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The comparison of effects of two selected functional and Theraband trainings on the dynamic balance and strength of lower limb among elderly men

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Abstract

Physiological changes related to aging and muscular problems can increase the risk of injuries in the elderly people. Hence, one of the major risks in the elderly people is falling down. The present study aims to compare the effects of two selected Functional and Theraband trainings on the dynamic balance and strength of lower limb in the elderly men.
45 old men with physically healthy in range of 60 to 75 years were randomly divided into three groups: the Functional trainings (n=15), Theraband trainings (n=15) and control groups (n=15). The dynamic balance with Berg test and the lower limb strength with 30 Second Chair Stand tests were measured. The Functional and Theraband groups take part in Theraband and Functional trainings for 6 weeks. All tests were repeated for all of the groups after six weeks of training in the same condition. Data were analysed by covariance analysis (ANCOVA). The level of significance was $p \leq 0.05$.
The results of this study showed that the Functional and Theraband trainings lead to a significant improvement in the dynamic balance and strength of lower limb in the elderly men. Furthermore, Theraband trainings on the strength of lower limb and Functional trainings on the dynamic balance had more effect. Elderly men are recommended to use Functional trainings for improving the dynamic balance and the Theraband trainings for improving the strength of lower limb.

Keywords: Functional training, Theraband, Balance, Strength, Elderly men

Introduction

Elderly is a phenomenon which is considered as an integrated natural process in human life. Elderly is categorized into two age groups of 55-75 called young-old and over 76 called old-old (Hanachi et al, 2010) and is a period of time which is accompanied by some erosive, regular progressive and spontaneous changes in most of organs and physiologic performance of body(Stevens et al., 2000). Of these changes, one can point to the organs involved in keeping balance which may expose aged people to serious harms resulted from reducing balance such as bone fractures and long-term incapacities (Shumway-cook et al., 2007). Falling on the ground or collapsing is one the commonest and most prominent predicaments of ageism which is so frequent and causes

some mental and physical complications and consequences and due to its high costs, identifying the underlying reasons and factors and prevention methods have been in centre of attention (Seadiabdoli et al., 2012) and as people age, sensory function and muscular strength of body decreases. The natural performance of musculoskeletal system is essential for keeping and preserving balance. Decrease in flexibility and strength in aged people consequently decreases quick return to the previous state after turbulence (imbalance). Taking into consideration the fact that imbalance is among the most significant reason of falling among aged people; the issue of balance has been in center of attention among this group age (Seadiabdoli et al., 2012). This decline in balance will intensify as a result of inactivity and decline in muscular power. Reports reveal that physical activity can improve posture control reduce falls in elder people (Perrin et al., 1999). Recent studies have indicated that functional training, in which practicing complex motor task is a prerequisite, could develop functional physical fitness and sport performance of aged people (Nagy et al, 2007; Cromwell et al, 2007; Thompson et al., 2007). Functional trainings have some roots in rehabilitation. Physical and occupational therapists mostly apply this method for retraining patients suffering from movement disorders functional. The interventions are designed in way that be considered as a model for basic physical exercises in significant fields for each patient with functional independence approach (O'Sullivan et al., 2007). Creating physiologic compatibilities, functional trainings play significant role in learning skills, calling motor units (Kornatz et al., 2005), increase in the formation of motor cortex (Karni et al., 1995) and the improvement of using muscles (Carrol et al., 2001). Functional skill training is closely related to the increase in spinal cord irritability. It seems that neural compatibilities consequent of these trainings have a good durability (Jensen et al., 2005). In another research, it has been observed that functional strength training has significant impact on the balance of elderly people (De Bruin et al., 2000). Bomben's research revealed that intensive strength trainings increase strength and power in aged people (Bemben et al., 2000). Of progressive resistance trainings is the use of elastic band which causes the muscles to increase in size and strength among aged people (Ebrahim et al., 2011). Elastic band trainings have been registered as a safe tool and a proper strategy for improving the performance of neural system, muscular power and strength, and increasing the ability of doing functional tasks among elderly people (American College of Sports Medicine, 2011; Performance health Academy theraband academy). Progressive resistance trainings have been officially approved as a main system for over 25 years; elastic resistance (theraband) has been approved for increasing strength, mobility and performance and reducing pain in joints (1, 2, and 3 grade). Researchers benefit from theraband resistance trainings to increase strength and posture stability and have come to effective conclusions (Ciolac et al., 2010). Sport plans based on evidences are implemented to improve functional ability and sport performance among aged people and also to rehabilitate injuries and to cure many of chronic diseases using theraband bands and tubes. These elastic bands are made of natural latex and are available in a set of variety from pink, yellowish brown, yellow, and red to green, blue, black, white, silver, and gold. The elastic resistance tubes and bands are reasonable, portable and versatile. The strength that is created by theraband is directly proportionate to the increase in length. Each color of therabnd shows particular resistance at specific lengths (American College of Sports Medicine, 2011; Performance health Academy theraband academy). In most of the researches conducted in this field, free weights or strength training devices based on resistance programs more than 12 weeks have been applied which are available for all people of society (Lovell et al., 2010) while the use of other devices such as theraband have been less investigated. Moreover, it has been revealed that theraband trainings affect balance of elderly people (Maritz et al., 2013). Taking into consideration the already-mentioned issues, various training methods are proposed for increasing strength and balance of elderly people; hence, the main purpose of the present research is to compare the effect of two kinds of selected functional trainings and theraband on dynamic balance and the strength lower body organs of elderly people.

Materials and Methods

This study was conducted in 2014 through semi-experimental method implementing pre- and post- testing. The statistical population of this research consisted of 45 healthy aged people in Mashhad with the age group of 60-75 who voluntarily participated in this research through available sampling publication; and after investigating their general health condition under the supervision of physician and determining their qualifications weather to have the requisite criteria to participate in the research, they were categorized into three groups of experimental theraband training (15 people), functional training (15), and control group (15) using physical activity and readiness questionnaire PAR-Q (whose reliability and validity was already determined in Iran) (Shafa, 2013). The acceptance criteria for the participants in the research were: the age group of 60-75, desire to participate, not taking and neural medication, not using any aids such as cane and walker, their health condition regarding cognition, eyesight, hearing, avoiding sport exercises or intensive activities during their participation in the research, not having any acute and advanced neural-muscular, orthopedic, neurologic, romathologic, psychological diseases, diabetes, bone fractures, structural deficiencies

and cardiovascular diseases which may prevent them from doing the trainings in the research. After completing the consent form, the participants were requested to give their personal information and their medical records. Afterward, their dynamic balance rate and lower body strength were measured through Berg's performance test (the internal and external validity of this method for elderly people is 0.98 and 0.99, respectively) (Bogle Thorbahn et al., 1996) and 30 second chair test. Jones et al. (1999) consider this test as a valid and reliable tool for measuring lower body strength of elderly people that reside in a society (Jones et al., 1999). Then, the experimental groups did the exercises for about three weeks, each week containing 3 sessions of 60 minutes (one day rest after each day of exercise) and the control group did their daily routine alongside the exercises. The training program was executed as follows: 10 minutes warm up, 40 minutes the main training, and 10 minutes cool off. In the preliminary levels of functional training, aerobic trainings and flexibility of the examinees for their preparation were more emphasized, and as the trainings proceeded, more emphasis was given to strength and balance trainings. At the intervals between the trainings, the examinees rested for about 2 to 3 minutes (Table 1) (King et al., 2000). Moreover, in the age group of theraband, the main training was done with pink theraband, 1 set with 10 times frequency for the weeks 1 and 2 and afterward 2 sets with 12 times frequency for the weeks 3 to 6 (table 2) (Fahlman et al., 2011). After the training course finished, the examinees were again tested for the second time and the results were recorded as the post-test records (in the pre- and post-test level, each test was executed three times and the mean of the results was recorded as a record). After investigating the normality of data distribution through Shapiro Wilk test, statistical average indicators, standard deviation, covariance statistical tests, ANOVA, Bonferroni post hoc test, mean difference, and coefficient of variation were applied to analyze the data. The normality of the variable data for the homogeneity of the groups was considered and all the tests were executed at a significant level of $P \leq 0.05$).

Table 1: Functional training protocol

movement	target	protocol
Sitting and standing up from the chair	Promoting strength	15 times fast performance
Dorsiflexion on one side while standing	Promoting strength	15 times frequency
Body fluctuation back and forth with straight posture	balance	2 minutes, 10 seconds pause in the front and back
Kneeling from standing position and getting up	Balance/strength	2 sets with15 times frequency
Raising legs and hands from all-fours position	Balance/strength	2 sets with 15 times frequency
Ascending stairs	Balance/strength	2 sets with 3 times frequency
Reaching the hand to the opposite leg while standing	balance	2 sets with 15 times frequency

Table 2: Theraband training protocol Scott

instruction Place both legs at the center of band and hold the two ends beside the body with both hands, preserve directly the traction with the elbow. Hold your elbow straight, while bending a little to the front from hips, slowly bend your knees then slowly resume the start position. Note: hold your back straight Target: strengthening knee extensors and hips
Instruction: sit tight on the chair. First, place theraband on the upper part of knee and around the hip. Then, lower the two ends downward and hold it still under the opposite leg and slowly move your hip against the resistance of theraband upward and hold it in flexion position and then resume the start position Note: hold your back straight and do not bend to the front Target: strengthening hip flexor muscles
Instruction: wrap the middle of theraband around one wrist and hold still the two ends under the opposite leg. Hold the knee completely straight, move your leg backward against the resistance of theraband and hold still, slowly resume the start position. Note: hold your back completely straight and do not bend more than needed

Target: strengthening hip extensor muscles

instruction:
Wrap the middle of theraband around ankle and hold still the two ends under the opposite leg and hold the remains of the band in your opposite hand. Hold you knee straight, move your leg away from the body against the resistance of theraband, hold still and slowly resume the start position. .
Note: straighten your back and do not bend more than needed.
Target: strengthening the abductor muscles of hip

instruction:
Connect one end of the band to a safe and fixed object and wrap the other end around your ankle. Hold your knee straight, move your leg inward to the opposite leg (supporting leg), hold your leg still in the same position and slowly resume the start position.
Note: in order to preserve balance lean to stable object near you as a support
Target: strengthening the adductor muscles of hip

instruction:
Lie in supine position and bend the leg 45 degrees from hip and knee so that the palm of the feet is on the ground. Then place the instep and toes in the middle of theraband , hold still the two ends of the band beside the pelvis and extend the leg from the knee without any change in degree, straighten your knees and hold your leg at 45 degrees front he ground
Note: the 45 degree of the hip should be preserved throughout the training
Target: strengthening 4 head thigh muscle.

instruction:
Lie in supine position and bend your leg 90 degrees from hip joint and bend your knee to the extent that your foreleg reaches hip flexors. Place instep and toes in the middle of the band and stabilize the band under the pelvis. Afterward, extend your knee up to 90 degrees against the resistance of the band.
Note: the 90 degrees of the hip should be preserved throughout the training.
Target: strengthening 4 head high muscles

Results

Descriptive information of the examinees including age, height, and weight are given in table 3 according to the age groups

Table 3: descriptive information of the examinees

group	age(Year)	Height(Centimeter)	Weight(Kilogram)
functional	66.60±2.89	174.20±2.04	66.32±3.21
theraband	65.40±3.73	173.20±2.45	67.80±2.88
control	60.40±2.92	174.60±2.66	65.98±3.09

The results of one-way ANOVA test for investigating the difference between means revealed that there is no significant difference mean of the three participant groups in the pre-test(theraband group Sig=706, F=351 & functional group Sig=880, F=118) which signifies the inter group homogeneity ($P \geq 0.05$). Taking into consideration the control of strength factor, the results of covariance test revealed that there is a significant difference between the three groups on performance in dynamic balance test (P=0.001). Besides, the results of ANOVA test indicated that there is significant difference between the three groups on performance regarding the test for lower body strength (P=0.001) (table 4).

Table 4: the results of covariance and ANOVA test in Berg and 30 seconds chair test for comparing the impact of training in the three groups

variable	The source of variations		Total squares	df	Mean squares	F	p-value	Eta coefficient
dynamic balance	strength		0.075	1	0.075	0.042	0.839	0.001
	group	D	173.175	2	86.578	48.023	0.001	0.701
	theraband	5						
	functional	5.20						
	control	-0.60						
	error		73.925	41	1.803	-	-	-
Lower body strength	group	D	46.800	2	23.400	22.750	0.001	0.520
	theraband	2						
	functional	1.40						
	control	-0.40						
	error		43.200	42	1.029	-	-	-

Bonferroni post hoc test was also used for determining the most effective training protocol on the research variables and no significant difference was observed between the results of the two groups ($P \geq 0.05$). But this little difference was determined and reported through mean differences and variable coefficients. This eludes to the fact that theraband and functional trainings have the most impact on dynamic balance and lower body strength in elderly men, respectively (table 5).

Table 5: the results of mean differences and coefficient of variations

Comparing groups		Mean differences		Coefficient of variations	
		Dynamic balancel	Lower body strength	Dynamic balance	Lower body strength
control	theraband	5.6	2.4*	10.91	18.51*
	functional	5.8*	1.8	11.60*	13.72

Discussion and conclusion

The main purpose of conducting this research was to compare the effects of two selected functional and theraband trainings on the dynamic balance and strength of lower limb among elderly men. The results indicated that both protocols of functional and theraband training had significant impact on improving balance and lower body strength of elderly men with little difference which concurred with Godard et al (2004). Godard selected an 8-week training course to perform in the research where the statistical sample had an age average higher than the present research (Godard et al., 2004; Gallahue et al., 2005; Lovell et al., 2010; Ciolac et al., 2010)'s research, the same the results were obtained close to those of Godard (Gallahue et al., 2005; Lovell et al., 2010; Ciolac et al., 2010). In addition, (Rosendahl, 2006) reported that intensive functional trainings and balance improves the ability to walk and the lower body strength and reduces the danger of falling (Rosendahl, 2006) all of these results are consistent with the present research results, while they are not consistent with those of (Kraily et al., 1998). Since their research was associated with 12 weeks of training on elderly women with the age average of 82 and age domain of 72 to 92 (Crilly et al., 1989), this inconsistency may be justified through difference in gender of the examinees, higher age mean of the statistical sample in Kraily's research or difference in the number or training sessions in the two researches. Taking into consideration fact that imbalance is one the most significant factors of falling among elderly people, the issue of balance is much adverted in this age group; the coordination of various parts of body such as visual, auricular, and somatosensory systems play significant role (Seadiabdoli et al., 2012). Tersa believes that training can effectively reduce the risk of falling through improving physiological weaknesses such as weak balance, muscular deficiency and low reaction rate (Teresa et al., 2004). Additionally, the previous studies have revealed that following training programs can

increase strength even up to the age of 90. Besides, physical trainings affect body's readiness among aged people and make them independent for doing their daily works (Cromwell et al., 2007). After statistical investigation with the error level of (P>=0.05), it was revealed that there is no significant difference between the two already-mentioned protocols, but through more precise investigation and using mean differences and coefficient of variations it was revealed that functional trainings have more effect on the improvement of dynamic balance and theraband trainings the most effect on the improvement of lower body strength among elderly people. Finally, it cab ne stated that the above trainings are considered to be effective for increasing balance and other involving factors for balance and lower body strength among elderly people.

Conflict of interest

The authors declare no conflict of interest

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American College of Sports Medicine, 2011. This brochure was created and updated by William Kraemer, Ph.D., FACSM, and is a product of ACSM's Consumer Information Committee. Visit ACSM online at www.acsm.org.

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