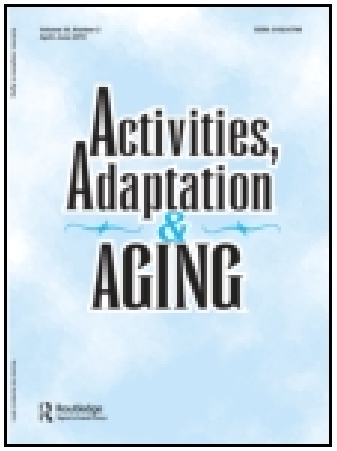

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Determining the Effects of Tai Chi on Dynamic Balance and Fear of Falling in an Elderly Population

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Determining the Effects of Tai Chi on Dynamic Balance and Fear of Falling in an Elderly Population

J. Kyle Busing

ABSTRACT. In this study, the potential value of Tai Chi in improving dynamic balance and falls self-efficacy in a healthy elderly sample was investigated. Performance of the 33 Tai Chi practitioners on the 8-foot-up-and-go balance test and the scores on the Falls Self-Efficacy Scale was compared with a nonpredictor control group. A multivariate analysis of variance demonstrated that there was not a significant difference between the practitioners and the nonpractitioners on pre-test dependent variables ($g > .57$). The practitioners did significantly improve their time on the balance test after the intervention ($g < .05$). However, the experimental group did not improve their self-reported measures on the self-efficacy scale ($r > .98$). *[Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <http://www.HaworthPress.com>*

KEYWORDS. Tai Chi, self-efficacy, falling, elderly

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INTRODUCTION

Statistics demonstrate that the population in the United States is rapidly aging. Baby-Boomers, those between the ages of 45 and 60 years, will soon be reaching the age of retirement. Population projections predict that the number of Americans between the ages of 65 years and 85 years will reach 58 million by the year 2030 (U.S. Census Bureau, 2003). While this population is growing quickly, the fastest growing population in America is that of people aged 85 years and older. The number of individuals in this age group will number 9 million by 2030 and will be more than double that by 2050 (U.S. Census Bureau, 2003). Various health concerns accompany aging individuals, many of which can lead to falling.

The elderly population is at the highest risk for falls among all Americans (Runge, 1993). Not only do the elderly have the highest risk for falling, but the risk of dying from falls is eight times that of children and the rate of hospitalization is 10 times higher in the elderly (Runge, 1993). Fall-related injuries are the leading cause of death among Americans aged 65 and older and more than 60% of deaths resulting from falls are suffered by individuals aged 75 and older (Murphy, 2000). The lifetime cost of falls for people over the age of 65 is three times higher than that of children and hospitalization costs are estimated at 10 million dollars a year (Bogle-Thorbahn & Newton, 1996).

One in three persons over 65 years of age will fall at least once in the next year (Bogle-Thorbahn & Newton, 1996). Tinetti and Speechley (1989) reported that 25% of elderly people over the age of 70 in a community setting fall every year and that over 50% of the institutionalized elderly fall every year. Some researchers suggest that 50% of people aged 80 years and older will fall at least once in the next year (Bogle-Thorbahn & Newton, 1996). Coupled with the fact that the rate of hospitalization due to falling is ten times higher in the elderly than in other populations, it is important to understand the causes of falls (Runge, 1993). One such cause is the loss of dynamic balance. It is the purpose of this study to explore the effects of Tai Chi on dynamic balance and fear of falling.

Craik (1989) suggested that the causes of falling can be considered to fall into two different categories, one of which is the result of a loss of balance. Factors that result in a loss of balance include reduced sensitivity of sensory systems and reduced muscle strength. Reduced quadriceps strength has been linked to individuals who have fallen multiple times (Lord, Clark, & Webster, 1991). This lack of muscle strength can hinder

a person's ability to compensate for a sudden change in balance or a loss of balance.

An increasing life span and the cost of health care related to falls highlight the need to prevent falls in the elderly. Prevention of falls would limit the cost of health care and could also affect the quality of life issues that are common to elderly people. Introduction of elements of a healthy lifestyle, such as exercise, may be influential in reducing the risk of falling. Tai Chi is an intervention strategy with the potential for improving dynamic balance and also for introducing a healthier lifestyle to the elderly.

Tai Chi is a style of martial art that originated in China and is over 3,000 years old. The movements of Tai Chi are done slowly, smoothly, and in a relaxed manner. These patterns consist of motions such as punching and kicking. Tai Chi is easy to learn, inexpensive, and can be helpful in developing and maintaining a favorable outlook toward physical exercise for individuals of all ages. The facilities and equipment required to practice Tai Chi are minimal. Tai Chi can easily be done in assisted living or community centers because all of the movements can be done in place if required. Also, because the pattern can be done in a short period of time, and can be adapted to a person's individual needs as well as time schedule, there are few limiting factors to the implementation of a Tai Chi program. These features make Tai Chi an excellent form of exercise for an elderly population.

Tai Chi has been used previously as an exercise intervention for the elderly. Results of research studies indicate that Tai Chi has been positively associated with the reduction of falls. For example, Wolf, Barnhart, Kutner, McNeely, Coogler, and Xu (1996) reported that Tai Chi delayed the onset of falls in the sample investigated. This study, however, did not find any effect on measures of balance.

Prior research has shown that Tai Chi is an exercise intervention that can be effectively used with an elderly population for reducing falls. Tai Chi has also been found to positively change psychosocial outcomes as well (Wolf et al., 1996). One such psychosocial construct is falls self-efficacy. Falls self-efficacy describes a person's confidence in their own ability to complete activities without falling (Tinetti, Richmand, & Powell, 1990).

A person's perception that they are able to successfully complete an activity will increase the possibility of a person engaging in that activity (Marcus, King, Clark, Pinto, & Bock, 1996). This confidence is behavior specific, however, and so it would be valuable to develop specific exercise intervention programs that may influence falls self-efficacy in

the elderly. Tai Chi has been found to reduce fear of falling, but it is unknown how Tai Chi will affect confidence toward performing certain activities of daily living without falling. Improvements in balance may also result from Tai Chi.

Tai Chi

Tai Chi is valuable in affecting physical health in the elderly for a variety of additional reasons. It is predictable in that practitioners of Tai Chi have self-control over the practice of a learned routine or pattern. Tai Chi is also noncompetitive and can be individualized to meet the varying needs of its practitioners. Predictability and a noncompetitive environment are two aspects that are very important to senior adults (Yan & Downing, 1998). The performer of Tai Chi focuses on the movements of the pattern and the resulting physical sensations.

The movements that make up a Tai Chi form are movements that stress dynamic balance. Previous research has indicated that exercise may improve static balance, but little research is available on the influence of exercise on dynamic balance. As Wolf and Gregor (1999) commented, "Phases of the gait cycle involving shifts in weight support (e.g., transitions from double to single support and from single to double support) are critical periods for balance control" (p. 80). The movements of Tai Chi emphasize shifting weight and making transitions from one stance to another. Tse and Bailey (1992) suggest that in accordance with the motor program theory (Schmidt, 1991) Tai Chi may enhance the motor programs stored in the brain. This may train the various balancing systems and thereby create greater steadiness in the body.

This theory has been tested and the results are promising. Tai Chi has been found to significantly influence kinesthetic sense at one angle of joint displacement, and lateral stability and balance (Jacobson, Cheng, Cashel, & Guerrero, 1997). These results support the findings of Tse and Bailey (1992), who found that Tai Chi could reduce falls in the elderly.

Additionally, in respect to fall reduction, other studies have suggested similar benefits for reducing falls in the elderly. Wolf et al. (1996) reported that Tai Chi delayed the onset of falls in the sample investigated. Tai Chi has also been found to improve quality of life indices (Kutner et al., 1997). Through interviews after the Tai Chi intervention, subjects in the Tai Chi group reported a beneficial effect on sense of confidence and also reported that Tai Chi changed their normal daily activities.

Province et al. (1995) studied the effects of Tai Chi instruction on the rate of falls in a study titled "Frailty and Injuries: Cooperative Studies of Intervention Techniques" or FICSIT. The FICSIT study compared findings from eight different communities that had used a variety of physical activity interventions to determine changes in the rate of falling. One of the eight communities in this study used Tai Chi as a form of dynamic balance training. The results of this study indicate that there was a significant decrease in the risk of falling for the group that used Tai Chi training as part of the exercise intervention. This particular group was one of the only two that demonstrated a significant decrease in the risk of falling. Province et al. (1995) described the possible reasons for the effectiveness of Tai Chi as the result of an increased awareness of our balance and/or mobility. By becoming more aware of balance and mobility, more effective means of compensation can be employed by an individual.

Wolfson, Whipple, Derby, Judge, King, Amerman, Schmidt, and Smyers (1996) conducted balance research using computer posturography and single stance time to measure balance. These researchers then employed an intervention program that focused on balance. The balance training focused on real-life tests of balance as well as on clinical treatments, such as the use of a therapy ball and walking on foam. The balance-training group showed a significant improvement when compared with the control group's computer posturography tests.

The subjects participated in the balance training for three months. At the end of the three months, the subjects participated in a six-month Tai Chi program in order to prevent the diminishment of improvements in balance. Thus, Tai Chi was used as a form of maintenance. The results of this investigation demonstrate that Tai Chi, as an exercise intervention, was successful in maintaining the results of balance training for six months beyond the completion of the balance-training program.

Falls Self-Efficacy

The use of Tai Chi may also have psychological and social benefits for the elderly population (Kutner et al., 1997). An important psychological benefit is self-efficacy or confidence in one's ability to complete a specific task successfully (Bandura, 1977). An individual's perception that they are able to perform a behavior can significantly influence the likelihood that a person will engage in that behavior (Bandura, 1986). For the elderly population, balance self-efficacy is related to falling likelihood. The fear of falling often increases as a person grows

older. This fear can have significant effects on the types of activities in which a person will participate. Bandura (1986) also theorized that situational self-efficacy will influence the effort put forth during an activity and also the persistence demonstrated after failures or setbacks occur while engaged in a specific activity.

Tinetti, Speechley, and Ginter (1988) examined confidence levels in completing basic activities of daily living (ADL) without falling and discovered that lower self-efficacy for performing activities of daily living was associated with slower gait speed. Gait efficacy has also been shown to have a significant independent effect on gait speed (Rosengren, McAuley, & Mihalko, 1998). This suggests an association between belief in one's ability to ambulate successfully and characteristics of gait.

Campbell, Borie, and Spears (1989) found that poor gait performance also has an association with falling. Along with the changes in gait, there may be a self-imposed decline in physical activity undertaken by older individuals if the fear of falling becomes too great (Tinetti & Powell, 1993). This decline in physical activity may not be necessitated by an actual physical condition but may just be the result of decreasing efficacy levels. Tinetti et al. (1988) reported that 26% of all fallers avoid activities as do 13% of nonfallers due, in part, to fear of falling. Fear of falling can consequently lead to increased physical dependence in an older population (Tinetti & Powell, 1993).

Measures of Balance

The Mobility Index has been developed as a tool for indicating abnormalities of gait and balance influence on the risk of falls (Tinetti, Williams, & Mayewski, 1986). In a study done by Tinetti et al. (1988), subjects who performed poorly on this mobility index demonstrated an increased number of falls when compared with those who performed well on the mobility index. With training of clinicians in its use, this measurement tool has been found to be reliable (Cipriany-Dacko, Innerst, Johannsen, & Rude, 1997).

Another measure of dynamic balance that has been used is the eight-foot-up-and-go test. This test is a modified version of a three-meter timed up-and-go test developed by Podsiadlo and Richardson (1991). Individuals are asked to rise from a chair and to walk around a cone and to return to the chair. The test uses less space than the three-meter timed up-and-go test. The overall test-retest reliability for this test was estimated at .95 (Rikli & Jones, 1999).

Validation for the timed up-and-go test was also supported by its ecological validity. This test reflects common maneuvers required in daily independent living. Rikli and Jones (1999) reported that up-and-go performance is a good predictor of recurrent falling and is responsive to changes resulting from activity interventions (Podsiadlo & Richardson, 1991; Tinetti et al., 1986).

Training that emphasizes balance appears to be the most effective strategy for decreasing the likelihood of falls in the elderly. Intervention strategies that have focused on this outcome have provided good results (Province et al., 1995). Tai Chi, with its emphasis on dynamic balance has demonstrated very encouraging results in its ability to reduce the likelihood of falls (Province et al., 1995). This is especially important because this component of dynamic balance is one that is often overlooked in exercise interventions but appears to be one of the most important for the reduction of falls.

Tai Chi may also be effective for improving falls self-efficacy. In turn, improved self-efficacy may increase adherence to an exercise program. If efficacy to perform daily activities and exercise is increased, individuals will be more likely to participate in these activities. If Tai Chi is effective in improving balance, there may also be a parallel improvement in the confidence to perform activities without falling. The hypothesis of the author was that Tai Chi would improve dynamic balance and increase self-efficacy for performing activities of daily living.

METHODS

Participants

The participants in this study were a convenience sample of fifty-three elderly adults, from private homes, that were selected from the population that participates in community center programs for the elderly. Only subjects who were ambulatory without the use of canes or walkers and were without the presence of pathologies that would affect adherence or participation in the intervention were included. The sample included elderly adults between the ages of 60 and 85 years. The participants in the study comprised 94% females, 6% males, and all were White/Caucasian.

Prior to participation in this study, each volunteer attended an individual orientation session. During this orientation session information was provided about the purpose of this research study and also about the

Tai Chi pattern that would be taught. During this orientation session each individual was allowed to ask any questions they had about the study. Before commencement of the Tai Chi training program, all participants were made aware of the risks, procedures, and benefits of participation and signed an informed consent in accordance with Internal Review Board policy. After the purpose of the study was explained, individuals were then asked if they would like to participate. The volunteers of this study participated in the Tai Chi intervention for six weeks.

A convenience sample of 15 elderly adults participated in an exercise group. This sample included adults from private homes that participated in community center programs for the elderly. This sample included adults between the ages of 65 and 80. The exercise group comprised 100% females and all were White/Caucasian. Each individual in this sample was informed of the purpose of the study and asked if they were currently participating in a Tai Chi program. After the purpose of the study was explained, individuals were then asked if they would like to participate. If they agreed, each individual completed an Informed Consent to give permission to take part in the study. The individuals in the study participated in exercise activities for six weeks.

Measures

Subjects reported demographic information related to age level and current activity level. Information about the type of current activity and the frequency of activity were requested. Each respondent was also asked to categorize their frequency of exercise as one time per week, two to three times per week, four to five times per week, or more than five times a week. A falls history measure was used to assess the number of previous falls, when the fall(s) occurred, and the circumstances under which each fall occurred. The falls history was an open-ended recall of experiences. Information regarding any previous experience with Tai Chi was collected. If there were previous experience with Tai Chi, information regarding how long the subject had practiced Tai Chi was obtained. Information on Tai Chi practice and how recently practice had occurred was also obtained.

8-Foot-Up-and-Go Test. The 8-Foot-Up-and-Go test is used as a practical measure of dynamic balance. The 8-Foot-Up-and-Go test is a composite measure involving power, speed, agility, and dynamic balance. This test is a modified version of a previously published 3-m timed up-and-go test (Podsiadlo & Richardson, 1991). This test involves getting out of a chair, walking eight feet and around a cone, and walking

back to the chair in the shortest time possible. The score is the time elapsed from the signal "go" until the participant returns to a seated position. The score is recorded as the average time in seconds to perform the task across two trials. This test was given before the exercise intervention began and then was given at the completion of the exercise intervention. Podsiadlo and Richardson (1991) have reported test-retest reliability of the 8-Foot-Up-and-Go test to be .95. These authors also reported this test is significantly correlated with the Berg balance scale. A full description of the 8-Foot-Up-and-Go test is found in Appendix D.

Falls Self-Efficacy Scale. The Falls Self-Efficacy Scale was developed to measure fear of falling in an elderly population (Tinetti et al., 1990). Individuals were asked to indicate their confidence in performing daily activities using a 10-point scale. A sample question from the scale is "How confident are you that you can get in and out of a chair without falling?" This scale has been found to have adequate test-retest reliability ($r = 0.71$) (Tinetti et al., 1990). Face validity has been supported by including commonly performed activities of daily living as selected by physical therapists, occupational therapists, and rehabilitation nurses. Convergent validity was demonstrated by showing that the total score was higher for individuals with low fear of falling, and those who did not avoid various physical activities (Tinetti et al., 1990).

Research Design

Two intervention groups received identical Tai Chi instruction throughout this study. The groups were established when individuals agreed to participate in the study. Each individual selected the intervention session that he or she preferred to attend. Each group received instruction in the Yang style 24-Form Simplified Tai Chi (Yan & Downing, 1998). The 24-Form Simplified Tai Chi Yang style pattern is a Tai Chi pattern that uses slow movements throughout the entire form. The pattern is a sequence of punches, kicks, and parries, utilizing many different stances, with a focus on correct breathing. The postures in this style are transitory and emphasize movement around the center of balance. Movements of this form require many shifts of weight by the subjects.

Each intervention group received Tai Chi instruction once a week for six weeks. The instruction consisted of group participation in the Tai Chi form following an observation of the instructor. The individuals in this group learned new movements for the first half of the class and then practiced the form with all the movements that had been learned to that point. The instruction lasted for one hour with a warm-up period of five

minutes and cool-down period of five minutes for a total of one hour and ten minutes.

The exercise group participated in an exercise class that combined low-impact aerobics and low-impact weight bearing exercises. This exercise class met once a week. The individuals in this group performed low-impact aerobic exercise for the first 35 minutes of the class and then participated in weight-bearing exercises for the next 15 minutes. There was a five-minute warm-up and cool-down period during each class. A pre-test balance measurement and also a pretest falls self-efficacy measurement were taken prior to the beginning of the first exercise class. The control group participated in this exercise program for six weeks. A post-test dynamic balance measure and a post-test falls self-efficacy measure were taken during a ten-minute appointment three days after the final exercise instructional session.

Collection of Data

During the initial orientation session, the subjects were informed of the general purpose of the research experiment, shown the eight-foot-up and go test, shown the Tai Chi pattern that would be used, and were allowed to ask any questions. At the completion of the initial orientation session, each participant was scheduled for a ten-minute appointment to collect his or her pretest dynamic balance measurements. This data was collected using the eight-foot-up and go test. These measurements were taken individually. Post-test dynamic balance measurements were taken during a ten-minute appointment three days after the final Tai Chi instructional session. Post-test balance measurements were taken using the eight-foot-up and go test. Pre-test falls self-efficacy was assessed at the beginning of the initial Tai Chi instructional session and post-test falls self-efficacy was assessed during the ten minute-appointment three days after the final Tai Chi instructional session.

Statistical Methods

In relation to the hypotheses of interest, the data were statistically analyzed using a repeated measure analysis of variance (ANOVA). The dependent variables were falls self-efficacy and dynamic balance and scores on these outcome variables were assessed in relation to group differences. All differences were considered significant at $p < .05$ level. The statistical analysis was completed using the SPSS program.

RESULTS

Participants and Descriptive Statistics

The study comprised 33 participants (M = 69 yrs; SD = 5.7 yrs.). These participants self-reported as being in good health. The majority of the participants reported low scores on the Falls Efficacy Scale at pre-test (M = 12.60; SD = 4.42). The exercise group consisted of 15 participants, who were all relatively healthy, with the majority also reporting low scores on the Falls Efficacy Scale (M = 12.45; SD = 3.88).

Participants' times in completing the up-and-go test also revealed that the majority of the participants demonstrated a relatively fast time in completing the pre-test up-and-go test (M = 7.22 seconds; SD = 1.80 seconds). The exercise group was also timed in completing the up-and-go test. The majority of this group also demonstrated fast times in completing the post-test up-and-go test (M = 7.00 seconds; SD = 1.94 seconds).

The attrition rate in the intervention group was high during the study. The study took place during late spring and the beginning of summer and 20 participants were not able to complete the intervention program due to vacation plans. Nine participants expressed displeasure with Tai Chi and chose not to continue participation. One participant developed symptoms that consisted of pain in the knee that eventually required surgery and therefore this participant was unable to continue. Travel plans interfered with eight control group subjects' compliance as well. Due to the small number of exercise group subjects, four additional control group subjects were recruited after the initial research period. The additional participants were contacted during the sixth week of their aerobic class. These additional subjects were recruited to increase the power of the study. Because of this, pre-test up-and-go scores and pre-test self-efficacy scores were not available for the control group.

A repeated measures analysis of variance (ANOVA) was conducted to test for differences between the control and the experimental group on the dependent variables of post-test self-efficacy and balance. This analysis indicated that there was not a significant effect of the Tai Chi intervention when compared with the control group on the dependent variables F (2, 41) = .57, $p > .57$, Wilks' Lambda = .973.

For the experimental group, within group analysis was conducted for balance and self-efficacy. There was a significant effect for balance F (1, 32) = 5.42, $p < .05$. An examination of the pre-test and post-test means indicated that balance improved with the intervention. Time to

complete the balance test at post-test decreased ($M = 6.78$, $SD = 1.37$, $n = 33$), when compared with the beginning of the intervention program ($M = 7.22$, $SD = 1.80$, $n = 33$).

For the experimental group, the Tai Chi treatment did not have a significant effect on the post-treatment falls self-efficacy scores when compared with the pre-treatment, $F\ (1, 32\ ) = .001$, $p > .98$. Thus, we may not conclude that the Tai Chi treatment had any positive effect on the falls self-efficacy of the participants.

DISCUSSION

The present study was an investigation conducted to determine the effects of a Tai Chi intervention program on the dynamic balance and falls self-efficacy of an elderly sample. Although the effects of Tai Chi on balance have been documented (Yan, 1998; Jacobson et al., 1997; Tse & Bailey, 1992), previous research has not addressed the effects of Tai Chi on dynamic balance. As discussed earlier, Tai Chi has been found to improve sense of confidence, but the effects of Tai Chi on self-efficacy related specifically to falling are not known.

The results of this study indicate that the effect of the Tai Chi intervention on balance was not statistically significant between the intervention and the exercise groups on the dependent variables of balance and self-efficacy ($p > .57$). Balance scores in the intervention group improved with time, but there was not a significant improvement in the balance scores of the intervention group when compared with the exercise group. Thus, it is not possible to conclude that the Tai Chi intervention had a greater effect on dynamic balance than did the exercise intervention. But, it is important to realize that both the Tai Chi and the exercise interventions had an effect on balance.

The current study utilized an assessment of dynamic balance that has not been used in previous studies involving Tai Chi and balance (Tse & Bailey, 1992, Jacobson et al., 1997). Assessments of static balance such as a timed one-legged stance or postural sway do not measure the ability of an individual to maintain control over their center of gravity as do dynamic balance measures. Consequently, measurements of dynamic balance may give a more accurate reflection of the effect of Tai Chi on balance. Activities of daily living such as putting groceries away, walking, or opening doors all require movement by an individual that demand balance. These tests are functional and accurate for measuring dynamic balance and have been successful in predicting independence

in performing activities of daily living (Judge et al., 1996). Other dynamic balance tests such as stability platforms have been used to measure balance (Jacobson et al., 1997) during Tai Chi interventions. These tests are not as functional outside of the laboratory, however. Measures of dynamic balance should also be assessed often as to determine the effectiveness of any training intervention.

The training intervention given during this current study was of a relatively brief period of time. Other Tai Chi studies have used intervention lengths ranging from 15 weeks to six months (Wolf et al., 1996; Wolfson et al., 1996). Tse and Bailey (1992) conducted an *ex post* facto study that involved subjects who had been practicing Tai Chi from one year to 20 years. Their study found that Tai Chi improved postural control. In the study done by Wolf et al. (1996), Tai Chi was found to be associated with less risk for falling even in the presence of identified risk factors such as diminished balance control. The current study offers further support for those findings, but also suggests that benefits may be obtained in a shorter span of time.

Specific support for the use of a six-week intervention cannot be found in the literature but Spirduso (1995) has suggested that force production measures can change rapidly with beneficial change occurring within two months. These changes can occur even within an elderly population. The use of a one-hour a week, six-week intervention could easily be provided for the elderly and also for independent elderly persons who are trying to obtain rapid improvement in balance.

The intervention did not have any effect on falls self-efficacy. This result is not consistent with studies that have evaluated the effect of Tai Chi on psychological variables (Kutner et al., 1997; Wolf et al., 1996). Exit interviews to establish the positive effect of Tai Chi on confidence related to balance, but did not use a tool to measure fear of falling specifically. Tai Chi has been found to have an effect on falls self-efficacy as well, however (Fuzhong, Fisher, Harmer, & McAuley, 2005).

The current study used participants who were already physically active when they entered into the exercise intervention. This may account for the high levels of Falls Self-Efficacy at the pre-test and there may have been a "ceiling effect" in the present study. Tinetti et al. (1990) mentioned that the limitation of the Falls Efficacy Scale is that it may not be appropriate for an active, older population.

Social cognitive theory (Bandura, 1986) states that self-efficacy change is very task specific. Self-efficacy has been shown to be influenced by relevant skills, past experiences, and by social persuasion (Bandura, Adams, & Beyer, 1977). Some of the same factors could also influence falls

self-efficacy. Tinetti et al. (1990) reported that gait and past experiences with falling had an effect on falls self-efficacy. Over half of the participants in the current study reported no previous falls due to the loss of balance. This was a weakness with the design used in this study. It is quite likely that falls self-efficacy would have been more influenced had the participants in the study had more past experiences with falling, and participants with a history of falls should have been included.

This study of the influence of Tai Chi on dynamic balance reaffirms the belief that Tai Chi can positively influence balance (Jacobson et al., 1997), although other forms of physical activity can do so as well. However, this study also found that Tai Chi was not effective in influencing falls self-efficacy. Although the results of this study reaffirm the benefits of Tai Chi when used with a less frail sample, continued study of the benefits with a frailer sample is warranted. Initial research with a frail sample suggests that Tai Chi is not as effective in preventing falls when compared with a less frail sample (Wolf, Sattin, Kutner, O'Grady, Greenspan, & Gregor, 2003). Attempts to study the effects of Tai Chi with an older, frailer sample should form the basis of further studies.

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