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The Effect of Four Weeks of Home-Based Exercise Program with Unstable Sandals Functional Indicators Related to Falls in Older Men

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Abstract

Introduction: Due to the population growth rate, Iran will face an aging explosion soon. Thus, maintaining functional independence and fall prevention should be considered as the main policy concerns in caring for this group. Therefore, the aim of the present study was to investigate the effects of training with unstable sandals on some functional indicators related to falls in healthy elderly men prone to falls during the corona epidemic. **Materials and Methods:** In this quasi-experimental study with pre-test and post-test design, 42 elderly men who were prone to fall (age: 70.69±4.11 years, height: 174.12±6.07 cm, weight: 73.29±7.58 kg, BMI: 24.2±2.42 kg/cm^2) with some diagnostic performance indicators were selected from 61 elderly people and divided into three groups of 14 people. One group performed home exercises with unstable sandals, the second group performed these exercises with stable sandals, and the control group was engaged in their normal life and did not participate in any exercise training intervention. The training course was performed in three sessions per week on non-consecutive days for four weeks. Before and after the training session, participants were assessed using the Berg Balance Scale, Timed Up & Go, Functional Reach Test, and 30-second stand chair. **Results:** Analysis of variance with repeated measures showed a significant difference in all performance tests of both training groups compared with the control group after 4 weeks of training ($P<0.001$). There was a significant improvement in the unstable sandal group in the Berg Balance Scale and Timed Up & Go tests with a progress of 12.3% and -27.1% compared with the pretest, and 8.5% and -21.1% compared with the stable sandal group ($P<0.05$). Despite the improvement in Functional Reach and 30-s stand-chair tests in the unstable sandal group compared with the stable sandal group, no significant difference was observed between them ($P\geq0.05$). **Conclusion:** Using unstable sandals in a home exercise protocol as an overload training tool for greater improvement in healthy elderly men who are prone to falls can effectively improve some static and dynamic performance indicators, but it has no effect on increasing the strength of the lower limbs.

Keywords: Elderly; Falling, Home-Based Exercise; Functional Movement Tests; Sandal; Unstable Shoes

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Introduction

Aging is an undeniable process of human life characterized by indicators such as muscle loss, bone density loss, and negative growth changes in other organs such as nerve tissue [1, 2]. Following these negative changes, we will naturally see a decrease in strength, stamina, reaction, balance, and overall functional capacities [3, 4]. This problem naturally endangers the elderly by falling to the ground, the consequences of which can lead to illness and even death [3]. According to the World Health Organization, approximately one-third of people aged 65 and over experience at least one fall a year, and as the elderly get older, their falls have increased so much that they fall at least once a year after the age of 80 [5]. Collapse is a multifactorial process in which all threatening factors can be expressed in terms of the friendliness of external and internal factors [1, 6].

Often, the control of the external environment is not under the control of the elderly; therefore, researchers and health care providers use exercise as a very important and efficient strategy for preventing falls, slowing the aging process, and re-empowering weakened functional capacities [4, 7]. Because falls are influenced by several factors, many researchers have pointed to the superiority of sports activities that combine several factors to reduce the risk of falls, rather than sports that traditionally focus on strengthening only one factor, such as strength, balance, or endurance [8].

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Otago exercise is one of the most successful of these methods, which at home and without the need for equipment improves performance and prevents falls [9]. This type of exercise, which has very high performance indoors, is called home sports or home-based exercise [10-13]. That's why many researchers are interested in exploring the compatibility gained from it. In 2021, Jahanpeyma et al. applied three sessions of Otago training per week for 12 weeks on 72 elderly prone to falls and found that this protocol could significantly improve performance in BBS and 30s-CTS tests [13]. The correct step pattern is also a crucial factor in preventing falls [14] because the ability to maintain the center of gravity within the limits of the level of reliance during body movements is a key factor that challenges elderly people when walking in more than static positions [15]. Therefore, the instructions attached to the Otago exercise suggest that walking should be included between the training days of the week [9].

On the other hand, some researchers have been interested in introducing different interventions such as unstable shoes (US) as a challenge to gain more consistency from practice [16-20]. For example, in 2018, Sabhani et al. applied the whole body vibration board exercise protocol for 4 weeks, divided 51 elderly people with an average age of 70 years into two groups with and without US shoes, and found that both groups significantly improved in Fullerton balance tests, preferential pacing speed, and maximum walking speed, but only this group of US shoes had significant improvements. After 1 month of detraining, he maintained the adaptations of 4 weeks of training [21]. In fact, the supporting logic of these shoes includes increasing calorie intake while walking, changes in biomechanical pattern during walking [22], increased postural oscillations during standing [18, 20, 23], and increased electrical activity of lower extremity muscles in performing movements compared with normal shoes [19, 23], all of which are the reasons for overload when using these shoes. However, some studies have failed to report a significant impact on the short-term use of US shoes, the main reason for which is the very low and gentle challenge of this type of shoe [17]. For this reason, it has been recommended that to obtain the above-mentioned adaptations, it must be used continuously and for a long time.

According to this issue, it can be said that long-term use in hopes of obtaining the mentioned adaptations is an exhausting process, so the researchers of this study decided to design a shoe as a challenging exercise device by modeling this research, and after registering its innovation in the intellectual property organization as an invention to the number of the declaration 139850140003006049 and 102828 registration number of it as an overload in home practice And they use it [24]. Up to now no research found that performed home-based exercises with unstable shoes to investigate the compatibility of it, so in this study we decided to combine these two interventions to investigate the effect of a 4-week period of this exercise model along with unstable sandals. Therefore, the purpose of this study is to determine whether inserting this model of unstable shoes in the short term as a training device can highlight the adaptations gained from home exercise and increase its productivity.

Materials and Methods

Participants

This quasi-experimental study was conducted with pretest-posttest design on 42 elderly men in three groups. This sample size was obtained using G-power software with the level (= α 0.05) with three groups and two pretest and post-test methods. Note that the present study was part of a doctoral dissertation at Kharazmi University, and before the beginning of the study, the goals, methods, and protocol of practice were approved by the ethics committee of the Institute of Physical Education and Sport Sciences IR. SSRI. Rec.1400.1220.

This study was conducted on elderly people aged 65 years and over in Kashan who were selected through available sample under multistage conditions such as: they had no musculoskeletal injuries, musculoskeletal and neurological damages, and did not participate in regular exercise program during the past 6 months and no history of falls during the past year. In addition, previously unstable shoes such as the Tan-Tak shoe and any shoes with a longitudinal arch in the outsole have only mild to moderate balance dysfunction. Functional impairment was considered by the condition that only requires the use of a crutch and the Ripening Functional Test (FRT) is less than 26 cm [25]. The 5-time sitting and rising (5-STST) test is longer than 18 s and the time to complete the TUG is greater than 13.5 s. In order to ensure that there was no mental deterioration in the elderly, a short state of mind test (MMSE) was taken, and the inclusion criterion was to obtain a minimum score of 24 out of 30 in this questionnaire [28].

The purpose of these inclusion criteria was to identify individuals with mild to moderate impairment in maintaining balance and homogenization of subjects from the very beginning of the study. For 61 elderly attendees, a briefing session was held to explain the research process, and after full familiarity with the study process, the subjects expressed their consent to participate as subjects. In the same session, after answering the health and activity questionnaire, the performance tests were performed, among which only 42 subjects were selected and finally divided

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into three groups as matched pairs. In addition, 30-s standing and sitting tests (30-s-CST) and the Berg Balance Scale (BBS) were also taken from 42 selected elderly. The exclusion criteria included any illness or discomfort that prevented the participant from participating in more than two sessions of activity or negatively affected the measured factors. The researcher also agreed in writing that in addition to maintaining confidential information, he would agree to any unwillingness to cooperate from the testers without asking for a reason.

Data Collection Tool

Since home-based training exercises several physical factors simultaneously, these four tests were used with different purposes to examine the effect of the exercise.

The 30s-CST, which measures the strength of the lower limbs dynamically, was performed as the first test in such a way that the subjects sat on a chair with a height of 45 cm without leaning on the supporting back, put their hands crossed, and were ready for the GO command. At the same time, time began to record with the stopwatch, and during this time, the subjects tried to stand up completely and sit completely without relying on the back of the chair, which was the most repeated at this time as the record of each individual. This test was performed twice with an interval of at least 20 min, which was the highest score of each individual in this test was set for him [13, 29].

The BBS was selected as another functional balance test because all 14 stages of this test as static tasks assess different aspects of daily activities. Each test was scored from zero to four, and the total score was 56, with a lower score indicating less ability to maintain functional balance [30]. This test was recorded only once.

The TUG test assesses lower extremity function, mobility, and the risk of falling. This test is performed in such a way that the subject is sitting on a chair with a height of 45 cm and leaning on the GO command. After bypassing the marked 3-m distance, the subject returns the mileage and sits on the chair again. The execution time of all these steps is recorded in seconds as the odd score, which naturally results in less time yielding a better score. The test was conducted three times, five minutes apart, and the best record of each individual was recorded as his or her score.

The Functional Reach Test (FRT), designed to identify elderly prone to fall, requires subjects to stand on one side against the wall and flex their arm close to the wall to 90˚.

Exercise Protocol

The training protocol was a modified form of the Otago style of exercise. The home-based exercise program, introduced in New Zealand in 2000 to prevent falls, includes 22 types of moves that need to be performed in one session. The focus of these movements is on three power factors, balance, and various steps [9]. In fact, training for these three main factors contributing to falling can have a significant impact on falling [13]. This type of design has been highly regarded by researchers, and even researchers have made changes and adjustments in this program to adjust their research protocol [31]. Thus, taking inspiration from this training protocol and studies that have focused on a different type of home exercise program design, which also focuses on lower limb strength, balance, and strategies of movement and stride simultaneously in one session [32], as well as from instructions on how to design exercise from other studies [33] and modeling repeated motor tasks in the daily life of an elderly [11]. The home sport was discussed, and its performance ability was controlled by a physician after several pilot studies and approved by the ethics committee. Table 1 details this exercise. Note that the subjects of both experimental groups completed the PARQ questionnaire before the start of the training period, and the study was authorized by the physician.

The overload method was that for each week, one liter of water was added as a transporter to both exercise groups, and this volume of water was transported in two different containers to make it similar to everyday life. 1. in a saucepan of rice cooker in one place 2. In two smaller pitchers of water of half size, this variation was applied to prevent exercise in every other session. In addition, in the third and fourth weeks, a set was added to the main trunk movements of both groups. In this training model, if no participant could perform double tasks, the priority was the main trunk exercises.

Three sessions per week for 4 weeks (total of 12 training sessions) were performed for the two experimental groups, and the control group did not perform any additional activities except daily tasks. The exercise group with unstable sandals, except for the warm stage of the neck, performed all of their exercises even cooling with unstable sandals. Also, it should be noted that since the sandals used in this study had an innovative air cushion in the insole and were handmade [24], only one pair of unstable sandals was used in this study because it was not mass produced.

In the stages of preparation of unstable sandals, detailed information on the website of the Center for Intellectual Property [24] states that air cushions with a two-way valve were designed and installed to adjust the air pressure inside it to match the power of the wearer on the insole of a pair of medical sandals (Figure 1). However, according to the screening, the power of all participants was assumed to be the same, and the level of air pressure inside was adjusted to 30 mm Hg.

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Table 1. Exercise Protocol for the Experimental Groups

Warm up	**6 min of walking, 6 min of stretching and mobility, especially the lower extremity**	**1 Repetition**
Main work out 35–45 Minutes	Getting up from sitting position from chair to standing position and left-right li-up	**3*10**
	Single-leg step-up fixed on a 30-cm box	**3*10**
	Half-backward launch intermittently in place	**3*10**
	Holding the sumo half squat isometrically while carrying 1 L of water	**3*20”**
	Raising the toe while standing while carrying 1 L of water	**3*15**
	Raising the heel while standing while carrying 1 L of water	**3*20**
	Carrying 1 L of water zigzag back and forth in a 5-m path	**2*5**
	Carrying 1 L of water by stepping back and forth from a 20 cm box	**2*5**
	Carrying 1 L of water in three steps from the right side, three steps from the left side	**2*10**
	Carrying 1 L of water by stepping from the side and back from a 20 cm box	**2*10**
	Carrying 1 L of water by climbing 8 steps with a height of at least 25 cm and going down	**2*2**
home works double (3) minutes	Getting up from a lying position on the floor to a standing position	**3 repetitions**
	Picking up a pencil that has fallen on the floor from a standing position	**3 repetitions**
	stops and 360° left and right rotation in a 30-m path	**1 repetition**
Cool down	4 min of normal and long walking	**1 repetition**

**Symbol of the number of training sets multiplied by the number of repetitions of movements*

Figure 1. A sample prepared from an unstable sandal

The logic behind our design for this sandal was the lack of balance exercises that could be used to walk and perform everyday tasks. In fact, all the equipment available for balance training in sports and rehabilitation centers is static and fixed, including the bosuball, wobble board, tilt board, balance pad, and other similar equipment. However, it is not possible to find any means of moving on an unstable surface, such as walking or performing sports techniques. That's why we used this technique to fill this training gap.

Statistical Analysis

Data are quantitatively described with mean and standard deviation. Shapiro-Wilk test was used to determine the normality of the data, Lune’s test was used to determine the homogeneity of variances, and ANOVA repeated measures and Tukey’s post hoc test were used to determine the significance between the averages of the groups. In addition, the one-way ANOVA test was used to ensure the appropriate arrangement of the subjects in three groups that were divided into equal pairs, and for more information on the amount of intra-group changes in the post-test compared to the pre-test of each group, the paired-sample t-test was used. All calculations were performed using SPSS version 26 software at a significance level of $P<0.05$.

Results

The information related to the demographic characteristics of the subjects and the results of the One-way ANOVA test indicate the appropriate arrangement of peer pairs in the groups, and the absence of significant differences between them are reported in Table 2.

Significant differences were reported in both home exercise groups with and without unstable sandals compared with the control group (Tables 3 and 4). The results show the improvement of both training groups compared with their pre-test and the lack of significant difference of the control group compared with their pre-test in all variables (Table 3).

The noteworthy point in this statistical analysis was the significant superiority of the 12.3% increase in the unstable sandal group compared with the 8.5% increase in the group without unstable sandals in the BBS test (P=0.047). In addition, this superiority of the group with unstable sandals (-27.1%) compared with the group without unstable sandals (-21.1%) was also observed in the TUG test (P=0.030).

In addition, there was no significant difference between these two groups in the changes related to the FRT test in the group with unstable sandals with progress (34.3%) and the group without unstable sandals with progress (32.8%) (P=0.305). Similarly, for the changes related to the 30s-CST test in the unstable sandal group with progress (62.9%) and the group without unstable sandals with progress (48.6%), no significant difference was observed between these two groups (P=0.989).

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Table 2: Demographic characteristics of participants in the research (mean ± standard deviation)

Groups		number	Age(year)	Height(cm)	Weight(kg)	BMI(Kg/m²)
Control (no training)		14	71.57±4.71	6.5±175.86	6.04±73.36	**6.04±73.36**
Exercise with unstable sandals		14	4.19±70.71	5.51±172.07	8.48±75.14	**6.04±73.36**
Exercise without unstable sandals		14	3.42±69.79	5.97±174.43	8.08±71.36	**6.04±73.36**
Compare mean	F	-	0.677	1.322	0.823	**0.695**
	P	-	0.759	0.259	0.672	**0.793**

Table 3. Mean and standard deviation of functional variables related to falls before and after 4 weeks of training in the different groups

Outcome	Group	Pre-test	Post-test	symbol	P value	Percentage of changes
BBS(score)	With an unstable sandal	45.07±2.46	50.64±1.90	ʆ ❊	0.00	12.3
	Without an unstable sandal	43.64±3.05	47.36±3.10	₸ ❊	0.00	8.5
	Control(without train)	43.14±2.07	42.93±2.84	NS	0.596	-0.4
30s. CST(number)	With an unstable sandal	9.299±2.61	15.14±2.90	₸ ❊	0.00	62.9
	Without an unstable sandal	9.71±2.94	14.43±2.47	₸ ❊	0.00	48.6
	Control(without train)	9.07±2.46	9.43±3.18	NS	0.355	3.9
FRT(cm)	With an unstable sandal	30.57±4.45	41.07±3.19	₸ ❊	0.00	34.3
	Without an unstable sandal	28.93±4.04	38.43±3.52	₸ ❊	0.00	32.8
	Control(without train)	29.71±3.70	30.07±4.19	NS	0.355	1.2
TUG (second)	With an unstable sandal	0.97 ± 14.34	10.45±0.73	ʆ ❊	0.00	-27.1
	Without an unstable sandal	0.99± 14.38	11.68±1.08	₸ ❊	0.00	-21.1
	Control(without train)	0.85 ± 13.93	14.17±0.85	NS	0.110	1.7

❊Index of significant difference between the pre-test and post-test within the group (P<0.05). ₸ Significant difference index with the control group (P<0.05); ʆ Significant difference index between the control group and the training group without unstable sandals (P<0.05). NS non-significant index compared with the pretest.

Table 4. Paraphrase: Results of repeated measures analysis of variance for functional variables associated with falls in elderly men

Outcomes	references	sum of squares	Degree of freedom	F	P value	Pa.Eta.Sq
BBS	Exercise	192.012	1.00	224.724	0.00	0.872
	Exercise*group	122.167	2.00	71.493	0.00	0.784
30s-CST	Exercise	278.679	1.00	278.679	0.00	0.813
	Exercise*group	117.929	2.00	58.964	0.00	0.649
FRT	Exercise	966.964	1.00	783.909	0.00	0.953
	Exercise*group	437.429	2.00	177.310	0.00	0.901
TUG	Exercise	107.440	1.00	414.840	0.00	0.914
	Exercise*group	67.469	2.00	130.252	0.00	0.870

Discussion

In this study, we investigated the effects of a home-based exercise program on functional indicators of lower limb strength, static and dynamic balance, and whole body mobility in healthy elderly men prone to falling in two groups of exercise with and without unstable sandals. In this way, at the beginning, we identified people prone to falling with entrance tests, and based on the Otago home-based exercise protocol and several other studies, we designed and applied the necessary adjustments to the home-based exercises of our research subjects, the result of which was the improvement of both exercise groups in all Functional tests were compared to the control group. The training group with unstable sandals showed a significant superiority in BBS and TUG tests with 12.3% and -27.1% progress, respectively, compared to the progress in the training group without unstable sandals.

In the research literature, there are many studies that have shown the effects of home training (home-based), especially the Otago training protocol, compared to the control group in performance tests. One of these studies was related to Jahanpima and his colleagues who investigated the Otago exercise protocol on performance indicators and reported a significant improvement in these indicators. In this research, after 12 weeks of BBS training, the number of falls during the 3-month research period showed a significant improvement compared to the control group (P<0.05) [13]. In another study in which Benavent Kabler and his colleagues investigated the Otago exercise protocol on the physical performance of elderly people with the help of a video program, they reported a significant improvement in mobility, balance and lower limb strength. In this BBS research, it was pointed out that this exercise protocol increased by 3.5 points compared to the control group (P=0.003) [34]. In this regard, there is convincing literature about using this

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training protocol or even other exercises such as resistance training on unstable surfaces such as balance pad, wobble board and unstable shoes in order to make the adaptations gained from training more efficient. The results of Sobhani et al's study show significant increase in performance indicators such as the Fullerton index adjusted by BBS after 4 weeks of training with using two types of unstable shoes and regular shoes for people, but only the training group with unstable shoes retained the adaptation gained from training after one month of non-training (*P*=0.003) [21]. Our findings regarding BBS were in agreement with the background and no contrary research was found.

Our findings were in line with the background of the research, and perhaps the reason for the superiority of the training group with unstable sandals compared to the training group without unstable sandals can be found in the physiological factors associated with this type of training. In fact, combining resistance exercises with exercises at unstable levels in the elderly may lead to more adaptation in neuromuscular adaptations in the unstable sandal training group, which has been reflected in the higher ability of this group in the BBS and TUG tests. In support of this topic, Brent White showed that when a person wears unstable shoes for the first time, he will encounter a greater response of lower limb muscle activity than normal shoes [19], which is caused by the disruption of COP stability compared to normal shoes. It is that the nervous system in response is forced to use more motor units and even create a new movement pattern and the involvement of auxiliary muscles to return the COP to the range of the support level [17, 18, 22]. As a result, it is expected that improved motor memory can transfer many short-term adaptations to long-term motor programs under the consolidation process [38].

FRT functional reaching test is another assessment that is used in clinical studies, especially in predicting the risk of falling. In this regard, in a study he conducted on this test, Duncan mentioned the high risk of falling for people who cannot bend forward more than 26 cm in this test [25]. In this study, we saw a significant improvement in this test in both groups of training with unstable sandals and training without unstable sandals after 4 weeks compared to the control group. These results were consistent with studies conducted after a home exercise course in previous research [36, 39]. For example, Cooksan and his colleagues, who compared the effects of Tai Chi training and Otago home training with 2 training sessions per week for 12 weeks, reported a significant superiority of the FRT test in the Otago group (P<0.001). In another example, Lee and his colleagues studied the effects of adaptations obtained from Otago exercises by studying 67 elderly people aged 65 and over during a period of 6 months, and the FRT test was one of these indicators. They reported a significant improvement of this index compared to the control group (*P*=0.015) [39]. On the other hand, in the present study, no significant difference was observed between the two training groups (*P*=0.305). In fact, although the improvement of FRT in the training group with unstable sandals by 34.3% compared to the improvement of 32.8% in the training group with unstable sandals was not statistically significant, but considering that the entire training period was 12 sessions and considering The fact that the training group with unstable sandals experienced more challenges in their training, perhaps it can be expected that if the duration of the training period was longer or if the designed training protocol was more challenging, naturally, the training group with unstable sandals would have faced more challenges and this superiority Maybe it can be statistically significant.

It has been reported in studies that lower limb strength is related to the functional independence of an elderly person and is a good predictor of physical vulnerability to falling and a good indicator of the risk of falling in elderly people [40]. The results of CST in our research indicated a significant increase in the training group with unstable sandals compared to the pre-test. The training group without unstable sandals also had a significant increase compared to their pre-test. Also, after 4 weeks of training, both of these training groups had a significant increase compared to the control group, but statistically, no difference was observed between the training group with unstable sandals and the training group without unstable sandals. Regarding the increase in strength during the 4 weeks of home training of both training groups, it is completely consistent with the research literature that investigated the effect of home training in increasing the strength of the lower limbs with the 30s-CST test. The results of Jahanpima et all's study showed a significant increase in 30s-CST compared to the control group by performing Otago home exercise for 3 sessions per week for 12 weeks in people aged 65 and over [13]. Another study compared two training protocols, Tai Chi and Otago, during 2 sessions per week for 12 weeks. The results show significant increase in the number of repetitions of sitting and standing in the 30s-CST test compared to the Tai Chi group after 12 weeks [36]. Since the only difference between these two groups was the intervention of unstable shoes, and on the other hand, all the exercises of these two groups were completely similar, the lack of significant difference between these two groups in increasing the strength of the lower limbs seems logical. In this context, we can refer to studies that support these results [35, 41]. For example, David Behm and his colleagues clearly stated in their review that

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if the goal of training is to increase strength, training at unstable levels will not have any additional benefits compared to stable levels [41]. Also, in another study conducted by Pirao and his colleagues in elderly women, it was found that 24 weeks of resistance training at an unstable level compared to a stable level did not show a significant difference in increasing strength [35]. Therefore, the lack of significant difference between the two training groups in the present study can be seen in the fact that the nature of this test was of the type of strength measurement, and both groups had training in a completely similar way during their training period. But why the training group with unstable sandal could not improve more than the training group without unstable sandal due to the greater challenge it faced with unstable sandal, it should also be acknowledged that this higher challenge created with unstable sandal is a challenge for the proprioception of the lower limb joints may result in the recruitment of motor units associated with increased balance rather than the recruitment of motor units associated with increased strength.

Among the strengths of the current research, we can mention the design of unstable sandals for the rehabilitation of elderly people. Another strong point of this research was the design of home exercise with variety and creativity of indoor equipment that meets the needs of an elderly Iranian. The limitations of this study include the short training period, the lack of control over the amount of daily activities of the participants, the amount and quality of sleep, the amount and quality of food consumption, and the inability to control the stress of the participants. It is suggested to investigate the effect of using this sandal without doing any exercise in a time interval of one month and several months along with the use of laboratory tests such as dynamometer plate, muscle electrical activity and kinematic movement recording cameras in the next studies. Also, if the effects of this intervention are considered positive, they should track the effects of not using it during a non-training period.

Conclusion

According to the findings of the current research, which assessed elderly people with mild to moderate weakness with a home exercise protocol, it can be said that if they use the unstable sandal of the current research while performing these exercises, considering the challenge that they face in maintaining balance When they will face it while doing the exercises, some indicators related to balance will be increasingly strengthened in them. In other words, it can be said that the use of this sandal, which is considered a training device, can act as a training overload to improve performance in balance indicators and cause a greater increase in balance than when it is not used. But if the purpose of training with unstable sandal is to increase strength, it should be acknowledged that using it will not have any potential advantage.

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Research ethics

Ethical considerations related to this research were carried out in accordance with the instructions of the Ethics Committee of the Research Institute of Physical Education and Sports Sciences with the code IR.SSRI.REC.1400.1220. The mentioned principles are fully followed in detail in this article. The participants were informed about all the details of the study and while we committed to keep their information confidential, we also assured them that they could withdraw from the study at any time.

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Conflict of interest

None.

Authors' contributions

All authors contributed equally to the preparation of this manuscript.

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