators (FL) to teach the classes. All instructors had a minimum of 10 years prior Tai Chi teaching experience and came from different ethnic and cultural backgrounds. The Tai Chi intervention was the classical 24-Form Yang style incorporating elements of balance, postural alignment, and concentration (China National Sports Commission, 1983; Yan & Downing, 1998).

Participants in the intervention group attended a 60-minute Tai Chi practice session twice a week for 6 months. The sessions consisted of a 15-minute warm-up, 30-minutes of Tai Chi, and a 15-minute cool-down period. During the practice, participants were led by an instructor and replicated the motions, postures, and speed of movement of the instructor.

Participants in the control group were instructed to maintain their routine daily activities and not to begin any new exercise programs. These participants were promised a 4-week Tai Chi program at the end of the 26-week intervention study period.

Measures

Background information. A short inventory was administered at baseline to assess demographic characteristics such as age, gender, education, income, and race/ethnicity.

Health-Related Quality of Life. HRQL was assessed with the Short-Form General Health Survey (Stewart et al., 1988) measured at baseline (Week 1), middle (Week 12), and termination (Week 24) of the study. The SF-20 was designed for use in clinical practice, research, health policy evaluation, and general population surveys. The SF 20 has proven useful in monitoring general and specific populations, comparing the burden of different diseases, differentiating the health benefits produced by different treatments, and in screening individual patients. The instrument comprises twenty items representing six domains of HRQL: physical functioning, role functioning, social functioning, bodily pain, mental health, and health perceptions. Each is defined below.

Physical function was assessed by six items assessing the extent to which health interferes with a variety of activities (e.g., carrying groceries, climbing stairs, and walking). Each item was measured on 3-point scale ranging from 1 (= limited for more than 3 months) to 3 (= not limited at all). Higher scores indicate better physical functioning.

Role functioning was assessed by two items assessing the extent to which health interferes with usual daily activity such as work or housework. Each item was measured on a 3-point scale ranging from 1 (= yes, for more than 3 months) to 3 (= no). Higher scores indicate better role functioning.

A single item determined participants levels of social functioning and measured the extent to which health interferes with normal social activities such as visiting with friends during past month. This item scale was measured on a 6-point scale ranging from 1 (= none of the time) to 6 (= all of the time) with higher scores indicating better social functioning.

Mental health was assessed by five items assessing general mood or affect, including depression, anxiety, and psychological well-being during the past month. Each item was measured on a 6-point scale ranging from 1 (= all of the time) to 6 (= none of the time) with higher scores representing better mental health.

The health perceptions dimension used five items designed to provide overall ratings of current health in general. Each item was measured on a 5-point scale from 1 (= definitely true) to 5 (= definitely false). Higher scores represent better health perceptions.

The scale of bodily pain was measured by a single item assessing the extent of bodily pain in previous four weeks. This item was measured on a 5-point scale from 1 (= none) to 5 (= severe). The bodily pain subscale was recoded so that a high score represents less pain.

All subscales were transformed to a 0 to 100 scale, with higher scores indicting better functioning, and five points “defines differences that are clinically and socially relevant” (Ware et al., 1993). In general, physical-, role-, and social-functioning subscales capture behavioral dysfunctioning caused by health problems. The dimensions of overall health, bodily pain, and particularly mental health reflect more subjective components of health and general-welling (Stewart et al., 1989). The consistency estimates of the four multi-item SF-20 measures varied from .77 (physical functioning) to .89

(mental health) for Week 1, .78 to .88 for Week 12, and .79 to .86 for Week 24.

Procedures

All participants completed the measures described previously during an initial group orientation meeting (Week 1). Before beginning, participants signed consent forms, indicating the voluntary and anonymous nature of the study. Instructions were read aloud by the researcher, and sample questions were provided prior to the administration of the questionnaire. Additionally, participants were encouraged to clarify any questions/confusions they might have with regard to the questionnaire. No problems were encountered with participants understanding the questions or completing the questionnaire.

Participants from the experimental group completed these measures a second (Week 12) and third (Week 24) time either at the end of class or at home within a week interval. Participants in the control group completed their second and third assessments by mail. Trained research assistants in compliance with institutional review board procedures for studies involving human subjects, administered the survey measures.

Program Compliance

From the initial sample of 94 participants, seventy-two completed all assessments. Nine participants in the Tai Chi group (18% attrition rate) dropped out of the study for reasons such as traveling and family-related commitments. Thirteen participants dropped out of the control group (29% attrition rate) because of unwillingness to wait for the Tai Chi class offered at the end of the study. Thus, the total attrition rate at the end of the study was 23%. Class attendance was recorded for each subject in the experimental group. The average attendance rate (2 times/per week, a total of 48 possible sessions) in the Tai Chi group was approximately 90% with a median compliance of 41 sessions, and ranging from 29 to 47 sessions. Reasons for missing sessions included inclement weather, holidays, and family commitments.

Statistical Analyses

Before conducting the primary analyses of the study, we examined whether attrition influenced the representativeness of the remaining subject sample and whether the experimental participants were different on demographic variables that were not controlled in the random assignment procedure. All tests were completed using the analysis of variance (ANOVA) procedure. Following these preliminary tests, repeated measures ANOVA procedures (with Group as a between-subjects factor and Time as a within-subject factor) were used to examine changes over time and differences between Tai Chi and control groups. An interaction between Group and Time indicated a difference in group responses on HRQL measures, suggesting a treatment effect. The primary outcomes (dependent variables) analyzed were the six dimensions of SF-20. Statistical significance was defined as a P value of less than .05; all P values are two-tailed.

Effect sizes (ES) were calculated using the following formula: effect size = (x2 - x1) / SDP, where x2 is the mean score at Week 24 for the experimental group, x1 is the mean score at Week 24 for the control group, and SDP is the pooled standard deviation at Week 1. The effect size was interpreted as follows: an ES greater than .8 was large, an ES around .5 was moderate, and an ES less than .2 was small. All analyses were performed using the Statistical Package for the Social Sciences, Version 9.0 (SPSS, 1998).

Results

Baseline Characteristics of Participants and Dropouts

Preliminary analyses (t-tests or chi-square tests) comparing participants in the Tai Chi group (n = 49) and the control group (n = 45) indicated that the two conditions did not differ significantly (p .09) at baseline on any of the demographic measures involving age, gender, income, and education. Additionally, there were no significant differences (p.13) by group on any of the HRQL measures at baseline. These results indicated no need for adjusting any demographic and/or baseline measures in the subsequent main analyses.

Furthermore, two (completion status: drop vs. remain) by 2 (condition) analysis of variance (ANOVAs) on age, gender, income, and education revealed that there were no significant differences between those who dropped (n = 22) and those who remained (n = 72), nor were there any interactions between completion status and conditions (p=.25).

Change Over Time in HRQL Measures

The outcomes of the study were tested by comparing participants receiving Tai Chi with those on the waiting-list condition on change in HRQL measures from pretest to posttest. Scores from the various dimensions of SF-20 were entered into univariate repeated measures ANOVAs to test for differences in follow-up HRQL scores between individuals in the Tai Chi and control groups. Because preliminary analyses indicated that the participants who dropped out were similar to those who adhered to intervention on the demographic and outcome variables, we analyzed the change in HRQL measures with participants who completed the study (n = 72).

The results of ANOVAs indicated that, over the course of the study, individuals receiving Tai Chi had better outcomes had those on the waiting list on all the SF-20 subscales (significant Group by Time interaction): $F(2,69) = 4.234$, $P < .02$, for physical functioning; $F(2,69) = 2.953$, $P < .05$ for social functioning; $F(2,69) = 5.369$, $P < .007$, for role functioning; $F(2,69) = 4.630$, $P < .05$ for bodily pain; $F(2,69) = 2.763$, $P < .01$, for mental health; and $F(2,69) = 6.653$, $P < .002$, for health perceptions.

Table 1 presents means and standard deviations of various health functioning indicators for participants in the experimental and control groups at the pretest, middle, and posttest.

Table 1
Means And Standard Deviations of HRQL Indicators for Experimental and Control Groups at Pretest, Middle, and Posttest Sessions (n = 72)

	Pretest (M, SD)	**Middle Test (M, SD)**	**Posttest (M, SD)**
Experimental Group (N = 40)			
Physical Functioning	74.167 (26.474)	76.250 (25.987)	84.750 (18.945)
Social Functioning	91.875 (19.926)	91.875 (18.246)	95.625 (19.620)
Role Functioning	82.500 (30.592)	80.625 (32.762)	83.250 (24.645)
Bodily Pain	58.125 (27.379)	61.250 (25.913)	63.000 (24.200)
Mental Health	75.625 (16.946)	71.875 (18.345)	77.237 (18.091)
Health Perception	59.605 (17.613)	65.937 (21.787)	70.147 (21.904)
Control Group (N = 32)			
Physical Functioning	73.177 (27.658)	66.250 (34.524)	66.875 (32.373)
Social Functioning	79.688 (30.742)	79.688 (28.707)	67.969 (32.524)
Role Functioning	78.125 (35.212)	82.031 (31.899)	62.500 (29.099)
Bodily Pain	60.156 (31.661)	57.813 (32.027)	49.375 (25.895)
Mental Health	77.344 (19.513)	63.281 (26.073)	63.816 (29.615)
Health Perception	4.789 (21.473)	57.422 (28.373)	57.537 (25.388)

*Values in the parentheses are standard deviations.

Higher scores indicate an increase/improvement in HRQL measures over time. Examination of means for each condition showed that, in general, participants in the Tai Chi group reported a significant improvement (i.e., higher HRQL mean scores) over time in all domains of SF-20 measures. Identical results were obtained when these dropout individuals were also included in the analyses.

Using the five-point difference as the criterion (Ware et al., 1993), only changes (i.e., from baseline to posttest) in Physical Functioning and Health Perceptions reached clinical significance (see Table 1).

The effect sizes were: .69 (physical functioning), .92 for social functioning, .78 for role functioning, .5 for bodily pain, .56 for mental health, and .54 for change in health perceptions. Based on our criteria on effect size, these values were judged as meaningful treatment effects.

Discussion

This study filled a gap in the gerontological literature and showed that exposure to a 6-month Tai Chi exercise program can effect long-term changes in HRQL identified by the General Health Survey, a well-established HRQL measure which includes distinct dimensions of quality of life indicators.

On all measures, Tai Chi exercise resulted in significant changes in the HRQL indicators except social functioning, compared to the no-Tai Chi waiting-list control. Overall, Tai Chi participants reported significant improvements over the 6-month period in physical-, role-functioning, bodily pain, mental health, and health status.

Over the 6-month intervention, we observed an 18% drop-out rate in the Tai Chi group. This is relatively low given the fact that many who decide to become more physically active return to a sedentary lifestyle within three to six months (Dishman, 1988; Martin & Sinden, 2001). Failure to complete the study was attributed to traveling or family-related commitments rather than dissatisfaction with the program itself. In fact, people who completed the study looked forward to enrolling in further courses offered in the community. Such a finding corroborates findings of Wolf et al. who noted that almost half of their Tai Chi participants chose to continue meeting informally after the study was completed.

Results from present study have a number of implications. First, important domains of HRQL such as physical and psychological health can be enhanced through Tai Chi because it improves balance and coordination in a framework of meditation and concentration thus, theoretically, integrating one's physical and mental states. This is important because global wellness is predicated not merely on the functioning of each domain but the interaction between the two.

Second, physical functioning is an important HRQL indicator which affects continued independence of older adults. As with other studies that have shown difficult-to-observe change in physical functioning (Kutner et al., 1997; Stewart et al., 1997), this study demonstrated that physical functioning could be improved through a relatively short 6-month Tai Chi program. Overall, the Tai Chi group had 83% improvement across the six individual functional status items, suggesting the Tai Chi intervention enabled participants to improve aspects of their physical functioning. Thus, Tai Chi should be considered favorably as a health promoting program for older adults with or without physical limitations. Finally, results from this study appear to support health promotion and disease prevention benefits of Tai Chi in older adults, which may be achieved without the strenuous physical impact of more common activities such as jogging or aerobics.

There are several limitations of the current study. First, the study used exclusively self-report (self-rated) health measures, which rely on respondents' memories. Future studies need to consider use of objective physical health measures (e.g., functional tests) that would not only allow us to confirm the current findings but also more rigorously examine the effects of Tai Chi on quality of life. Another limitation is that the study sample was comprised of volunteers who might have been more highly motivated to

participate in activity than the typical sedentary older adult population. Additionally, the mode of advertising the study (local newspapers, senior center flyers, retirement community notices) could also have created a selection bias toward people who receive and read newspapers and those who live in or visit certain locales in the community. Therefore, the sample might not be representative of the older adult population as a whole. Finally, although the randomized nature of the study is a strength, we must be mindful of the absence of an attention control group. This experimental protocol does not control for the influence of attention on the outcome measures. It is possible that the participants in the Tai Chi group were benefiting from the social support and attention provided by the instructors and members of the classes, with respect to both the outcome variables and compliance. Further studies should control for this effect by having the control participants attend non-exercise health education classes in a group format (Wolf et al., 1996).

In summary, we conclude that Tai Chi classes taught by experienced Tai Chi teachers improved self-reported quality of life among older persons in a 6-month randomized controlled study. The results confirm that Tai Chi can also be considered a suitable and acceptable health promoting activity for older adults over a long term period, as evidenced by the low rate of attrition in the classes. The extent to which the Tai Chi – HRQL relationship is moderated by psychosocial variables could be explored in future studies. Similarly, it would be useful to replicate our findings using individuals with functional deficits and psychological impairment.

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