

Effect of Tai Chi and Stepping Exercise for Balance Training in Geriatrics: Randomized Control Trial

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ABSTRACT

Introduction: Approximately 40% of geriatric population in India experience some form of balance difficulty. It may be due to decreased muscular strength, flexibility, impaired vision and hearing problem. There are many approaches for improving balance such as Tai Chi exercise, stepping exercise, wobble board exercises, strengthening exercises. Tai Chi is a series of slow, smooth and graceful movements for improving neuromuscular function, endurance, joint sense and cognitive function. Stepping exercise is exercise performed using stepper. It improves balance by strengthening muscles, flexibility and range of motion.

Objective: To compare the effect of Tai Chi and stepping exercise for improving balance in geriatric population.

Method: In the present study, 40 participants of age group 60-80 years with balance problem were taken. Random sampling was done in two group, group A (n=20) and group B (n=20) giving Tai Chi and Stepping exercise respectively. Outcome measured used were BBS, TUG, FES and POMA.

Results: In present study, Tai Chi exercise was more effective than Stepping exercise statistically proved with unpaired t test BBS (p=0.0001), TUG(p=0.0001), FES (p=0.0679) and POMA (p=0.0039). When comparison was done within the groups, all outcome measures showed significant values at pre and post intervention, BBS (p=<0.0001 in group A and B), TUG (p=<0.0001 in group A and B), FES (p=<0.0001 in group A and B) and POMA (p=<0.0001 in group A and B),

Conclusion: Tai Chi exercise showed more effect than Stepping exercise in geriatric population with balance impairments.

Keywords: Tai Chi exercise, stepping exercise, geriatric population, Balance Training in Geriatrics, balance impairments

INTRODUCTION

Ageing is the process of change in the properties of structure or system occurring over a period, either spontaneously or through deliberate action.¹ It is estimated that approximately 40% of geriatric population in India experience some form of balance difficulty. Conditions associated with balance problems include dizziness, muscular weakness, impaired vision, hearing, diabetes.⁴

According to 2011 population census, nearly 104 million elderly persons

are in India.² The sex ratio among elderly people was as high as 1028 in 1951 but subsequently dropped to about 938 in 1971, but has finally increased again to about 972 in 2001. According to 2011 population census there are 53 million females and 51 million males in India.³

Falls are defined as an event which results in person coming to rest inadvertently on a ground or floor or other lower level.⁵ Falls are major public health problem. It is second leading cause of unintentional injury death, after road traffic accident. 31% of

individuals aged 65 years and older fall at least once year. The prevalence of fall in India among older adults aged 60 years and older was 14% to 53%.⁶

Balance is staying upright and steady when stationary, such as when standing or sitting, or during movement. The loss of ability to balance may be linked with a higher risk of falling, increased dependency, illness and sometimes early death.⁷

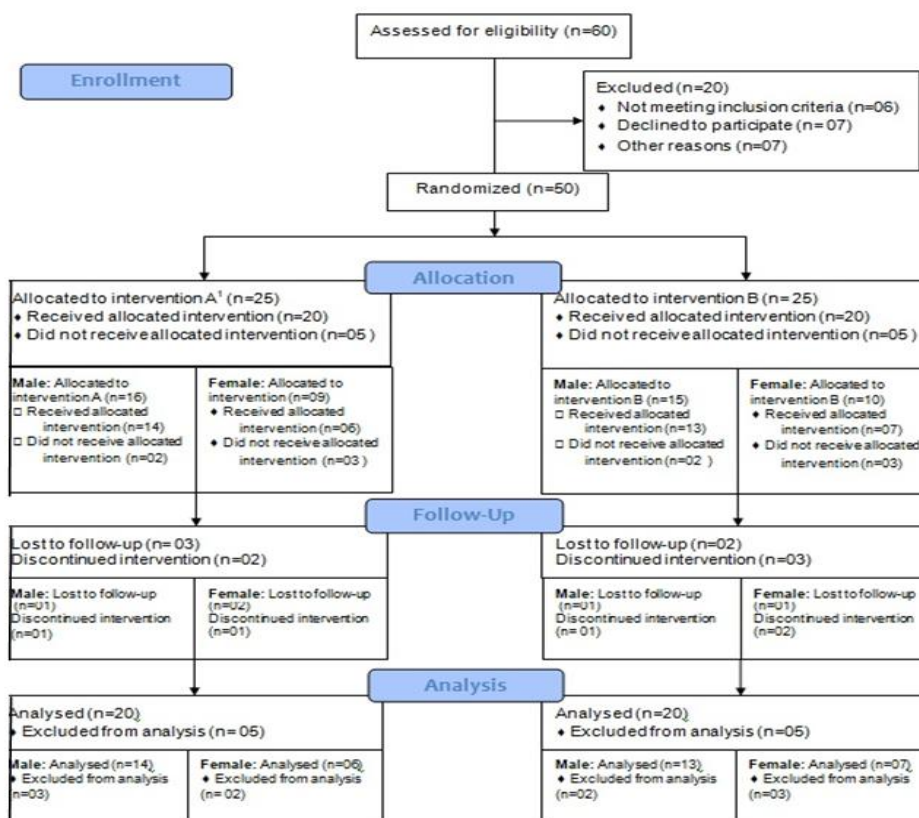
Tai chi exercise is the task of maintaining balance which becomes highly difficult, as evidenced by the increased frequency of falls in older adults. Tai Chi is a traditional Chinese form of exercise among older adults, especially in Asia used for improving balance and other neuromuscular functions. It's a series of slow, smooth, and graceful movements, with an emphasis on coordination of the eyes, head, body, and upper and lower extremities. Timothy C et.al has shown Tai Chi training and practice there was significant improvements in balance and it

had beneficial effects on health.⁸ A. Vonkelatos, L., et al they concluded that Tai Chi appeared to reduce the falls in geriatric population.¹⁴

Stepping represents a common means for balance recovery after a perturbation to upright posture.¹⁰ It is a form of aerobics exercise using an elevated platform. The height can be tailored to individual needs by inserting risers under the step. It helps to improve balance in elderly. It strengthens the muscles which helps in maintain balance.¹¹ Ryosuka shigematsu, et.al concluded that stepping exercise is more effective then walking in reducing fall risk factors. Hence stepping exercise is effective in balance training in geriatric population¹¹.

Hence, this study aimed the dearth to investigate which is the enhanced the effects of Tai Chi and Stepping exercises on balance in elderly people.⁹ The hypothesis of the study there will be improvement in balance by Tai Chi exercise than Stepping exercise in geriatric population.

METHODOLOGY



The study design for this research is comparative study. Data was collected from MGM hospital, Aurangabad and Old age home in and Around Aurangabad City. 40 Convenience sampling were taken for this study and randomly divide into two groups by using envelope method. Inclusion criteria were: 60 to 80 years Age group, Able to walk independently, Mini mental state examination score greater than 24 and Berg Balance Scale score greater than 14. Exclusion criteria: A medical history that contained current treatment for recent fracture, uncontrolled diabetes and seizure disorder, Fainting and dizziness, and any cognitive behavioral and perceptual problems. Materials used were Non slippery surface, Countdown Timer (stop watch), Chair, Step platform and Music System.

PROCEDURE:

There was 2 group which were included in this study, Group A Tai Chi exercise and Group B Stepping exercise for balance training in geriatric population. Total number of 50 participants were divided into group A (n=20) and group B (n=20) by envelope methods respectively. In that 40 people were recruited for this study. Pre, intermediate and post values were taken for motor function with the independence level. The purpose of the study was explained, the subjects were screened based on the inclusion and exclusion criteria and examinations were done using BBS, TUG,

FES and POMA. The treatment was 5 sessions per week for 4 weeks each session for 45-60 minutes. Written consent was obtained from all the participants after their inclusion and the treatment session.¹²

Group A (Tai Chi exercises)

Patient received for Tai Chi training. Before training group A received training for a total of 4 weeks with 5 session per week for 45 to 60 minutes. The sessions covered theoretical background and demonstration various forms of Tai Chi exercises.¹³

PROCEDURE:

- A. Patient – explanation of the reason why using Tai Chi exercises and obtaining the patient’s consent to the treatment before proceeding.
- B. Briefing the patient about Tai Chi exercise and its benefits.

Application:

- I. The first 10 min session was reserved for warm up.
- II. Further 30 min session was reserved for various forms of Tai Chi exercises.
- III. Further 5 to 10 min was reserved for cool down.
- IV. Patients was advised for extra 2 session in a week of Tai Chi exercises by their excluding above mentioned sessions so that proper effect can be seen.

Various forms of Tai Chi exercises¹²

FORM	MOVEMENT DIRECTION AND NUMBER OF REPETATIONS
1. Commencing form	Both hands rise to shoulder level
2. Curving back arms(Repulse Monkey)	Right, left; 3 times each side
3. Stepping sideways and moving arms (Grasp Peacock’s Tail: ward off, rollback, press, push)	To the left then to the right
4. Moving hands (wave hands like clouds)	Left side leads, 3 times
5. Diagonal strides (Fair lady works at shuttles)	Left, then right
6. Standing on one leg(Golden Cock stand on one leg)	Right, then left
7. Stepping and pushing (Brush knees and twist step)	Left, then right
8. Closing form	Both hands fall to the side, left leg drawn to the right leg.

Group B (Stepping exercises)

Patient received for Tai Chi training. Before training examinations were done using BBS, TUG, FES and POMA.

Group B received treatment for 4 weeks with 5 sessions per week for 30 to 45 minutes. The sessions covered theoretical background and demonstration of

standardized technique used in stepping exercises.¹⁶

PROCEDURE:

- A. Patient –explanation of the reason why using stepping exercises and obtaining the patient’s consent to the treatment before proceeding.
- B. Briefing the patient about stepping exercise and its benefits.

Application:

- I. The first 10 min session was reserved for warm up.
- II. Further 30 min session was reserved for various forms of Stepping exercises.
- III. Further 5 to 10 min was reserved for cool down.
- IV. Patients was advised for extra 2 session in a week of Stepping exercises by their excluding above mentioned sessions so that proper effect can be seen.

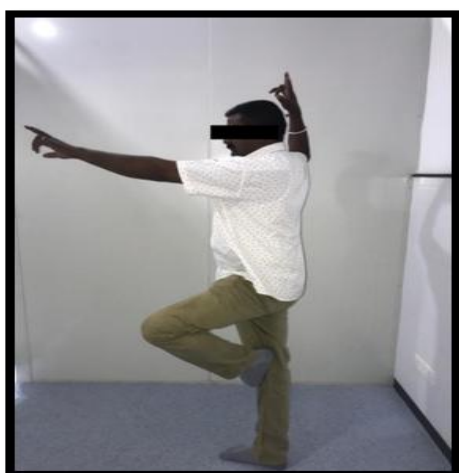


Fig: Tai Chi exercises



Fig no. 6: Stepping exercise

OUTCOMES MEASURES USED:

- 1. Berg balance scale 14 items scale 56 components designed to measure balance of older adults in clinical setting. The berg balance scale is reliable and valid measure that is used to asses characteristic in balance. Total score=56.

- Inter-rater reliability estimated at 0.97 and intra-rater reliability estimated at 0.98.²¹
- 2. Timed up and go test: this scale is to assess the functional mobility of the patient. Person who ever performing this test should wear the light foot wear and stand from a chair and walks for 3 meters. Timed up and go scale is having

good reliability and validity to assess the functional mobility in old agepatient.²²

3. Fall efficacy scale: this scale is used to measure fear of fall in older persons. Fall efficacy scale, on scale from 1 to 10, with 1 being very confident and 10 being not confident at all. A total score of greater than 70 indicates that the person has fear of falls. Fall efficacy scale is reliable method to find out the fear of fall among elderly people. Reliability estimate at 0.94.²³
4. Performance oriented mobility assessment: this scale is task-oriented test that measures and older adult's gait and balance abilities by an ordinal scale of 0 to 2. Reliability estimated at 0.28-0.51.²⁰

RESULTS

In this study Group A (n=20) Group B (n=20) were taken with the age group of 60-80 years Male and female geriatric

population with balance problem was included in the study. Result analysis has done using graphed software and paired t-test and unpaired t-test was used to comparing value within the group and between the groups.

When inter group comparison was done in BBS, TUG, and POMA there was significant in both the groups (p<0.05) but group A tai chi exercises were more statistically significant than group B that is stepping exercise group. When inter group comparison was done in FES, there was no significant difference found. (Table 1)

In the intra-group evaluations, changes that occurred in the values recorded before the treatment, after 2 weeks of treatment and post treatment, i.e. after 4 weeks, there was significant difference in all the parameters (BBS, TUG, FES and POMA) evaluated in both the groups (p < 0.05)

Table 1: Comparison of mean, standard deviation of post assessment values of various outcome measures between group A and group B using unpaired t test.

Outcome measures	Group A	Group B	t value	df	p value	Significance
	Mean ± s.d.	Mean ± s.d.				
BBS	42.7±2.81	39.5±1.82	4.272	38	0.0001	Significant
TUG	8.41±0.48	9.05±0.38	4.63	38	0.0001	Significant
FES	47.45±2.42	48.8±2.12	1.879	38	0.0679	Not Significant
POMA	25.15±1.23	24.1±0.91	3.074	38	0.0039	Significant

DISCUSSION

The present study was conducted to compare the effects of Tai Chi and Stepping exercise for balance training in geriatric population. Total number of 40 participants were divided into group A (n=20) and group B (n=20) respectively. The treatment was 5 sessions per week for 4 weeks each session for 45-60 minutes. Pre, intermediate and post values were taken for motor function with the independence level.

This preliminary study showed that both Tai Chi exercise and Stepping exercises induced significant improvements in balance improvement in geriatric population. At the end of training, participants randomized to either Tai Chi exercise or Stepping exercises, showed significant changes in the clinical outcomes

such as BBS, TUG, FES, POMA without between-group differences.

The efficacy of Tai Chi exercise for balance improvement in geriatric population has been already documented by studies showing significant therapeutic results. Low S. et al said that most of the studies support the value of BBS for measuring recovery of balance in geriatric population.⁹ A study done by Fuzhong et al shows improvements in BBS score after Tai Chi exercise intervention. It also showed that Tai Chi exercise improves a physiological system that is visual, vestibular, somatosensory and musculoskeletal and neuromuscular systems are involved in postural control, thus stabilizing body positions and reducing the risk of falls. It also improves dynamic weight transition between double- stance

and single-stance postures, constant exchange between loading and unloading of both the legs, interchange of roles between stabilizers and movers, and co-ordination between upper-body and lower-body movements. This all mechanisms contributes to postural stability in the participants which are performing Tai Chi. As postural stability increases, it improves the balance thus reducing the risk of falls.¹²

Another study done by Hosseini L, et al supports the values of TUG scale for recovery of balance problem in geriatric population.¹⁸ When the comparison between group A and group B was done at the post intervention, results were significant, but Tai Chi exercise was comparatively more effective than stepping exercise. The study done by Sarah Clary et al on effects of step aerobics and walking on balance in elderly shows that stepping exercise increases the strength of lower limb muscles and endurance.¹⁷ This study demonstrates that stepping exercise has a positive effect in elderly population and it improves balance, speed and co-ordination in elderly by improving and maintaining musculoskeletal strength.¹⁶

Lack of balance capacity, decrease in muscle strength, lack of joint position sense, flexibility, and the changes in gait are some of the major risk factors that are associated with falls.⁶ Tai Chi exercise emphasis continuous slow movement, with small to large knee movements, and rotation of the trunk, head and extremities. Tai chi exercise improves balance by improving ankle joint proprioception and foot tactile sense thus reducing the risk factors of falling.⁹ Tai chi also facilitates proper breathing pattern and kinesthetic awareness. This kinesthetic awareness decreases the fear of fall. Thus, Tai Chi exercises has effects on balance training.¹⁵

Another study done by Liu H. showed that Tai chi exercise combines the physical components of the body to stay upright that is leg strength, flexibility, range of motion, speed and co-ordination; all of which tend to reduce with age. Tai Chi

exercise helps in shifting of body weight properly. It also helps in improving lower limb strength.¹³ Tai chi exercise is smooth and coordinated movements. Hence it helps in improving the lower limb strength and coordination between both the limbs. As strength of the muscles improved, speed and range of motion also increases. Thus, Tai chi exercise is effective in balance improvement.

As expected, all the outcomes (BBS, TUG, FES and POMA) were significantly improved after treatment, irrespectively of Tai Chi exercises or stepping exercises. Tai Chi and stepping exercise both have positive effect in improving balance in geriatric population. But according to our study Tai Chi is more effective than stepping exercise in reducing the fear of fall and improving balance in geriatric population. Stepping exercise improve mostly muscle strength, flexibility and range of motion.¹⁶ Whereas Tai Chi exercise helps in improving muscle strength, flexibility, endurance, proprioception and kinesthesia which are important factors for improving balance and reducing the fear of fall in geriatric population.¹²

Limitations of Study

1. Sample size was less so this study can be done with large sample size.
2. The study was conducted on a smaller scale and at local level i.e. a small geographical area
3. As the Tai chi intervention was done on geriatric population, it was difficult for them to perform as they used to get exhaust very early. More research should be done on this area.
4. For long term effects, the duration of intervention should be increased.

CONCLUSION

This study provides evidence of positive effects of Tai Chi exercise and stepping exercise for improving balance in geriatric population after 4 weeks of treatment. But Tai Chi is better as compared to stepping exercise to improve balance in

geriatric population. Tai Chi exercise improves neuromuscular function in our body, thus improving balance.

Future Scope

Further studies with larger sample size are required to confirm the similar results.

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