



## Original Article

### Comparative Study of the Effect of Aerobic and Resistance Exercise on Static and Dynamic Balance in Elderly Males

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#### ABSTRACT

##### Article history

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**Introduction:** Stumbling or falling is a major health problem among the elderly which accounts for their majority of physical injuries such as pelvic fractures, disability, loss of independency and even death. The goal of the study was comparison of the effect of aerobic and resistance exercise on static and dynamic balance in old men.

**Methods:** A quasi-experimental study was conducted and thirty elderly males, who were referred to Jahandidegan institute of Borujen, were divided randomly in three empirical groups subdividing aerobic, resistance and control group. 24 hours before the start of and 24 hours after completion of eight weeks -aerobic and resistance exercise, all participants went under static and dynamic balance examination. The results were analysed by SPSS software version 19.

**Results:** Mean and standard deviation of dynamic balance scores before the exercise for the resistance, aerobic and control groups were  $1017.6 \pm 212.7$ ,  $930.5 \pm 238.2$ ,  $1119.6 \pm 287.3$  and after eight weeks exercise were  $851.7 \pm 155.5$ ,  $743.4 \pm 130.1$ ,  $1220.06 \pm 226.9$  respectively. On the other hand, Mean and standard deviation of static balance scores before the exercise in resistance, aerobic and control groups were  $2280.3 \pm 2286.2$ ,  $3534.9 \pm 4455.4$ ,  $1284.1 \pm 231.4$  and after eight weeks exercise were  $5563.4 \pm 8014.6$ ,  $6089 \pm 7888.4$ ,  $1297.1 \pm 214.4$  respectively. ANOVA test revealed that the difference in changes of three groups were not statistically significant ( $p > 0.05$ ).

**Conclusion:** Despite marginal correlation between static and dynamic balance as the outcomes of aerobic and resistant exercise these activities are proposed because such the exercises reduce incidence of falling events and related-injuries; and also risk of independency among older adults.

**Keywords:** Aerobic, Aging, Balance, Exercise, Resistant

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#### Introduction

One aspect of ageing that affects the old performance is imbalance. Ten percent of community-dwelling persons over the age of 65 lose their dependency in activities of daily living each year (1). Decreasing muscle power is a major risk factor that exacerbates progressive disability among elderly people, such as difficulty to keep stability while walking that predisposes them to falling (2). Falling obviously causes much morbidity and mortality in

frail older people such as fracture and soft tissue contusion (3). The more excellent the cardiovascular and musculoskeletal system perform, the more effectively the balance, physical flexibility and self-confidence keep walking safe for the elderly. Therefore, special practicing programs are needed to improve elderly life quality. Consequently, health and medical care cost is saved (4).

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Balance is one main requirement to perform routine activities and plays a crucial role in static and dynamic activities. Situation control system and balance is a complex mechanism which contains arrangement of three balance systems including visual, vestibular and somatic-sensory systems (5, 6). The ultimate output of the system is postural control and balance. Being physically active and regular exercise effectively prevent or delay (non-) fatal complications of ageing (3). Exercise can decrease falling risk through improving physiological weaknesses of balance, muscular power (7).

In this study, effect of an eight-week aerobic/resistance exercise program was examined on balance status of old males. First, the effect of aerobic and resistant exercise on balance level was specified. Afterward, the difference between aerobic and resistance exercise on the subjects' static and dynamic balance was recognized.

## Methods

### Procedures

In a quasi-experimental study, thirty male subjects, in age range of 70 to 85 years old and weight range of 60-75 kg were selected from referred patients to Jahandidegan institute of Borujen. They were divided randomly in three categories; two empirical groups (aerobic and resistance exercise) and one control group. The aims of the study as well as study procedures were thoroughly explained to participants who gave written consent before participation. To be enrolled in the study, participants fulfilled following inclusion criteria: non-smoker, and free from endocrine disease, diabetes and heart disease.

In the aerobic group, the subjects practiced 3 sessions of 40 minutes per week an aerobic exercise at the temperature of 20 centigrade for a period of 8 weeks divided to three stages: dating, overload protection and stabilization the intensity. The aerobic exercise program also included running (3 times a week, no more than one working-day rest between sessions) for 30 to 45 minutes with 60 to 75 percent of the maximum heart rate expected for age. Maximum heart rate expected for age =  $220 - \text{age}$ .

The 8-week, 3-time/week program for resistant group included 10 minutes warm up through stretching and performing 10 station movements in circular mode for 30 to 40 minutes, and 10 minutes were taken for cooling at the end. Situations include 10 kinds of resistant exercise: Resistance (leg press, chest press, shoulder press, biceps, triceps), extension of the knee (quadriceps femoral), knee flexion (serine and hamstring), lifting the heel (muscle strengthening twin), and long-spill. The exercise program in each section includes three times and twelve repetition with 40% to 65% of maximum repetition. The rest time between stations was 45 to 60 seconds and the rest time between each circle was 90 seconds. Overload was designed to test participant after 6 sessions of exercise and 5% of weight was added. In order to determine maximum repetition below formula was

used,  $1RM = W / (1.0278 - (R \times 0.0278))$ , (W= weight (kg), R= number of repetitions). This protocol adopted from valid resources (8, 9), also special recommendations of American College of Sports Medicine for elderly was considered. The control group received no intervention. Balance status of all participants was examined 24 hours before the first and, finally, 24 hours after the last session. To test static balance, the stork test was applied. In this test participants should stand on one leg and lift the other leg, and the time they endure the test is recorded.

Dynamic balance begins with the subject sitting correctly (hips all of the way to the back of the seat) in a chair with arm rests. The chair should be stable and positioned such that it will not move when the subject moves from sit to stand. The subject is not allowed to use the arm rests while lifting. A piece of tape or other marker is placed on the floor 3 meters away from the chair so that it is easily seen by the subject. On the word GO the subject will stand up, walk to the line on the floor, turn around and walk back to the chair and sit down.

Participants were asked to implement these tests with their maximum safe speed but they cannot run. The test starts timing on the word "GO" and stops timing when the subject is seated again correctly in the chair with their back resting on the back of the chair. To familiarize with the tests, all participants were allowed to perform each test 3 times and the average time of the test was registered as patients' record.

### Data analysis

Analyzing data was done by SPSS 19 Software. Based on normality of the data, variance analysis statistical test was used to compare means in different stages. Also, the confidence level for all test were 95 percent.

### Ethical considerations

The Institutional Review Board of Islamic Azad University, Khorasgan Branch, approved this study. Moreover, all participants were informed about aim of the study before participation and all signed the consent form.

## Results

The Mean and standard deviation of dynamic and static balance before and after aerobic and resistant exercise are summarized in Table 1. Table 1 compares and contrasts average time of static and dynamic balance test in three groups. Considering the level of more than 0.05 as significant, there is no significant difference between three groups.

The results of LSD post hoc test depict There is significant correlation between 8 week aerobic exercise and resistant exercise on dynamic balance of elderly men ( $p = 0.029$ ).

Table1. Physiological feature of the participants

Variables	Groups	Before		After		f	p
		Mean	SD	Mean	SD		
Static balance (Hundredth of a second)	Control group	1284.1	231.4	1297.1	214.4	1.891	0.17
	Resistant exercise	2280.3	2286.2	5563.4	8014.6		
	Aerobic exercise	3534.9	4455.4	6089	7888.4		
Dynamic balance (Hundredth of a second)	Control group	1119.6	287.3	1220.06	226.9	3.501	0.05
	Resistant exercise	1017.6	212.7	851.7	155.5		
	Aerobic exercise	930.5	238.2	743.4	130.1		

## Discussion

For many years, aerobic exercise has been applied to improve joint stability, neural-muscular and muscular postural control. A bulk body of recent evidence has approved aerobic exercise to achieve moderate walking ability, and physical preparedness improvement. Furthermore, from a scope of wider view, physical exercise, overall, influences on body composition. Thompson et al. conducted a study of 14-week multidimensional exercise on balance, instability and falling risk in elderly people. 105 subjects with past history of at least one falling event were divided in three groups (21 subjects in control group, 52 subjects in multidimensional exercise group, and 32 subjects in one-type exercise group). At the end of week 14, there was a significant difference between the empirical groups than the control group (16). Based on the available data, maintaining and improving performance of cardiovascular system decrease muscle mass and strength compensation from the process of aging, improve balance, increase body flexibility, increase life expectancy, maintain mental ability and increase self-confidence in old age (13).

The purpose of this quasi-experimental study was to determine whether aerobic and resistance exercise increases dynamic and static balance, respectively. Some improvements was found in dynamic and static balance after 8 week aerobic exercise and resistant exercise on empirical group rather control group which was not statistically significant. Results of the study is consistent to Di Bervin et al. and Manini et al. (10, 11) and the result of static balance was not consistent to findings of the study by Alison et al., Barnett et al., Rozendal and Ronita et al. (1, 6, 12). In a study about effect of a 8-week resistant exercise on balance status of 50 elderly male participants, there was a significant correlation between static and dynamic balance of elderly ( $p = 0.05$ ) (6).

According to Katola et al. resistant exercise improved old aged patients' balance (13). In other study by Ghasemi in 2009, a 12- week performance exercise improved static and dynamic balance in elderly women (14). Rozendal et al. reported that an intensive performance exercise improves balance, walking ability and upper body power; and also decreases falling risk.

Also, this study illustrated a significant difference between the effectiveness of a 8-week aerobic and resistant exercise. These findings are consistent to

RandA et al. results (15). Also, these findings is not consistent to Di Bervin, Manini et al., Rozendal et al. Sadeghi (2, 3, 10, 11).

## Conclusion

Although the present study was unable to show any statistically significant correlation between a 8-week aerobic and resistant exercise on static and dynamic balance in male old persons considering, however, little improvement in balance and enhancing elderly overall health status, such the daily activities are recommended to decrease the incidence of mortality and morbidity in old age.

## Study limitations

A main limitation of the study was that members of the control group were not screened for confounding diseases and conditions.

## Conflict of interest

The authors declare that they have no conflicts of interest.

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