

# Effects of Balance Training on Muscle Endurance and Balance Performance in Elderly Men

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## Abstract

This study investigated the effects of balance training on muscle endurance and balance performance in elderly men. 30 elderly men (age 70.5±9.8 yrs) participated in present study. The static balance was evaluated by Tandem stance test. Using wall Scott test, the endurance of the lower extremities' muscles was measured. The experimental group underwent eight weeks balance training. The control groups did not participate in any training program. The evaluations were repeated after the treatment sessions. Within group comparisons was carried out by paired t-tests, where between groups comparisons was performed by t test for independent samples. After balance training the ability of older men in balance control was significantly improved compared with control group. There was no significant difference in the muscle endurance ( $p=0.9$ ). Balance training improved balance performance in the older men. This method is recommended for elderly rehabilitation.

**Keywords:** Elderly; Balance Training; Balance Performance; Muscle Endurance

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## 1. Introduction

It has been demonstrated that aging is related to poor balance, incorrect gait and weakness in strength and endurance of the muscles [1,2]. There are the reductions and limitations in skeletal muscle function associated with the normal aging process [3]. Specific attention has been given to changes in muscle strength and muscle endurance on the elderly. It is concluded from the literature that, although healthy old people achieve high levels of muscle activation in tests of voluntary strength, a loss of motor neurons and skeletal muscle fibers with aging appears to cause a gradual decline of muscle strength after the sixth decade. In association with that lowered strength, there is

some reduction of muscle endurance for heavy lifting and carrying tasks [3]. On the other hand, older adults have significant decline in postural stability where their base of support is reduced. It is directly associated with daily activity like during stair climbing and walking which both require one foot stance 20 to 40% of the time [4]. Also, the previous studies have been showed that poor balance performance [5-8] and weakness in muscle endurance cause many difficulties to do daily activities in elderly people [9,10]. Consequently, the exercises have been recommended for rehabilitation in elderly people are those which specially target balance training [1,6,11]. In other words, improvement of static balance by a proper balance program of content and intensity may

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improve daily activities and even prevent the risk of falling [12,13]. Then, it seems some balance exercise like walking, standing on one-leg, juggling around a chair and so on can improve both balance performance and muscle endurance. Therefore, the purpose of the present study was to investigate the effect of a 2-month balance training program on balance and muscle endurance of the lower extremities of elderly men.

## 2. Methodology

### 2.1 Participants

Thirty elderly men (age  $70.5 \pm 9.8$  years, height  $159.2 \pm 10.3$  cm, and body mass  $60.2 \pm 11.3$  kg) from an Iranian local pension in Isfahan voluntarily participated in present study. The patients had to meet the following inclusion criteria to participate in the study: (1) aged 60 or older, (2) living in a nursing home or residential care facility, (3) able to walk six meters or more (without a walking aid), (4) able to comprehend the conduct of the tests, (5) without any disease that grow worsen with exercise, and (6) no visual deficiency and severe auditory deficiency. The subjects were consecutively randomized to an experimental group ( $n=15$ ) with a balance training program and to a control group ( $n=15$ ) without intervention. All subjects completed assessments before and after the intervention.

### 2.2 Assessments

**Balance Performance:** Static balance was evaluated using the tandem stance test: heel of one foot directly in front of and touching the toes of the other foot [14]. **Muscle Endurance:** Using Wall Scott (or Wall- Sit) test, the endurance of the lower extremities' muscles was measured. The participant sits in chair-like position with his back against the wall. Hands are hanging beside the body. To avoid any possible knee injury, the proper angle for knee joints is set by the trainer based on the best suitable position for every participant. Endurance was scored as the length of time (sec) which the participants were able to keep the mentioned situation or until stand up.

### 2.3 Intervention

The balance training program include one hour of exercises realized three sessions per week on experimental group underwent an eight weeks period. The balance exercises described by Zamanian (2011) were used [15].

### 2.4 Data analysis

Data are presented as mean and standard deviation ( $\pm$ SD). The evaluations were repeated after the treatment sessions. Within group comparisons was

carried out by paired t-tests, where between groups comparisons was performed by t test for independent samples.

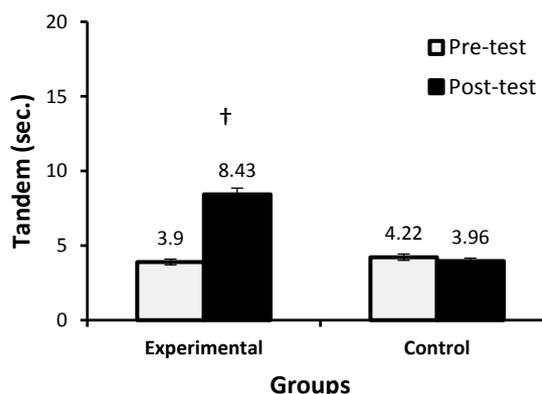
## 3. Results

Tandem values were significantly higher compared with the pre-test ( $p < 0.001$ ,  $8.43 \pm 4.4$  vs.  $3.90 \pm 0.5$ ) and with control group ( $p < 0.001$ ,  $8.43 \pm 4.4$  vs.  $3.96 \pm 2.2$ ). Although muscle endurance was not significantly higher compared with the pre-test ( $p = 0.9$ ,  $52.09 \pm 45.8$  vs.  $38.71 \pm 12.5$ ) and with control group ( $p = 0.8$ ,  $52.09 \pm 45.8$  vs.  $43.71 \pm 40$ ), it was increased.

**Table 1.** The effects of intervention on static balance (tandem stance), endurance muscle (wall scott). Values are mean  $\pm$ SD. N=15 for each group.

Variables	Groups	Pre-test	Post-test
Tandem (sec)	Experimental	$3.90 \pm 0.5$	$8.43 \pm 4.4$ <sup>a,b</sup>
	Control	$4.22 \pm 0.14$	$3.96 \pm 2.2$
Endurance (sec)	Experimental	$38.71 \pm 12.5$	$52.09 \pm 45.8$
	Control	$40.09 \pm 11.5$	$43.71 \pm 40$

<sup>a</sup> Significant difference compared with pre-test ( $p < 0.05$ ).  
<sup>b</sup> Significant difference compared with control group ( $p < 0.05$ ).



**Figure 1.** The effects of balance training program on tandem stance test, N=15 for each group, † Significant difference compared with pre-test ( $p < 0.05$ ).

## 4. Discussion and Conclusion

This study showed that a program of balance training in a period of eight weeks was effective in improving the balance performance in the elderly men. Aging impairs the mechanisms such as sense (visual), proprioceptive and somato-vestibular systems which control balance function [16]. By providing physical exercise opportunity and challenge in the balance mechanism, balance performance would be improved [16,17]. These findings were similar to Laforest et al., (2009), Nagy et al., (2007), Rogers et al., (2002), and McCleanaghan et al., (1995) [5-8].

The activity in this study such as walking while raising the leg (open and close eyes), jogging around a chair, moving the head side to side, tandem stance with head rotation and neck extended and so on did not improve significantly the muscle endurance. It seems these activities stimulate the vestibular and proprioceptive systems. Maybe activities like juggling around a chair and walking are simple and do not keep enough pressure to improve muscle endurance in this study. Although the mean difference between pre-test and post-test of control group was not significant, those who did not take part in any kind of exercise did worse in the post-test measurements. In fact, this is so probably because living in a pension without any kind of exercise gradually deteriorates the body functioning of the elderly people. The result of this study showed that the balance training program used in the research, helped the participant to somehow overcome on the general trend of decline in body functioning.

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