

The Role of Tai Chi Exercise in Promoting Health Benefits for Older Persons

Fuzhong Li, Ph.D., Oregon Research Institute

Tai Chi, or Taijiquan to be exact, originated in China about 300 hundreds years ago (China Sports, 1980) and began as a form of martial arts like boxing. It has continued to evolve from being originally used as a combative and self-defense form to a health-enhancing exercise, practiced by individuals of all ages to maintain health and prevent disease. As an alternative exercise, Tai Chi has drawn increasing research interest, with accumulating evidence showing the therapeutic value of Tai Chi to overall health and well-being. The goal of this paper is to summarize current research findings with a particular focus on geriatric populations, discuss findings with respect to their practical implications, and highlight future research directions.

Overview of Research Findings

A number of excellent review articles exist showing evidence that Tai Chi generates various health benefits for individuals of varying age groups and patient populations (Fasko & Grueninger, 2001; Lan, Lai, & Chen, 2002; Li, Hong, & Chan, 2001; Verhagen, Immink, va der Meulen et al., 2004; Wang, Collet, & Lau, 2004; Wayne, Krebs, Wolf, et al., 2004; Wu, 2002). Without overdue redundancy, the following provides a summary review of research studies that involve randomized controlled trials (RCTs) although results from non-RCTs are reported in the absence of RCTs. With aging processes, declines in physical and mental status in older adults often result in balance control impairments, functional limitations in locomotor activities, disability in particular activities, and decreased quality of life. Therefore, this review also focuses on health outcomes that have been shown to be clinically most relevant to this population. These include balance and falls, musculoskeletal conditions, sleep quality, cardiovascular and respiratory function, and psychosocial wellbeing.

Balance Control, Falls, and Fear of Falling

Falls are significant public health problem among older adults (Murphy, 2000; Stevens, 2005), making it a major threat to the independence and quality of life of older adults, as well as imposing significant burden to individuals, society, and national health systems (National Action Plan, 2005). As a stand-alone exercise intervention, Tai Chi has been shown to reduce the risk for falls.

Wolf and his colleagues (1996) conducted the very first randomized controlled trial comparing the efficacy of two methods of exercise on falls. Community living healthy adults were randomized to one of three groups: Tai Chi training; computerized balance training; and an attention control. Results of this 15-week trial showed that Tai Chi participants experienced significant reductions (by about 47%) in falls compared to the exercise control participants. In a follow-up 48-week RCT, Wolf et al (2003) evaluated Tai Chi with older adults who were less robust (that is, transitioning to frailty). No significant between-experimental group reductions in falls were observed. However, by analyzing fall data from month four through month twelve, the study showed a significantly reduced risk of falls in the Tai chi group compared with the exercise control group.

In an independent study, Li et al. (2005) confirmed the general findings of those reported by Wolf and his colleagues. These researchers reported that, at the end of a 6-month Tai Chi intervention, significantly fewer falls (38 versus 73), lower proportions of fallers (28% versus

46%), and injurious falls (7% versus 18%) were observed in the Tai Chi condition, compared to a low-impact stretching control condition. Overall, the risk of multiple falls in the Tai Chi group was 55% lower than that of the stretching controls. In addition, compared to stretching control participants, Tai Chi participants showed significant improvements in measures of functional balance, physical performance, and reduced fear of falling. Of equal importance, intervention gains in these measures were maintained at a 6-month postintervention follow-up in the Tai Chi group (Li et al., 2004).

Musculoskeletal Conditions

Evidence to date indicates that Tai Chi training preserves or even increases lower-extremity muscle strength. Wolfson et al. (1996) showed that 6 months of Tai Chi training (following their primary interventions) did not improve lower-extremity muscle strength, compared to an exercise control group. However, their data did indicate that Tai Chi training preserved lower-extremity strength gains developed by the intervention. In a 20-week pilot study, Christou et al. (2003) showed that, compared to those in the control condition, Tai Chi participants significantly improved knee extensor strength and force control among older adults.

Tai Chi also appears to be safe and beneficial for patients with rheumatoid arthritis. In a randomized trial among older women with osteoarthritis, Song et al (2003) showed a 12-week Tai Chi program resulted in significant improvements in pain and stiffness in joints, balance, and abdominal strength, and fewer reported perceived difficulties in physical functioning, compared to those of control subjects. Another randomized trial, Hartman et al (2000) showed that a 12-week program significantly improved osteoarthritis symptoms such as fatigue, arthritis self-efficacy, feelings of tension, and satisfaction with general health status.

More recent evidence points to the potential of Tai Chi as a weight-bearing exercise for retarding bone loss in older women. In a 12-month randomized trial, Chan et al (2004) tested the hypothesis that Tai Chi may retard bone loss in early postmenopausal women. At the end of the trial, bone mineral density (BMD) measurements revealed a general bone loss in both Tai Chi and control subjects at all measured skeletal sites, but with a slower rate in the Tai Chi group. Although the BMD findings were equivocal, the findings lend some support for the potential of Tai Chi to retard bone loss.

Cardiovascular and Respiratory Function

Although numerous studies have evaluated the effects of Tai Chi on cardiovascular and respiratory function, no RCTs have been reported that involve older adults. A number of Taiwan-based observational studies have shown improvements in cardiorespiratory function resulting from Tai Chi. For example, among long-term older adults practicing Tai Chi, significantly better cardiorespiratory function has been reported (Lai, Lan, Wong, & Teng, 1995; Lan, Lai, Chen, & Wong, 1998), and improvements were also observed among coronary artery bypass surgery patients deemed to be at low risk during their participation in a Tai Chi exercise program (Lan, Chen, Lai, & Wong, 1999).

Hypertension

Tai Chi is a low-impact activity with self-paced and fluid movements, making it appropriate as a means to reduce blood pressure in people with hypertension. Two intervention trials compared the effects of Tai Chi and aerobic exercise on blood pressure – a surrogate for hypertension. An earlier study by Channer et al (1996) showed that over 11 sessions of exercise, both Tai Chi and aerobic exercise were associated with reductions in systolic blood pressure; Tai Chi was also associated with reductions in diastolic blood pressure in a sample of patients recovering from acute myocardial infarction. In a different study by Young et al. (1999), physically inactive older women with systolic blood pressure 130-159 mmHg and diastolic blood pressure > 95 mmHg were randomized to a 12-week moderate-intensity aerobic exercise program or a Tai Chi program of light activity. At the end of the intervention, the Tai Chi group decreased 7.0 mmHg of systolic and 2.4 mmHg of diastolic blood pressure. No significant differences were observed between the two exercise activities. The authors concluded that programs of moderate intensity aerobic exercise and light exercise may have similar effects on blood pressure in previously sedentary older individuals.

Quality of Sleep

Self-reported sleep complaints are common among older adults (Neubauer, 1999) and it is estimated that up to 50% of elderly persons complain about their sleep (Alessi, 2000). Li et al. (2003) conducted a six-month intervention trial to examine the impact of a simpler Tai Chi program on improving quality of sleep and reducing daytime sleepiness among older adults reporting moderate sleep complaints. Participants were randomly assigned to a Tai Chi group or an exercise control group. At the end of the study, Tai Chi participants reported significant improvements in several sleep-quality related measures in comparison to the control participants; with reduced sleep latency (by about 18 minutes per night) and daytime sleepiness, and improved sleep duration (by about 48 minutes per night). The study provided preliminary evidence linking the benefits of Tai Chi exercise to improved quality of sleep and reduced daytime sleepiness in older adults.

Psychosocial Wellbeing and Confidence

Li and his colleagues (2001a,b,c,d, 2002a, 2002b) provided a series of reports examining the extent to which Tai Chi enhanced older adults' multidimensional psychological well-being and health-related quality of life indicators. In a 6-month randomized controlled trial, healthy older adults were randomly assigned to either a control condition or Tai Chi. Results indicated that Tai Chi participants reported higher levels of health perceptions, life satisfaction, positive affect, and well-being, and lower levels of depression, negative affect, and psychological distress (Li et al., 2001a). Participants also showed higher levels of both domain-specific physical self-esteem (Li et al., 2002b) and exercise self-efficacy relevant to movement confidence (Li et al., 2001c). Change in the level of movement self-efficacy was found to be significantly related to change in physical functioning (Li et al., 2001b). Similar profiles have been reported by other researchers (Kutner, Barnhart, Wolf, McNeely, & Xu 1997) in that Tai Chi practice resulted in improved well-being, increased alertness, relaxation, better mental outlook, achievement, and greater confidence.

Practical Implications

The previous summary and review makes it clear that Tai Chi provides multiple health and therapeutic benefits for older adults. Thus, some discussion of practical implications appears to be in order.

Fall Prevention

Falls can result in devastating consequences for older adults. Accumulating evidence to date suggest that Tai Chi may be an effective means of improving deficits in balance and functional limitations, and therefore, may serve as a therapeutic exercise for balance and strength, and consequently, reduce the risk of falling and the rate of falls in older adults. Tai Chi may also be considered as an exercise modality that generates confidence building to counteract fear of falling, a common psychological symptom of falls among community adults.

However, Tai Chi does not provide a quick fix for the fall problem. Most research in this area has focused on short-term results. Findings from current RCTs show that, however, a minimum of three months training is required before clinically meaningful reductions in risks of falling can be achieved, suggesting the need for long-term, sustained, and frequent practice, perhaps on a day-to-day basis, to obtain the full benefit.

Tai Chi as an Alternative, Therapeutic Exercise

Tai Chi has been recommended for treating many chronic conditions. For example, as a low-impact, low-intensity alternative exercise therapy, Tai Chi has also been proposed as a potential option for the management of osteoarthritis (Lumsden, Baccala & Aartire, 1998). As a fall prevention activity, Tai Chi has emerged as an appropriate stand-alone balance training program for older adults to improve balance and prevent falls (JAGS, 2001).

But even though Tai Chi appears to have numerous benefits to participants, it is still too early for physicians to begin prescribing Tai Chi as a remedy for chronic health problems because many of the studies have design limitations (Wang et al., 2004), making it difficult to generalize results to broader patient populations. In this regard, patients with chronic health problems need to take precautions before beginning a Tai Chi program, because for some people Tai Chi could worsen medical conditions or problems/ symptoms. In some cases, appropriate modifications may be needed to better accommodate patients' special needs or physical limitations.

Program Costs, Logistics, and Protocols

One of the most desirable aspects of Tai Chi is its absence of a need for high technology in promoting health. Tai Chi is easily distinguished from highly technical computerized balance training protocols, and may be just as successful in achieving fall reduction or balance improvement objectives; certainly, Tai Chi is more practical. Tai Chi is a low-cost exercise regimen because special equipment or facilities are not needed (Lan et al., 2002; Li et al., 2003). Li et al (2001b) reported that, in a 6-month RCT, the total direct cost was approximately \$9000 (an average of \$3.50 per person per session). Others (Wilson & Datta, 2001) have reported that a twice weekly Tai Chi program was cost-saving whether direct benefits alone (hip fracture costs averted) or direct plus indirect benefits were considered, with a total net cost savings of \$1274.43 per person per year. When considering direct costs only, the net cost savings were \$8.04 per participant per year. Lower costs ensure that more community-dwelling older adults have

sufficient access to programs, and abundant opportunities to participate, which is likely to have profound public health implications.

While costs of learning Tai Chi are potentially low, one should not underestimate the fact that Tai Chi is a complex system of movements that, when performed, requires body awareness, motor coordination, and agility; features that could make Tai Chi less immediately deliverable to community adults (Li et al., 2003). Therefore, even though the benefits of regular Tai Chi exercise are quite clear, the challenge of maximizing the opportunity for older persons remains because certain movements may be beyond the capabilities of some elderly individuals or others with disabilities. Thus, there is a need to modify existing Tai Chi protocols to develop forms that are simple, easy to perform, and enjoyable (Chen, 2002; Li et al., 2003; Wolf et al., 1997), and that do not require years of sustained practice to master.

Tai Chi Styles

There are several styles of Tai Chi, some of which are historic/traditional and some of which are of more recent origin. The earliest known form can be traced to the Chen style and evolved and progressed into multiple styles or schools. Currently, there are five main schools of Tai Chi (People's Sports, 1996), each named after the style's founding family: (a) Chen, (b) Yang, (c) Sun, (d) Wu (Jian Qian), and (e) Wu (He Qin). Each style has a characteristic protocol that differs from other styles in the postures or forms included, the order in which they appear, the pace at which movements are executed, and the level of difficulty. For example, one significant difference between Chen and Yang styles is that Yang style movements are relaxed and evenly paced. By comparison, the Chen style is characterized by alternating slow movements with quick and vigorous movements, including restrained and controlled actions/motions, reflecting its martial origin.

Yang Style Tai Chi, which evolved from the Chen school, is probably the most popular Tai Chi style being practiced today (e.g., Swaim, 1999; Yu & Johnson, 1999). Yang style movements are performed in a relaxed and flowing manner, with the trunk erect as the axis of all movements, making it immediately suitable for elderly, frail, or disabled populations. To date, the Yang style, with its variations, has been used as an therapeutic exercise modality in most medical and behavioral research. Although there are multiple versions of the Yang style (both short and long, covering 24-, 48-, 88-, and 108-Forms) (China National Sports Commission, 1983), the 24-Form, based on the most popular sequences of the Yang Chengfu school (China Sports, 1980; People Sports, 1996), is the most readily adaptable to the lifestyles and living situations of older adult populations. It is also the most accommodating, requiring minimal demands of personal strength, speed, endurance, flexibility, and motor skills for participation.

Is Tai Chi Ready for Dissemination?

In a 2001 joint communiqué on the prevention of falls among the elderly, the American Geriatrics Society, the British Geriatrics Society, and the American Academy of Orthopedic Surgeons suggested that Tai Chi "...is a promising type of exercise, although it requires further evaluation before it can be recommended as the preferred balance training" (JAGS, 2001). Since the publication of this joint communiqué, one large successful RCTs has been published (Li et al., 2005) providing supporting evidence documented by Wolf et al.'s earlier work (1996). As a result of these studies, we should be asking questions about how we can most effectively translate and disseminate the Tai Chi program. With this accumulated evidence, the time is near

for Tai Chi to be recommended as a preferred exercise for balance training and be routinely prescribed for older patients at risk for falling following appropriate screening.

Future Research Directions

Despite the increasing interest in studying the effectiveness of Tai Chi training and the resulting evidence of health benefits, there remain areas that require further research. We highlight a few of these.

A Need to Understand the Mechanisms of the Benefits Shown

Although findings from Tai Chi intervention studies are important from a public health perspective, they provide little information relative to the underlying mechanisms that may produce such effects. In this regard, little attention has been given considering intervention/treatment mediators or moderators that help identify causal pathways between treatment and outcome, and possible mechanisms through which a treatment might achieve its effects. For example, although Tai Chi has repeatedly been shown to improve balance, possible mechanisms by which Tai Chi improves this outcome, and prevent subsequent falls, remains to be determined. Future studies should target specifically older adults with balance impairments, and consider integrated laboratory and/or clinical measures that may help identify specific mechanisms whereby Tai Chi can remedy balance disorders.

A Need to Better Understand Effects to Patients with Chronic Conditions

A review by Wang et al. (2004) concluded that there is insufficient information to recommend Tai Chi to patients with chronic conditions. For example, the impact of Tai Chi on several important geriatric syndromes such as frailty, dementia, and sarcopenia are worthy of study or further research. Large clinical trials, involving populations with specific medical conditions are needed before health professionals can recommend Tai Chi exercise as an alternative to the more conventional exercise forms that have been shown to produce health benefits. The potential application of Tai Chi to important geriatric issues yet to be studied include: obesity, osteoporosis, diabetes, neurological disorders (e.g., Parkinson's disease; peripheral neuropathy).

A Need to Study Long-Term Effects

Tai Chi intervention studies are typically conducted with a short-duration (e.g., 3 months, 6 months). Long-term effects of Tai Chi training (e.g., 12 months up to 2 or 3 years) are largely undetermined. Therefore, questions such as how long the established effects on clinical endpoints will sustain over a longer period of time remains to be determined. Certain outcomes may take a longer time to show an effect. Reductions in falls are a good example. Other outcomes such as BMD, may require up to one year to demonstrate clinically meaningful change because Tai Chi is a low-impact activity. Also, research from the general exercise literature indicates that people who participate in an exercise program often fall back into their older inactive lifestyle after a program ends (van der Bij, Laurant, & Wensing, 2002). Although anecdotal evidence suggest that participants remained active upon program termination (Li et al., 2001b; Wolf et al., 1996), critical issues such as getting people to initiate and maintain the Tai Chi activity over a long-term need to be addressed.

A Need to Evaluate Programs That Can Be Disseminated in Broader Community Settings

Ultimately, for the results of the research-based evidence to have greater public health impact they must be diffused and made accessible to the community. However, it remains unclear whether the general community can readily implement or adopt these Tai Chi training protocols despite evidence of their tested efficacy. To date, there is no widespread, nationally available Tai Chi-based falls prevention program that is based on the effectiveness of scientifically controlled studies. In this regard, program evaluation research is needed to translate effective interventions into a program that is implementable in community settings.

The Oregon Research Institute is currently conducting a project to move effective interventions into community practice. The project has identified randomized controlled studies of scientifically-based effective Tai Chi fall interventions and focuses on issues related to “reach” (i.e., proportion of older adults who are willing to participate in a given Tai Chi program initiative), “uptake” (adoption; i.e., the proportion of settings and service agencies who are willing to initiate a program), and “implementation” (i.e., the intervention agents' fidelity to the various elements of a Tai Chi training protocol, including consistency of delivery as intended and the time and cost of the intervention). The intended results of this translation and dissemination project will provide an effective, evidence-based falls prevention package that can be implemented in community settings to improve functional ability and reduce fall prevalence among community-dwelling older adults.

Summary

The extant research evidence provides strong support for what was originally considered “anecdotal evidence” about the health benefits of Tai Chi for older adults. Overall, Tai Chi has been shown to have physiologic and psychosocial benefits and appears to be safe and effective in promoting balance control and muscular strength, and cardiovascular fitness for older adults. More research is needed, with rigorous scientific methodologies, to fully understand the mechanisms whereby Tai Chi produces these health benefits. From a public health perspective, immediate efforts are needed to translate programs that can be disseminated in local settings that target community healthy older adults.

Fuzhong Li, Ph.D., is a Senior Research Scientist at the Oregon Research Institute, Eugene, OR.

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