The Influence of Tai Chi Training on Fall Risk Indicators in Community Dwelling Older Adults
Purpose

- Compare older community-dwelling adults’ balance, functional mobility, lower extremity strength, and joint mobility before and after participating in a Tai Chi program over a 16-week period.
- Compare the same measures to a group of older community-dwelling adults who did not participate in any Tai Chi training over a 16-week period.
## Fall Risk in the Elderly

<table>
<thead>
<tr>
<th>Prevalence and Cost</th>
<th>Causes of Falls</th>
<th>Falls Lead To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/3 of adults 65+ a year</td>
<td>Impaired balance</td>
<td>Decrease independence</td>
</tr>
<tr>
<td>EDs treated 2.4 million</td>
<td>Diminished strength</td>
<td>Increased risk of early mortality</td>
</tr>
<tr>
<td>nonfatal fall injuries</td>
<td>Fear of falling</td>
<td>Trauma</td>
</tr>
<tr>
<td>Hospitalized for fall-</td>
<td>Loss of proprioception and sensation in</td>
<td>Fear of falling</td>
</tr>
<tr>
<td>related injuries 5 times</td>
<td>LE’s</td>
<td></td>
</tr>
<tr>
<td>more often</td>
<td>Deterioration of vision</td>
<td></td>
</tr>
<tr>
<td>Direct medical costs was</td>
<td>Environmental factors</td>
<td></td>
</tr>
<tr>
<td>$30 billion</td>
<td>Medications</td>
<td></td>
</tr>
</tbody>
</table>

**Causes of Falls:**
- Impaired balance
- Diminished strength
- Fear of falling
- Loss of proprioception and sensation in LE’s
- Deterioration of vision
- Environmental factors
- Medications
What is Tai Chi?

- Form of martial art that incorporates the Chinese concepts of yin and yang and qi
- Key elements incorporated into a Tai Chi program:
  - Balance
  - Relaxation
  - Motor control
  - Muscle strength
  - Weight transfers
  - Stability and posture
The Evidence

- Research on Tai Chi intervention and fall risk
- Two systematic reviews evaluated 31 research studies
- Question effectiveness

A systematic review of the effectiveness of Tai Chi on fall reduction among the elderly

Serena Low, Li Wei Ang, Kiat Sern Goh, Suok Kai Chew

Keywords: Accidental falls, Elderly, Tai Chi

Abstract

Falls among the elderly is a major public health concern. There has been recent extensive research on the effects of Tai Chi in fall prevention among the elderly. As such, we undertook a systematic review to look for evidence on the effect of this intervention. There were 27 randomized controlled trials, which met our objective and inclusion criteria. Our review has shown that Tai Chi has the potential to reduce fall risk of falls among the elderly, provided that they are relatively young and non-frail. Further review is needed to look into the non-English studies, which assess the effectiveness of Tai Chi on fall reduction.

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Review of Tai Chi as an Effective Exercise on Falls Prevention in Elderly

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The risk of accidental falls and fall-related injuries increases with age. Regular physical exercise can delay the age-related changes affecting postural balance and reduce the risk of falls. Although Tai Chi (TC) has become a popular exercise among the elderly, does regular TC exercise lead to fewer falls and fall-related injuries? Who would receive the most benefit from TC exercise? What style of TC is best for fall risk reductions? What is the minimum amount of TC exercise needed before its positive effect is observed? How does the effect of TC exercise compare to other physical exercises? The goal of this study is to conduct a systematic review of recent literature on TC’s effectiveness for reducing fall risks in elders. A summary and analysis is provided for the following variables: targeted subject population, TC curriculum, comparative effect, and outcome measures.

KEYWORDS Tai Chi, accidental falls, fall risk, elderly
Methods & Criteria

Subjects: Convenience Sampling

Tai Chi Group
Mansfield Senior Center
(n = 16)
80.4 ± 6.8 yrs

Control Group
Community Volunteers
(n = 14)
71.2 ± 6.1 yrs

Inclusion Criteria
- Community dwelling, English speaking
- Age ≥ 55 years of age
- Ambulate independently
- With or without assistive device

Exclusion Criteria
- Recent cardiac or neurological (stroke) changes in medical status or surgeries in the last six months
Procedure

- Pre- and Post- Testing
  - Tai Chi Group
    - Within 1 week prior to Tai Chi intervention and within 1 week of completing program
  - Control Group
    - Testing done 16 weeks apart
Outcome Measures

- **Strength**
  - Hand held dynamometer (HHD): quad strength
  - 5 Time Sit-To-Stand (FTSTS)

- **Balance:**
  - Functional Reach Test (FR)
  - Berg Balance Scale (BBS)

- **Functional Mobility**
  - Timed-Up-and-Go (TUG)
  - 50 Foot Walk Test (FFWT)

- **Fear of Falling**
  - Activity Specific Balance & Confidence Scale (ABC)
Tai Chi Training

- 16 week program
  - 1 – 3 times per week
- Conducted by Tai Chi master
- Based on Li’s 8 position protocol
Analysis

- Independent t-test
  - Compare the two groups to identify existing differences at time of pre- and post- test

- Paired t-tests
  - Compare performance on pre- and post- outcome measures within each group

- [SPSS version 15. alpha level: .05]
Comparison of Groups Initial Assessment

- Significant differences in groups
  - Age: Tai Chi group older than Control
  - HHD: Control group stronger than Tai Chi
  - ABC #6 (stand on chair): Control more confident than Tai Chi group
- No significant differences in any other aspects
Results: Functional Mobility

- **Tai Chi**
  - Decrease in time to complete TUG

- **Control**
  - No significant change in timed TUG

<table>
<thead>
<tr>
<th>Group</th>
<th>Measure</th>
<th>Pre (mean)</th>
<th>Post (mean)</th>
<th>Significance</th>
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<tbody>
<tr>
<td><strong>Tai Chi</strong></td>
<td>TUG (sec)</td>
<td>10.87 ±5.94</td>
<td>9.59 ±4.84</td>
<td>p = 0.003</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>TUG (sec)</td>
<td>8.44 ± 2.65</td>
<td>8.23 ± 2.94</td>
<td>p = .457</td>
</tr>
</tbody>
</table>
Results: Functional Mobility

TIMED UP-AND-GO

*Black center line*
No difference between group means

Mean change in Tui Chi group (95% CI)
(-2.05 to -0.51 seconds)

Mean change in control group (95% CI)
(-0.37 to 0.77 seconds)

Time (sec)

Improved performance

Worse performance
## Results: Strength

- **Tai Chi**
  - *Increase* in force production of 10 lbs

- **Control**
  - *Decrease* in force production

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<td>HHD L (lbs)</td>
<td>38.96±13.19</td>
<td>37.41±10.85</td>
<td>p = .689</td>
</tr>
<tr>
<td>Control</td>
<td>HHD R (lbs)</td>
<td>44.06±11.21</td>
<td>40.43±12.43</td>
<td>p = .276</td>
</tr>
</tbody>
</table>
Results: Strength

**HAND-HELD DYNAMOMETERY (Left Leg)**

- **Mean change in Tai Chi group (95% CI):** (1.80 to 19.30 pounds)
- **Mean change in control group (95% CI):** (-9.82 to 6.71 pounds)

- Black center line
  - No difference between group means.

**HAND-HELD DYNAMOMETERY (Right Leg)**

- **Mean change in Tai Chi group (95% CI):** (1.83 to 17.17 pounds)
- **Mean change in control group (95% CI):** (-10.56 to 3.30 pounds)

- Black center line
  - No difference between group means.

Strength (lbs)
Results: Confidence

- **Tai Chi**
  - Significant increase in ABC score
    - Composite score
    - Specific measures: bending over to pick up an object, standing on a chair to reach for something, walking up or down a ramp, walking outside on an icy sidewalk

- **Control**
  - No significant change in ABC score
Comparison Groups on Final Assessment

- No significant differences between the Tai Chi trained group and the control group in performance of any measures despite the decade age difference.
Take Home Message

- Tai Chi leads to improvements in:
  - Strength
  - Mobility
  - Confidence

- Improvements continued to occur even though some participants had previous Tai Chi experience

- These results support CDC endorsement of Tai Chi as means of fall prevention in elderly community dwelling adults.
Acknowledgements

- Laddie Sacharko
  - Tai Chi Master - Starfarm Tai Chi

- Dr. Deborah Bubela, PhD, PT, PCS
  - University of Connecticut

- The Gordon Family

- Mansfield Senior Center

- Courtney Jenson
  - University of Connecticut
Time for Questions

References available upon request.

Please contact
Dr. Bubela, deborah.bubela@uconn.edu
Maegen Brady, maegen.brady@uconn.edu
Judy Chan, judy.chan@uconn.edu

Thank you.
<table>
<thead>
<tr>
<th>Measure (mean)</th>
<th>TC PRE</th>
<th>TC POST</th>
<th>CG PRE</th>
<th>CG POST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Func Reach (cm)</td>
<td>30.81 ± 8.54</td>
<td>28.75 ± 7.32</td>
<td>29.89 ± 9.69</td>
<td>27.49 ± 4.89</td>
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<tr>
<td>FFWalk (seconds)</td>
<td>14.87 ± 7.59</td>
<td>14.98 ± 6.03</td>
<td>13.27 ± 4.16</td>
<td>12.75 ± 4.0</td>
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<td>TUG (seconds)</td>
<td>10.87 ± 5.94</td>
<td>9.59 ± 4.84</td>
<td>8.44 ± 2.65</td>
<td>8.23 ± 2.94</td>
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<td>Berg</td>
<td>52.19 ± 4.23</td>
<td>52.06 ± 4.45</td>
<td>51.29 ± 3.73</td>
<td>51.71 ± 4.08</td>
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<td>HHD L (lbs)</td>
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<tr>
<td>ABC #3 (%)</td>
<td>80.63 ± 23.59</td>
<td>92.63 ± 11.14</td>
<td>93.93 ± 13.61</td>
<td>92.71 ± 20.59</td>
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<td>ABC #6 (%)</td>
<td>37.50 ± 27.14</td>
<td>60.63 ± 30.98</td>
<td>68.43 ± 35.52</td>
<td>75.57 ± 34.81</td>
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<tr>
<td>ABC #11 (%)</td>
<td>85.31 ± 16.98</td>
<td>95.63 ± 6.02</td>
<td>92.36 ± 17.12</td>
<td>95.21 ± 8.72</td>
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<td>ABC #16 (%)</td>
<td>44.06 ± 29.51</td>
<td>59.06 ± 22.45</td>
<td>56.79 ± 29.98</td>
<td>61.07 ± 33.52</td>
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</table>
## Tai Chi Pre and Post Comparison

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pre (mean)</th>
<th>Post (mean)</th>
<th>Significance (p value)</th>
<th>Effect Size (cohen's d)</th>
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<tbody>
<tr>
<td>FTSTS (seconds)</td>
<td>13.50 ± 3.56</td>
<td>13.36 ± 4.99</td>
<td>.064</td>
<td>.45</td>
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<tr>
<td>Func Reach (Cm)</td>
<td>30.81 ± 8.54</td>
<td>28.75 ± 7.32</td>
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<td>Berg</td>
<td>52.19 ± 4.23</td>
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## Control Pre and Post Comparison

<table>
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<td>FTSTS (seconds)</td>
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