Remarkable Results in Flexibility and Balance from Tai Chi for Healthy Aging

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Acknowledgement

This tutorial is created based on the article, A 12-week Taijiquan practice improves balance control and functional fitness in fall-prone postmenopausal women, published in June 2024 by the journal *Frontiers in public health*.

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Early Intervention for Fall-prone People

Falls are the leading cause of accidental death among older people, with postmenopausal women facing a greater hazard of falling due to osteoporosis.

A recent study investigated how a 12-week Tai Chi program could serve as early intervention for postmenopausal women (i.e., 60 to 70 years old) who self-identified as prone to falling.

This study aimed to examine the effects of Tai Chi practice on balance control and functional fitness in at-risk females.

The 12-week Tai Chi Program for Fall-prone People - I

In this Chinese study, 24 women were assigned to the Tai Chi group and 26 to the control group.

The Tai Chi group underwent 12 weeks of supervised training every Monday, Wednesday, and Friday from 6 to 7 a.m.

The training sessions were supervised by one Tai Chi master and two trainees.

Each session began with a 10-minute warm-up, consisting of a 5-minute slow marching activity followed by 5 min of stretching.

The 12-week Tai Chi Program for Fall-prone People - II

The stretching routine included exercises such as:

- Neck flexion and extension
- Shoulder rotations
- Lateral arm swings
- Forward arm swings
- Wrist rotations
- Trunk rotations
- Forward leg swings
- Knee bends
- Ankle rotations

The 12-week Tai Chi Program for Fall-prone People - III

Participants then practiced the Yang-style 24-form Tai Chi under the guidance of the Tai Chi master.

As the participants were new to Tai Chi, the duration of Tai Chi sessions was gradually increased:

In the first week, each session lasted 20 minutes.

Every 2 weeks, the session duration was extended by 5 minutes until reaching 45 min by the 12th week.

Each session concluded with a 10-minute cool-down period.

The 12-week Tai Chi Program for Fall-prone People - IV

- Participants engaged in a series of controlled deep breaths, repeating the process 10 times, followed by a comprehensive stretching routine targeting various muscle groups, including the quadriceps, calf, hamstring, upper body, triceps, shoulder, inner thigh, hip, and groin muscles.
- All physical activities were accompanied by calming music.
- Participants were advised against engaging in additional physical activities except for walking on non-training days.
- For the control group, no structured physical activity was allowed, and participants were free to engage in walking as part of their daily routine.

The Impressive Results from the Program

Following a 12-week intervention, the Tai Chi group demonstrated a remarkable 163.2% increase in flexibility, an impressive 61.0% improvement in balance, and an 8.3% enhancement in upper-body strength.

These gains not only helped participants achieve the expected goal of balance control but also improved handgrip strength beyond the norm, potentially leading to long-term benefits for independent living and healthy aging.

The Remarkable Increase in Flexibility - I

- The ability of older people to live independently is directly affected by age-related reductions in flexibility.
- Flexibility was assessed using the back scratch and sit-and-reach tests.

The Back Scratch Test

- In the back scratch test, participants stretched one hand over the shoulder and reached up to the center of the back with the other hand.
- The distance between their extended middle fingers was measured.

The Remarkable Increase in Flexibility - II

The Sit-and-reach Test

- For the sit-and-reach test, participants sat on the ground with bare feet touching and knees straight.
- Using their fingertips, they pushed a movable marker on a scale plate without bending their knees.
- The distance between the initial position and where the marker stopped was recorded.
- Measurements for both tests were recorded as positive or negative values.

The Remarkable Increase in Flexibility - III

In the Tai Chi group, participants, while showing no improvement in back scratch test, increased their sit-and-reach distance from 3.8 cm to 10.0 cm, marking a significant improvement of 163.2%.

Why Can Tai Chi Improve Flexibility - I

- A previous cross-sectional study revealed that Tai Chi practitioners exhibited faster reflex reaction times in their hamstrings and gastrocnemius muscles, along with reduced knee joint angle repositioning errors.
- The forward and backward movements of the center of gravity during Tai Chi practice primarily involve increasing and decreasing the joint angles of the bilateral lower limbs, thereby strengthening the lower limb muscles.

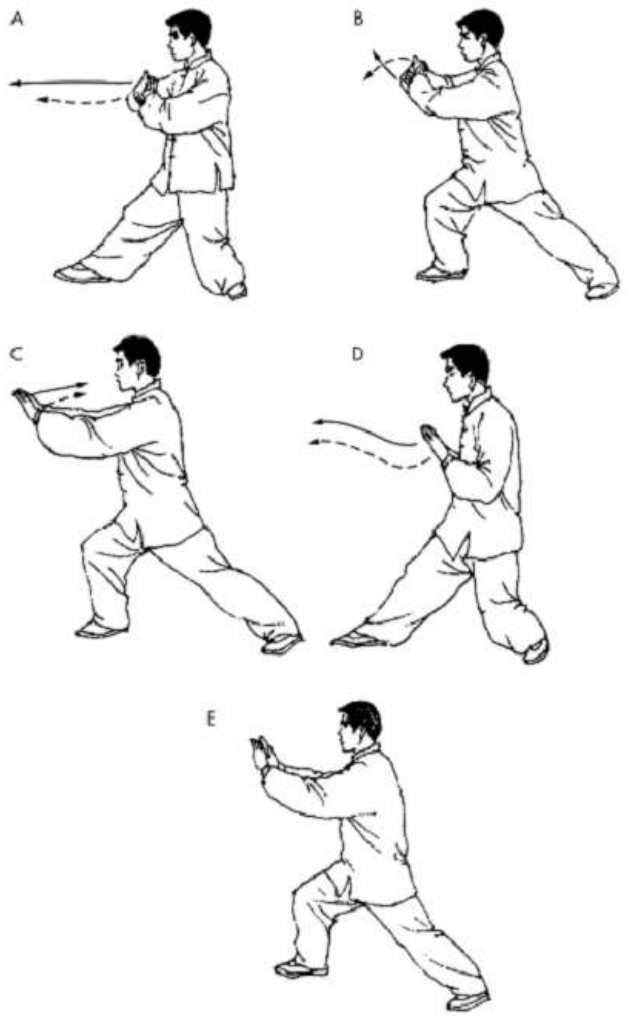


Figure 1 Press and push movements in tai chi

(Image source: Kinematic and electromyographic analysis of the push movement in tai chi, *the British Journal of Sports Medicine*, 2003)

Why Can Tai Chi Improve Flexibility - II

Contemporary Tai Chi, characterized by alternating slow motion and bursts of power, stimulates lumbar muscles and enhances lower back flexibility and muscular strength.

Consequently, improvements in hamstrings and lower back from Tai Chi practice are often accompanied by increased trunk flexibility.

The Significant Improvement in Balance Control

Two noteworthy facts should be emphasized regarding the 61.0% improvement in balance control.

First, the one-leg stand test serves as a reliable indicator of an individual's susceptibility to falls, thus supporting the evidence-based eligibility criteria for this study's primary objective.

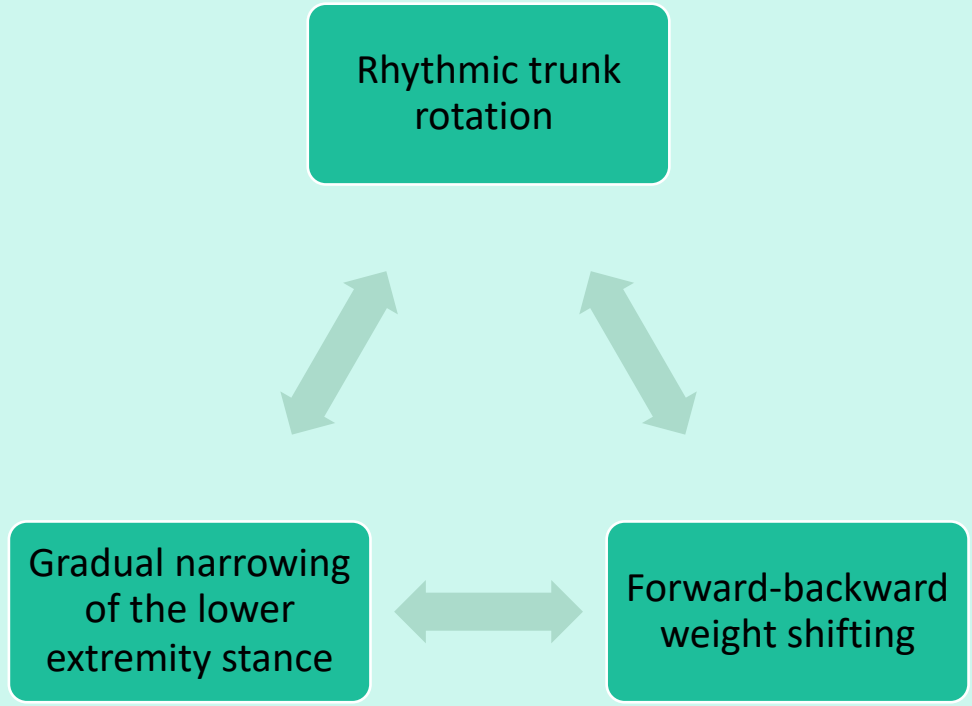
Second, a previous study showed that extending the duration of a one-leg stand by 1 second was associated with a 5% reduction in the risk of hip fractures.

In this study, the Tai Chi group achieved a noteworthy improvement of 2.5 second in this aspect, which can lead to substantial healthcare advantages.

Additionally, compared to general balance training effects reported in the literature, the results suggest that Tai Chi is more effective. This reinforces the objective that Tai Chi is particularly valuable for older adults given its efficacy and safety profiles.

Why Can Tai Chi Improve Balance Control - I

The mechanism underlying this improvement may be attributed to Tai Chi's emphasis on:

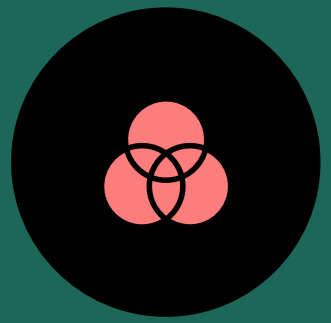


Why Can Tai Chi Improve Balance Control - II

- Such emphasis promotes neuromuscular adaptation for coordination and balance.
- Additionally, Tai Chi emphasizes the concept of "rooting with feet," which involves ensuring heels make initial contact with the ground during all movements, whether circular or explosive.
- This practice is designed to enhance the fluidity of the center of body's motion.
- As a result, improved normal gait and postural control can lead to enhancements in balance control.

Tai Chi’s Culture Root Builds Upper Body Strength - I

The gain in upper-body strength, particularly the improvement in handgrip strength was noteworthy and slightly exceeded what previous studies have shown.



Western resistance theory typically emphasizes weights, repetitions, and volumes, whereas Tai Chi stands out as an outlier in this context.

Tai Chi is perceived as a gentle workout that does not require heavy loads, contact, or repetitive motions.

The mechanism by which Tai Chi contributes to strength development is rooted in cultural heritage.

Tai Chi's Culture Root Builds Upper Body Strength - II

Originally a martial art known as shadow boxing, Tai Chi was never intended as a relaxing activity but rather as an energy-intensive one.

A study on Chen-style 56-form Tai Chi revealed a mean energy expenditure of 61.5 Kcal, corresponding to 10 Kcal/min of energy demand in the bare hands state during competitive routines lasting around 6 min.

In comparison, a single set in a typical western resistance training routine requires an average of 4.52 Kcal/min (43).

Past research mapped the striking force of Chen-style Tai Chi, illustrating its impact on upper-body strength development.

The philosophy of Tai Chi revolves around motion within stillness and overcoming hardness with softness.

Tai Chi: Equipment-less Exercise for Fitness

The improvement in upper-body muscular fitness is particularly relevant to aging, as arm curls are essential for daily activities, and low handgrip strength predicts all-cause mortality and cardiovascular disease.

Therefore, Tai Chi, being an equipment-free form of strength training, is desirable for preserving functional fitness in home environments.

Conclusions

Promoting appropriate balance exercises is a crucial consideration for long-term exercise participation and adherence, especially for older women at a higher risk of osteoporosis.

Studies have shown that up to 40% of older people who experience falls also have a pronounced fear of falling, leading to self-imposed restrictions on daily activities. This creates a negative feedback loop (falling-fear-inactivity) that can accelerate the aging process and increase the risk of premature morbidity and mortality.

Tai Chi practice, with its few safety concerns and low-intensity physical activity, addresses these issues. The improvement in flexibility, balance and functional fitness suggests that Tai Chi could serve as a useful exercise for older women with an elevated risk of falling.