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Original Article

The effect of eight weeks of Reactive Neuromuscular Training on balance, strength and quality of life of elderly women.

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Abstract

Background: Aging is related to a decrease in physiological and functional capacity which can increase disability, decrease balance and fall. The widespread problems in the elderly that occur as a result of the aging process are the loss of balance, increase in vertical fluctuations, and the possibility of falling. The purpose of the current study was to investigate the effect of eight weeks of RNT exercises on balance, strength, and quality of life of elderly women.

Method: The statistical population of the present study included 18 elderly women living in Isfahan selected as available sampling and after taking the pre-test, they were randomly divided into two experimental (9 people) and control (9 people) groups. The subjects were trained for 8 weeks and 3 sessions per week for 1 hour at Parsia Clinic. The research tools included functional reach test to measure static balance, timed back and forth test to measure dynamic balance, sit-to-stand test to measure lower limb muscle strength, and Lipad quality of life questionnaire. After the end of the training period, both groups were tested again by SPSS software version 24. The results were analyzed using the ANOVA statistical test for repeated measurements to check the research hypotheses.

Results: According to the results, eight weeks of dynamic neuromuscular stability exercises significantly improved the static balance and dynamic balance of elderly women(05/0>p). Also, eight weeks of RNT exercises significantly improved the strength of the lower limb muscles of elderly women and improved the quality of life of elderly women ($P<0.05$).

Conclusion: The present study showed that eight weeks of RNT exercises can be effective in improving static balance, dynamic balance, lower limb muscle strength and quality of life of elderly women. These factors are among the most important factors related to the health of the elderly. Therefore, RNT exercises can be effective for treatment and rehabilitation and are recommended as an effective method to improve these components in elderly women.

keywords: Quality of life, Reactive neuromuscular training, balance, elderly, women

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Introduction

Aging is a phenomenon that can be considered a stage of the natural course of human life and it is a process that happens to all human beings and there is no escape from it (1).

Also, this period is a natural path in which there are changes and physiological problems (Changes in the functional capacities of tissues and organs of the body such as the cardiorespiratory system, endocrine, immune and neurological systems, decrease in muscle strength, decrease in range of motion and increase in reaction time), Sensory system changes (impairment in posture control, balance and increased falling), Sensory system changes (impairment in posture control, balance and increased falling), Psychological problems (memory and cognitive disorders) and social problems (decreased self-esteem, self-efficacy, happiness and weak social connections) that occur in a person (2). As a result of aging, ligaments, tendons and vessels face a decrease in efficiency. Skeletal muscles are also faced with a decrease in mitochondrial capacity, an increase in collagen content, and a decrease in flexibility, and subsequently, physical fitness factors become weak and impaired in old age (3). Balance is one of the factors of physical fitness that is disturbed with age, and the reason for this is the reduction of sensorimotor responses needed for posture stability and orientation with age (4). Decreased muscle strength, power, and decreased range of motion along with sensorimotor coordination disorders are involved in postural control disorders in old age (5). Decreasing the ability to control posture and balance in the elderly is particularly important (6). Because these factors are among the most important and common movement and physical problems of the elderly (7). In the elderly, proper balance is necessary for many functional activities, reducing the rate of falls and increasing independence and quality of life. Balance disorders and the subsequent increase in falls are one of the most important problems and concerns of this period of people's lives, so that about a third of the elderly experience a fall at least once a year (8). According to the theory of counter-pasture systems, the ability to maintain and control body position in space is the result of a complex interaction that occurs between different sensory and motor systems and components, and the importance of each system varies according to the purpose of movement and environmental conditions (9). The decrease in the efficiency of the processes involved in balance and walking, caused by disturbances in different body systems, such as motor and nervous systems, is one of the effective factors in balance problems and the increase in falls in old age (10). Studies have shown that the strengthening of each of these systems and the

components involved in it can be a suitable strategy in the treatment and prevention of balance and walking problems of the elderly and ultimately reducing falls with the increase in the age of the elderly (11). Therefore, the aim of the present study was to investigate the effect of RNT exercises on the balance, strength and quality of life of the elderly.

Material and methods

The current research is of semi-experimental type and in terms of practical purpose, with a pre-test and post-test design. In the present study, among the elderly women over 60 years old in Isfahan who were interested in cooperation and qualified based on the criteria for entering the research, 18 subjects were selected in a targeted and available manner. Then the necessary information about the nature and method of conducting the research was given orally by the researcher to the subjects. Before starting the intervention, the patients were assured that the information related to each person will be examined in a completely confidential manner and will be reported in general. Then the subjects were randomly divided into experimental (RNT exercises) and control groups. Then a pre-test was taken from the subjects and after that, for eight weeks, three sessions of 60 minutes of exercises were performed in the experimental group. At the end, a post-test was also conducted. The place of research was Isfahan- Parsia Correctional Movement Center. After completing the consent form and personal information form, the subjects' height and weight were measured. The experimental group did the exercises for eight weeks, three sessions a week and each session lasted about 60 minutes. During the research, the control group did not receive the exercise protocol and did their daily activities. The data were analyzed by SPSS version 24 software. The results were used and analyzed by ANOVA statistical test for re-measurements to check the research hypotheses.

Results

The results of the descriptive study of the subjects' demographic information are shown in Table 1.

Table 1. General statistical information related to the demographic characteristics of the subjects.

Factor	group	Mean ± SD	SE ± crookedness	SE ± stretch	t Value	level meaning
Age	exercise	23/4±8/61	63/0 ±79/1	23/1 ±02/4	75/0	11/0
	Control	81/3±3/62	58/0±21/0	12/1±74/0-		

tall	exercise	08/2±4/158	63/0 ±41/0	23/1 ±19/0	28/0	27/0
	Control	88/3±6/159	58/0±02/0-	12/1±38/0-		
Weight	exercise	53/7±81/69	63/0 ±41/0-	23/1 ±25/0-	95/0	42/0
	Control	66/6±7/69	58/0±26/0-	12/1±84/0-		

Table 2 shows the results related to the statistical analysis of the effects within the subjects' groups. The first row of Table 2 shows that when the average grades of the groups in the pre-test and the post-test are compared, the differences are significant (P=0.000 and F=137.67 (1, 16). The second row of Table 3-4 shows that the interaction of changes within the group (slope of the change line) is also significant (P=0.00 and F=164.85 (1,16). In other words, when the changes in the scores of each of the two research groups are considered separately, the level of significance changes and the pattern of internal changes of the groups can be considered significantly different. In other words, it can be concluded that the exercises used have significantly improved the static balance of the subjects. Therefore, our hypothesis is confirmed.

Table 2. The results related to the statistical analysis of the effects within the subjects' groups.

Factor	**group**	**pre-exam Mean ± SD**	**After the test Mean ± SD**	**within a group (1,16) Df**	**Intergroup (1,16) Df**	**group interaction (1,16) Df**
Static balance (cm)	exercise	6.53±1.94	19.1±2.44	F=137.7 P=0.00	F=0.11 P=0.11	F=164.8 P=0.00
	Control	6.8±3.49	6.6±3.54			
dynamic balance (seconds)	exercise	19.46±1.46	10.63±1.06	F=92.21 P=0.00	F=0.01 P=0.89	F=58.64 P=0.00
	Control	17.6±2.13	17.86±2.26			
Lower limb strength (Nm)	exercise	8.4±17.61	11.5±20.37	F=63.68 P=0.00	F=0.21 P=0.64	F=82.68 P=0.00
	Control	7±43.06	6.7±43.03			
Quality of Life	exercise	60.7±8.21	72.3±7.96	F=10.56 P=0.003	F=522 P=0.04	F=65.11 P=0.00

Discussion

Aging is related to a decrease in physiological and functional capacity, which can increase disability, decrease balance, and fall (12). Falling is one of the most important

complications of becoming disabled in the elderly, which is associated with damage to their ability to perform daily activities (13). Balance disorders are one of the most common problems of the elderly that specialists in this field seek to treat and reduce these disorders by the best type of exercise (14). Therefore, it is essential to design exercises that can minimize balance disorders in the elderly (15). On the other hand, improving the strength of the lower limbs is the result of training methods that are related to increasing balance. In fact, the physical activity of the elderly maintains their function and muscle mass at high levels. Some age-related changes in the balance system may be reduced by maintaining an active lifestyle (13). Also, the purpose of standard clinical tests that exist for balance evaluation is screening in order to identify balance disorders and predict the risk of falling. These tools identify who may benefit from balance exercises and can help therapists decide how to reduce balance disorders and prescribe exercise for them (12). Muscle strength is considered one of the effective factors in achieving or the success rate in maintaining balance, its level in the elderly takes a horizontal path in the curve until about 50 years of age and decreases from then on. Therefore, around the middle of the 60s, the loss of muscle strength is very significant. In the 50s, this analysis is about 18 to 20 percent. But after the age of 65, about 45% drop is seen (13). On the other hand, there is a relationship between muscle weakness in thigh abductors, knee extensors and flexors, and ankle plantar flexor muscles with the risk of falling while moving and walking (14). Eight weeks of dynamic neuromuscular stability exercises significantly improve the static balance of elderly women ($P<0.05$). In this research, we were able to increase the strength of the lower limbs, and it was observed that the changes progressed significantly towards the improvement of the static balance of the experimental group. As a result, RNT exercises are probably useful for improving lower limb strength. To measure static balance in this research, the functional reach test was used, which included changing the posture and maintaining the posture in a sitting position. These exercises also significantly improve the dynamic balance of elderly women ($P<0.05$). Among the factors that improve dynamic balance, we can mention the improvement of static balance and strength. The purpose of this analysis was to investigate the effect of grouping on the dynamic balance of elderly women. To measure this index, the timed test of getting up and walking was used in this study. Performing RNT exercises significantly improves the strength of the lower limb muscles of elderly women. Due to the use of training equipment such as elastic, we saw an improvement in strength. Inferential

analysis shows that intragroup and interactive effects were significant in power ($P<0.05$). As mentioned earlier, we were successful in improving strength in lower limb muscles through RNT exercises, which indicated the positive effect of these exercises on increasing strength. To measure the strength of the muscles of the lower limbs of women in this study, the sit-up test was used in 30 seconds. RNT exercises significantly improve the quality of life in elderly women. The purpose of this analysis was to investigate the effect of grouping on the quality of life of elderly women. Similar to the previous variables, the intragroup and interaction effects were significant ($P<0.05$). In this research, the quality of life was measured using the Lipad questionnaire as a pre-test and post-test, and the results showed the improvement trend in this index. The results showed that the experimental group improved the quality of life by 19.1% compared to the control group.

Conclusion

The results of this research showed that eight weeks of RNT exercises significantly improve static balance, dynamic balance, lower muscle strength, and the quality of life of elderly women. Therefore, RNT exercises can be used as an effective method to improve these components in the elderly.

Competing interests

There is no competing of interest to disclose.

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