

Comparison Between Muscle Strength Training Versus Qigong Exercise Training in Older Adults with Balance Impairment

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ABSTRACT

In our aging society, balance impairment raises the risk of falls and fractures. The purpose of this study was to determine whether strength training or qigong protocol is more effective in enhancing elderly persons' balance and confidence in their physical health. A total number of 60 subjects was randomly assigned to one of the two groups. The first group was instructed to perform strength training whereas in group two, qigong exercises was given. The three outcome measures of Time up and Go Test(TUG), Functional Reach Test(FRT) and Chair Stand Test(CS30) were used to measure the effectiveness group I. The groups were compared using independent student's t test. The study showed more improvement was witnessed in group I as compared to group II (TUG; GI,T=5.483, p<p0.0001; FRT (T=0.768, P< 0.0001) and GII (T=1.397, p<.0001).) and GII (T=3.209,0.0001) and CS-30 GI (T=5.258, p<0.0001) and GII (T=4.791, P<0.0001). Thus, strength training may be a useful clinical intervention for mitigating balance impairment in the elderly population.

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INTRODUCTION

Ageing is a global reality. Almost every nation in the world is experiencing upsurge in both population size and the percentage of older people in that population. While in 2019, there were 703 million people worldwide who were 65 or older, demographic estimates suggests the number to reach to 1.5 billion by 2050. This means the percentage of elderly have grown from 6% in 1990 to 9% in 2019 to an expected 16% by 2050 globally.¹

This has huge implications from the perspectives of public health. Aging is commonly associated with progressive decline in physical and psychological health, increased risk of disability and dependency, as well as an increase in the number of comorbidities. The problem gets pronounced for a developing economy in lieu of lacking social security net.² Among various health issues associated with elderly population, Falls is one of the major public health issue because of its association with serious mortality and morbidity.³

Research evidence show that over 33% of community-dwellers aged over 65 years fall at least once a year, and also among those 50% have recurrent falls. With aging, the incidence rate can enhance by 60% and could be positively correlated to other associated factors including disability levels, and extent of functional impairment^[4]. Falls add to increase disease burden as hospitalization rate among this vulnerable group is five times more common as compared to injuries from other causes.^{5,6} In addition, other psychological and social consequences are witnessed in relation to post-fall syndromes including fear, depression and activity avoidance.^{7,8}

One of the most important elements for predicting falls among elderly population is their capacity to maintain postural stability.⁹⁻¹¹ Failure to control balance leads to impairments in postural stability and dynamic equilibrium, leading to incidental falls. Low lower limb strength is linked to functional restrictions in daily life. Additionally, a higher risk of falling is linked to muscle weakness. The deterioration of balance with age is very well documented and physical activities that increase balance and strength is recommended as a sustainable solution for falls prevention^[12,13].

Research evidences suggest a wide variety of treatment and management solutions to address the balancing issues related to aging. Moderate physical activity, strength training, flexibility training, and balance training are all effective fall prevention strategies.^{7-9,14,15} For older persons, strength training

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is frequently advised in order to build muscle mass, strength, and ultimately gain independence in ADLs. Depending on the physiological, functional, or performance goals, strength training can be done in a variety of methods.^{15,16}

In contrast to strength training, Qigong exercises which is a special category of exercise that combines deep diaphragmatic breathing and relaxation with many fundamental postures that flow smoothly from one to the other through slow, gentle, graceful movements. Qigong exercises has been shown to have a beneficial effect on proprioception and balance.¹⁷⁻¹⁹ However, the evidences for the effectiveness are scanty.²⁰ Therefore, the present study was aimed to compare the effects of a qigong training versus strength training on elderly people's balance and lower limb strength.

METHODOLOGY

A total number of 60 subjects with balance impairment were recruited from Department of Physiotherapy, Highland Hospital Research and Diagnostic Centre, Mangalore, Karnataka. Subjects with more than 60 years of age who had at least 1 fall in the previous 1 year and who suffered from any form of balance problems but could still independently walk were included for the research^[17,21,22]. Subjects with any severe musculo skeletal, neurological, cardiovascular problem, any hearing or visual problem, speech -language impairment affecting ability to respond verbally to auditory stimuli, any medical history of systemic disease or who could walk without the use of assistive device were excluded. In order to determine the necessary sample, with a power of 0.80, a significance level of 95%, and an estimated dropout rate of 10%, a minimum of 28 experimental units in the group reference and 28 experimental units in the experimental group were needed, for a total of 56 experimental units, in order to achieve a statistically significant difference using the muscle strength score obtained as a dependent variable.²²

The sample was retrieved using convenient sampling method and the duration of the study was 8 weeks. Certain equipment's were required to conduct the study. It included a chair (46cm), a stopwatch to record the time duration for exercises performed as well a tape were used to conveniently collect data.

The interventions used were Muscle strength training and Qigong exercises. A thorough verbal explanation of the process was given to the subjects and any queries on their part were answered before the study. Prior to the commencement of the study, complete evaluation was done and demographic data was collected which included subjects' weight, age etc. The 60 subjects divided into 2 groups with each group consisting of 30 subjects. The first group performing strength training exercises taken as group I (GI) whereas the second group performing qigong exercises was group II (GII). The intervention 1 group received 60 minutes exercise classes six time for first 2 weeks and for another six-weeks five times per week. The strength training comprised of a total of eight exercises in strength training exercises which included standing up from a chair, Hip flexion (raising one leg while lying on the back), Standing on toes, Body weight squat, Side leg, Shank lift, Abdominal exercises (raising legs and bending hip while lying on the back), and Back exercises (raising upper body while lying on the stomach).²³ The session initiated with a warm period of

4 minutes followed by the performance of strength exercises. Each exercise is performed for 5 minutes and between each exercise there was a rest time of 2 minutes.

The qigong exercise protocol included the following eight postures, collectively known as "the eight pieces of brocade" in Baduanjin Qigong.²⁴ They were identified as (a) "Shuang Shou Tuo Tian Li San Jiao" (holding the sky), (b) "Zuo You Kai Gong Si She Diao" (bowing on both sides like shooting an eagle), (c) "Tiao Li Pi Wei Xu Dan Ju" (separate heaven and earth) (d) "Wu Lao Qi Shang Wang Hou Qiao" (look back), (e) "Yao Tou Bai Wei Qu Xin Huo" (move the head and shake the tail), (f) "Liang Shou Pan Zu Gu Shen Yao" (touch the feet with both hands), (g) "Cuan Quan Nu Mu Zeng Qi Li" (clenching fists with angry eyes), (h) "Bei Hou Qi Dian Bai Bing Xiao" (raising and lowering the heels). A preparation posture was performed before performing the first of the eight postures. There were 6 sessions for first two weeks followed by 5 sessions per week for another six-weeks for a maximum of 8 weeks. The session was started with 10 minutes of warm up, 40 minutes of main qigong exercises followed by 10 minutes of cool down.

After performing exercise for 8 weeks, the balance and strength of older adults were measured again with balance and strength test on the various outcome measures such as Time up and Go Test(TUG), Functional Reach Test(FRT) and Chair Stand Test(CS30).²⁵

Data Analysis

There were no appreciable differences between the groups, as can be seen from Table 1. Descriptions between two groups was clearly defined. No injuries or negative effects were recorded throughout the intervention performed, and almost all of the respondents participated and attended the sessions. The data were summarized as Mean±SD while discrete (categorical) is in number and expressed as percentages. The Groups were compared by independent student's t test. A two-sided ($\alpha=2$) p value less than 0.05 ($p<0.05$) was considered statistically significant.

RESULTS

The present study compared the effect of strength training versus qigong exercises on elderly population. The basis characteristics (age and sex) of two groups were summarized in Table 1 with a (mean ± SD) 63.7±3.11 years and 64.57±3.45 years respectively in both groups I & II.

The effect of the treatment protocol on outcome measures on various parameters TUG, FRT & CS-30 were explained in (Fig. 1 to 3). The mean TUG, FRT & CS-30 in both groups decreased (improved) after the training, however the improvement was more pronounced in group I than group II among all the 3 parameters under study respectively (TUG; GI,T=5.483,

Table 1: Group Gender Tabulation

Gender	Group I	Group II	Total
Female	18	16	34
Male	12	14	26
Total	30	30	60

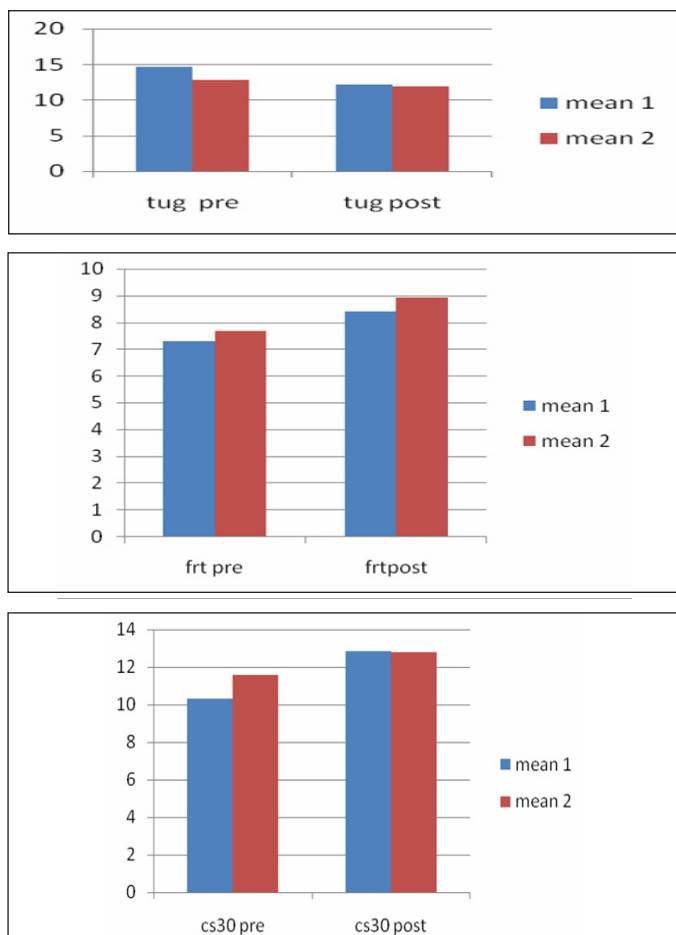


Fig. 1 to 3: Showing Pre and Post (mean ± SD) score for 2 groups or all three outcome measures (TUG,FRT & CS-30)

$p < 0.0001$; FRT ($T=0.768$, $P < 0.0001$) and GII ($T=1.397$, $p < 0.0001$.) and GII ($T=3.209$, 0.0001) and CS-30 GI ($T=5.258$, $p < 0.0001$) and GII ($T=4.791$, $P < 0.0001$).

DISCUSSION

The present study is one of the first to evaluate the efficacy of strength training versus qigong exercises among elderly people which are popularly recommended for fall prevention.⁵ The results showed that strength training was more effective than the qigong exercises over 8 weeks of training session. Previous studies support the benefits of strength training on balance. Literature evidence suggests that strength training have been found effective in reducing falls by 30%-50% among older adults [7,8,23]. Some of the reasons that might contribute for strength training preventing falls are that volume of strength training is associated with strength development and muscle hypertrophy, neural adaptation, maximal motor unit firing rate as well as elevated spinal motoneuronal excitability and increased efferent motor drive; thus promoting stability that prevent the initiation of a fall, and counteracts the downward force of a fall once balance is lost.^{9,26}

Evidences from various studies showed that strength training appear to elicit effective countermeasures in elderly individual even at very old age by evoking muscles hypertrophy along with substantial changes in neuromuscular function respectively. The training induced changes in muscle mass and nervous system function leads to an improved functional capacity during activities of daily living.^{26,27}

Muscle strength declines with age. The strength of people in their 80's is about 40% less than that of people in their 20s. Muscle weakness, particularly of the lower limbs, is associated with reduced walking speed; increased risk of disability and thus falls in older people. By the age of eighty, strength declines on average to almost half that of a young adult.^{28,29} This decline in strength is consistent across muscle groups and across all types of measurements including isometric, concentric, eccentric as well as isokinetic.

Specific strength training induces changes in muscle mass as well as nervous system functioning which might lead to an improved functional capacity during activities of daily living. This claim might find support from other studies by Papa and colleagues where intervention in form of strength training for consistent 6 weeks resulted in relatively modest increase (20-30%) in muscle strength.³⁰

With reference to the qigong exercises, the specialized techniques covers all components of balance system thus integrating the sensory systems to postural stability and balance. The technique facilitates enhanced use of visual and vestibular information, which might be responsible for enhancing balance where the methodology is primarily centered on the work of energy or the movement of energy popularly called as Chi^{20,21} The technique aims towards enhancing physical, mental, emotional, and respiratory well-being, where concentration, relaxation, breathing along with body posture is considered to be crucial for the proper functioning of all aspects of the physiological process. This is achieved through synchronizing rhythmic movements, breathing exercises and meditation which is valuable keeping one in good health and to helping both in disease prevention and treatment.^{17,18} For instance, during the performance of the fifth exercise while the participants had to circle their lumbar spine at a 45-degree angle, they were instructed to tilt their upper bodies 90 degrees forward while doing the sixth exercise.²⁴ This technique reinforce the elderly participants to maintain their center of gravity utilizing their lower limbs, particularly their feet, which had to be planted to the ground, without going over the shoulder width limit by completing these unusual movements. This most likely help in the reducing mean velocity of the CoP, which is thought to be one of the most accurate indicator of postural balance and a separate predictor of the frequency of fractures and falls. Thus, Posture control during the practice of Qigong might force the muscles involved in movement to work hard, which may lead to increased muscle strength.²¹

RELEVANCE TO CLINICAL PRACTICE & LIMITATIONS

This study will help in giving some concrete information about the effectiveness of strength training on fall reduction in elderly people. There were some limitations too. The duration of the study was long so few people cannot complete the study. In addition, the time duration for performing exercises was long, so was difficult for older people. Moreover, since the study was done on older adults and hence the result cannot be extrapolated with accuracy on young person.

CONCLUSION

The present study has shown that strength training is more effective in alleviating balance impairment as compared to

qigong exercise training. The research provides sufficient evidence to claim that the technique can be used judiciously for improvement of balance in elderly and prevent fall related injuries.

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