

## **Effectiveness of Tai Chi in preventing falls and improving balance**

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Falls continue to be a health issue for older people. One third of community dwelling older people falls each year with 10% of falls leading to injuries that require admission to hospital [1, 2]. Fall-related hospitalisations are increasing at a rate of 3.8% per year for those aged over 65 years, placing an increasing burden on the health care system [3, 4]. In response to this health care need, considerable research has been undertaken to identify pragmatic fall prevention strategies.

One of the strategies extensively evaluated is exercise and systematic reviews have shown that exercise regimes that challenge balance are effective in preventing falls in older people living in the community [5, 6]. Further, it has been found that exercise interventions have maximal benefits if they include at least 2 hours exercise per week and continue for at least 26 weeks [7]

Tai Chi uses slow, sustained smooth and rhythmical movements of the trunk and limbs whilst keeping the centre of mass in a balanced state. It therefore challenges balance and meets the criteria of highly challenging balance exercise necessary for effective falls prevention ([7, 8] 2011). Tai Chi has also been found to be a cost effective strategy [9] and Tai Chi classes have been successfully led by trained volunteers in some of NSW Health Districts (Southern NSW and Western NSW). Tai Chi has been researched as a physical activity fall prevention strategy for older people for over 20 years with the seminal study by Wolf and colleagues on Tai Chi to reduce frailty and falls (part of the FICSIT study) published in 1993 [10]. This pioneering study found that a 15 week Tai Chi intervention significantly reduced falls and fear of falling and improved balance control.

This mini review provides a summary of the findings of the reviews that have investigated the effectiveness of Tai Chi to prevent falls and/or improve balance in community dwelling people over 50 years of age. Information on the included reviews is summarised in Table 1.

The reviews conducted to date have included varying numbers of studies depending on their inclusion criteria with some reviews including only randomised controlled trials (RCTs) whereas others have also included pre and post- test studies, cross-sectional and quasi-experimental studies. Not all reviews included a meta-analysis of the results. The main factors differing among the trials include the mix of populations and ages, different styles of Tai Chi and length of intervention, total duration of intervention (varying from 3 – 52 weeks) and number of exercise sessions per week (20 min to 90 min, up to 3 times per week), frailty status of participants and type of control group (i.e. exercise, education or no exercise). These study discrepancies as well as differing review study inclusion criteria have led to some reviews concluding Tai Chi reduces falls and improves balance whereas others have considered the evidence too weak to support such claims (see Table 1).

Cochrane Reviews are considered the gold standard by many researchers, and the 2012 Cochrane Review on fall prevention interventions in the community 2 reported that from 7 RCTs included in their analysis, Tai Chi reduced the rate of falls (Rate Ratio [RaR] 0.72, 95% CI 0.52 – 1.00) and the risk of falling (Risk Ratio [RR] 0.71, 05% CI 0.57 – 0.87) [5]. However, there was substantial heterogeneity

in these findings and a subgroup analysis found the treatment effect was greater in older people who did not have a high risk of falling [5].

Other complementary systematic reviews have also only included RCTs [11-14]. These have reported more equivocal findings with some concluding that there is insufficient evidence that Tai Chi is effective in preventing falls, decreasing fear of falling and improving balance in people in the community over 50 years of age [12, 14]. Other RCT reviews found that Tai Chi was effective in reducing falls or falls risk in younger healthier participants but not in older frailer participants where the Tai Chi intervention increased the risk of falls [11, 13].

Several systematic reviews have included cross sectional and pre post studies as well as RCTs [15-17]. They concluded that the majority of studies demonstrated reductions in total number of falls and fear of falling (FOF), significant improvement in laboratory measures of dynamic balance but less consistent benefits for measures of functional balance. They also noted that balance improvements were equivalent to/no better than programs that included functional balance and resistance training. They identified a number of factors that were associated with improvements; using the style of Tai Chi that was compatible with the participant's abilities, the duration of the program and method of delivery, social compatibility and previous activity levels of participants.

As the reviews have included studies that have been heterogeneous and variable in their quality and inclusion criteria, it might also be insightful to summarise three of the better quality RCTs that have included falls as the primary outcome measure. These studies included large numbers (256-702) of participants with participants attending Tai Chi programs 1-3 hours per week for 16-26 weeks with control groups including stretching exercise, low level exercise or being on a waiting list [18-20]. Two of these studies found the Tai Chi programs were effective in reducing falls and improving balance in mainly healthy older community dwellers [19, 20]. One study found there was no difference between the Tai Chi group and the low level exercise group (this included mainly seated stretching and low level strength and cardiovascular exercises) with a similar falls reduction over a 17 month follow up period [18].

A recent integrative review by Hackney & Wolf [8] concluded that interventions such as Tai Chi had an impact on balance in older adults as this type of training involves gait, balance, coordination, functional exercise and muscle strengthening. Their caveat was that adherence was critical to achieving improvement in balance and mobility [8]. Finally, an overview of systematic reviews of Tai Chi for a range of conditions including falls prevention concluded that three of the included studies showed positive effects on preventing falls whereas one study did not [21]. Their overall conclusion was that Tai Chi was effective in preventing falls in older people.

In conclusion, there have been a large number of studies and reviews on the effectiveness of Tai Chi on balance control and fall prevention. The studies conducted have been very heterogeneous in design and therefore have provided a range of results. Overall, it appears that Tai Chi is effective in reducing falls and improving balance in general (non-frail) populations of older community dwelling people. As with all exercise interventions, long term adherence appears necessary for effective fall prevention. Tai Chi has also been found to be a cost effective in this population and therefore can be recommended as an evidence-based intervention for this group.

## References

1. Lord, S.R., et al., *An epidemiological study of falls in older community-dwelling women: the Randwick falls and fractures study*. Aust J Public Health, 1993. **17**(3): p. 240-5.
2. Advancement, C.f.H. and C.f.E.a. Research, *New South Wales Falls Prevention Baseline Survey: 2009 Report*. 2010, NSW Department of Health: Sydney.
3. Harvey, L. and C. JCT, *Trends in fall related hospitalisations, persons aged 65 years and over, NSW 1998-99 to 2011-12*. 2013, Neuroscience Research Australia: Sydney.
4. AIHW and B. C, *Hospitalisations due to falls by older people, Australia 2009-10*, in *Injury research and statistics series no 70*. 2013, AIHW: Canberra.
5. Gillespie, L.D., et al., *Interventions for preventing falls in older people living in the community*. Cochrane Database of Systematic Reviews, 2012. **9**(ePub): p. CD007146-CD007146.
6. Sherrington, C., et al., *Effective Exercise for the Prevention of Falls: A Systematic Review and Meta-Analysis*. Journal of the American Geriatrics Society, 2008. **56**(12): p. 2234-2243.
7. Sherrington, C., et al., *Exercise to prevent falls in older adults: an updated meta-analysis and best practice recommendations*. NSW Public Health Bulletin, 2011. **22**(3-4): p. 78-83.
8. Hackney, M.E. and S.L. Wolf, *Impact of tai chi chu'an practice on balance and mobility in older adults: An integrative review of 20 years of research*. Journal of geriatric physical therapy, 2014. **ePub**(ePub): p. ePub-ePub.
9. Church, J., et al., *The cost-effectiveness of falls prevention interventions for older community-dwelling Australians*. Australian and New Zealand Journal of Public Health, 2012. **36**(3): p. 241-248.
10. Wolf, S.L., et al., *Selected As the Best Paper in the 1990s: Reducing Frailty and Falls in Older Persons: An Investigation of Tai Chi and Computerized Balance Training*. Journal of the American Geriatrics Society, 2003. **51**(12): p. 1794-1803.
11. Gregory, H. and M.C. Watson, *The effectiveness of Tai Chi as a fall prevention intervention for older adults: a systematic review*. International Journal of Health Promotion and Education, 2009. **47**(3): p. 94-100.
12. Leung, D.P.K.M., et al., *Tai Chi as an Intervention to Improve Balance and Reduce Falls in Older Adults: A Systematic and Meta-analytical Review*. Alternative Therapies in Health and Medicine, 2011. **17**(1): p. 40-8.
13. Low, S., et al., *A systematic review of the effectiveness of Tai Chi on fall reduction among the elderly*. Archives of Gerontology and Geriatrics, 2009. **48**(3): p. 325-331.
14. Logghe, I.H.J., et al., *The effects of Tai Chi on fall prevention, fear of falling and balance in older people: A meta-analysis*. Preventive Medicine. **In Press, Uncorrected Proof**.
15. Liu, H. and A. Frank, *Tai Chi as a Balance Improvement Exercise for Older Adults: A Systematic Review*. Journal of Geriatric Physical Therapy, 2010. **33**(3): p. 103-109  
10.1097/JPT.0b013e3181eda1c4.
16. Schleicher, M.M., L. Wedam, and G. Wu, *Review of Tai Chi as an Effective Exercise on Falls Prevention in Elderly*. Research in Sports Medicine, 2012. **20**(1): p. 37-58.
17. Wooton, A.C., *An Integrative Review of Tai Chi Research: An Alternative Form of Physical Activity to Improve Balance and Prevent Falls in Older Adults*. Orthopaedic Nursing, 2010. **29**(2): p. 108-16; quiz 117-8.
18. Taylor, D., et al., *Effectiveness of Tai Chi as a Community-Based Falls Prevention Intervention: A Randomized Controlled Trial*. Journal of the American Geriatrics Society, 2012. **60**(5): p. 841-848.
19. Voukelatos, A., et al., *A Randomized, Controlled Trial of tai chi for the Prevention of Falls: The Central Sydney tai chi Trial*. Journal of the American Geriatrics Society, 2007. **55**(8): p. 1185-1191.

20. Li, F., et al., *Tai Chi and Fall Reductions in Older Adults: A Randomized Controlled Trial*. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 2005. **60**(2): p. 187-194.
21. Lee, M.S. and E. Ernst, *Systematic reviews of t'ai chi: an overview*. British Journal of Sports Medicine, 2012. **46**(10): p. 713-718.
22. Jiménez-Martín, P.J., et al., *A review of Tai Chi Chuan and parameters related to balance*. European Journal of Integrative Medicine, 2013. **5**(6): p. 469-475.

**Table 1 Included Tai Chi Review articles**

Reference	No of RCTs and other studies included	Quality of RCT and other studies	Meta-analysis	Review Conclusion
Jimenez-Martin et al 2013 [22]	27 RCTs	variable	no	Tai Chi Chuan improves static and dynamic balance and functional factors affecting balance in persons > 55 years.
Schliecher, Weddam & Wu 2012 [16]	14 RCTs ( 5 cross sectional & 5 pre/post-test designs	variable	no	Majority of studies demonstrated reductions in total number of falls, fear of falling and significant improvement in lab based balance measures.
Gillespie et al 2012 [5]	7 RCTs	Good quality	yes	Tai Chi reduces the risk of falling overall but is less effective in people at higher risk of falling.
Leung et al 2011 [12]	13 RCTs	Good quality (PeDro score >6)	yes	Tai Chi improved balance and reduced falls in non-frail older people and equivalent to / no better than stretching exercise or wellness education program.
Logghe et al 2010 [14]	9 RCTs	Good quality	yes	Compared with exercise controls Tai Chi participants showed significant improvements in fall rates and static balance, however when compared with non-exercise controls no improvement was found with Tai Chi in fall rates or static balance but there was a significant improvement in fear of falling.
Wooton 2010 [17]	18 RCTs (2 pre/post-test, 2 quasi -experimental	variable	no	Majority of studies concluded that Tai Chi improved balance.
Liu & Frank 2010 [15]	15 RCTs, 3 pre/post test	Good quality	no	Tai Chi improved balance and balance confidence in non-frail older adults.
Gregory & Watson 2009 [11]	7 RCTs	variable	no	Tai Chi Chuan was effective in reducing fall risk in healthy older people but not for frailer older people.
Low et al 2009 [13]	7RCTs	Good	no	About half the studies showed that Tai Chi was effective in fall reduction particularly in the less frail population.