The effects of single leg stance during daily toothbrushing on the balance skills of elderly adults

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Background and Study Aim It was aimed to measure the effects of single-leg stance on measuring the individual postural limits and balance skills of elderly adults.

Material and Methods The present study involved a total of 360 elderly adults aged between 70 and 80 years. The participants were divided into two groups as 187 individuals in experiment group (99 women / 88 men) and 173 individuals in control (94 women / 79 men). In measuring the risk of fall and balance skills, the Functional Reach Test, Timed up and go Test, and Single Leg Stance Test were used. The participants in experiment group were asked to stand on one foot for a total of 4 minutes (2 minutes in morning and 2 minutes in evening) every day while brushing their teeth for 50 weeks. Since the data showed normal distribution, the independent samples t-test was used in determining the intergroup difference, whereas the dependent sample t-test was used in determining the intragroup pretest-posttest difference.

Results It was determined that there was a significant relationship between elderly adults' balance skills and 4-min/day single-leg stance practice ($p < 0.05$). In all the tests, it was found that the balance skills of women and men have improved and men had better values in comparison to women.

Conclusions: It is thought that, via simple procedures such as lifting up one foot while brushing the teeth, the balance skills of elderly adults can be improved, the risk of fall can be reduced. They can be supported in terms of living an independent life.

Keywords: toothbrushing, elderly adults, balance, risk of fall, measurement, timing

Introduction

Aging, which is considered as a non-modifiable risk factor [1], is seen as a natural process [2]. This process is closely related with cell distribution [3]. Although developed countries used the term “elder” for the individuals aged 65 years or higher and receiving retirement salary, World Health Organization (WHO) defines the individuals turning 60 years of age as “elderly” [4]. Together with aging developing due to cell distribution, cognitive losses [1, 5], visual and hearing losses [1], degradations in the neural system and cardiovascular system, and decreases in muscular force are observed [6, 7]. These disorders negatively affect the balance by causing insufficiencies in the musculoskeletal system [8]. Together with aging causing degradation in motor development, losses are observed in endurance, strength, flexibility, and especially balance skills [5, 9]. The insufficiency of balance, which is among the motor skills, negatively affects the elderly adults' independent life and poses an important risk factor [10].

Balance plays a role in human life more important than thought [11] and is a fundamental requirement for posture and movement. Without a strong balance, it would not be possible to stand up, walk, run, or even climbing up the stairs [12]. The multilateral structure of balance caused the term “balance” to be defined in different ways in scientific disciplines such as chemistry, physics, medicine, and sports [13]. Chemistry defines balance

as the temporally non-changing conditions of reacting materials [14, 15], whereas physics defines the concept of static and dynamic balance as the balance of an object or that of forces influencing the object [16]. In medicine, unlike physics and chemistry, balance is considered from physical and psychological aspects [13]. Physical balance is defined as the constant condition of body in a stable or moving position, whereas psychological balance defines a mental condition characterized with emotional balance [13]. From the perspective of sports sciences, Fleishmann [17] structured the balance as static, dynamic, and object balancing. Static balance is characterized with body's return to its anatomic position after every movement [18], whereas dynamic balance refers to the protection of balance during a movement [19]. Balancing with an object refers to the effect of any object on the body for keeping the body in balance [13]. Considering the definitions provided, it is thought that balance has significant importance in human life, especially in old ages. The physiological changes brought by aging should be considered not only from the biological aspects but also from the temporal aspect. The biological changes that are not controlled by humans have 30% effect on aging, whereas the resting 70% is determined by the lifestyle of individual [20]. However, biological changes such as visual, hearing, taste, neural system, cardiovascular system, etc. having 30% effect in aging are thought to play a vital role for a healthy life by protecting the balance of body.

The prerequisite of stabilization of the balance is to have a strong sight [21]. Aging negatively affects the

balance by causing many changes in the sight such as weakening visual capacity and perception [22].

The structural changes in the neuromuscular system decrease the reflex modulation, cause fatigue, and lead to loss of strength as a result of the decrease in muscle mass [6, 7] and, as a result of the loss of strength, the reflexes to external stimulants would not occur in coordination [23]. Moreover, together with the strength losses to occur, the postural system would need longer reaction times for compensating the loss of balance [24].

The changes in the neural system occur in forms of decrease in links between the nerve cells, a reduction in transmission and response time, a decrease in cognitive performance, and increasing fatigue [12, 25-27]. This limited performance in the neural system causes a decrease in balance, movement control, and reaction time [12, 25, 27]. The decrease in speed of the neural system lays the foundation for distortion of balance by being incapable of responding to the stimulants required for keeping the body balance [21] and it also decreases the reliability of coordination and concentration skills [28].

The changes in cardiovascular system cause hypertension, high levels of resting and exercising heart rates [12], vasoconstriction [29], and a decrease in adaptation capacity [30]. It is thought that the changes in the cardiovascular system would negatively affect the balance [12, 29].

The age-related decrease in coordinative skills occurs slower than conditional skills. It was reported that the decrease in balance skills starts at the age of early 40s and a significant decrease is reached since the age of 60 [19, 31-37] and these losses reach a remarkable level after the age of 80 [5, 9].

The performance decreases in elderliness are inevitable but regular physical activity and exercises might significantly delay the onset of balance problems and keep the balance skills at a high level [12]. Lack of exercise might cause a decrease in balance skills even at the ages of 30s or 40s; this problem may reach a higher level at the early 50s and, more importantly, this problem can be only slightly reversed through exercise after 50s [38].

Besides the age-related biological, physiological, psychological, and social changes, also the age-related changes in balance skill is thought to negatively affect the lives of elders and, together with these changes, the decrease in birth rate and increase in life expectancy might pose a problem for the balance skill. In Germany, the birth rates decreased since 2012 and the population aged 70 years and higher increased from 8 million to 12 million [39]; it can be seen that, especially because of the decrease in balance skills of individuals aged more than 70 years, rate of fall incidents increases and 53% of fall incidents occur while walking [23].

It was observed that 55% of the German population aged >70 years remain distant from exercise [40], that the elders not doing exercise constitute the majority of fall cases, and motivation and time problem come forefront as the reasons for not doing exercise [41].

Hypothesis: Standing on one foot for only 4 minutes a day while brushing teeth without making extra effort would improve the balance skills of elders and decrease the risk of fall.

Objective: In literature, there is no study examining to what extent standing on one foot for 4 minutes while brushing the teeth affects the balance. Based on this idea, it is aimed to bridge the gap in literature regarding the effects of single-leg stance for 4 minutes during tooth brushing on the balance skills of elderly adults and to examine the risk of fall.

Material and methods

Participants.

The present study involved a total of 360 elderly adults divided into two groups as 187 individuals in experiment group (99 women /88 men) and 173 individuals in control (94 women/79 men). The participants in experiment and control groups were randomly selected among the individuals registered in Rehabilitation Sports Program in Germany TV Eberbach Rehabilitation Sports Unit.

The individuals having dizziness, severe balance problem, bone loss, stroke, concurrently participating in another sportive test, having physical disorder preventing the independent movement capacity, having amputation history, and showing symptoms preventing single-leg stance were not involved in the study.

Data collection was performed in accordance with the provisions of "Federal Data Protection Law (Bundesdatenschutzgesetz)" (BDSG). The required approvals were obtained from relevant federation and Germany TV Eberbach e.V. Rehabilitation Sports Department (TVE/GS 2018-012900). The involvement is based on the principle of voluntariness. The participants were informed about the objective, content, and data protection of the study and their written consents were obtained.

Research Design

Activity Protocols: The period of 50 weeks was determined in accordance with the receipts prescribed by the physicians and the participation in the program was followed using a signature list. Pretest and posttest were used in determining and comparing the improvements in balance skills.

In determining the comparison groups, significant attention was paid to ensure achieve groups as homogeneous as possible in terms of age and fitness. None of the participants have done performance sports or active for a long time.

In experiment group, the participants were asked to stand on one foot during tooth brushing (2 minutes in morning and 2 minutes in evening) for 50 weeks. The 4-minute period was divided into 8 30-second parts. During 2-min tooth brushing in morning, the participants were asked to keep their eyes open and stand on their dominant leg for 30 seconds, then change the leg, and then repeat the process with their eyes closed. The same practice was repeated while brushing their teeth in evening.

Considering the risk of fall, the participants were asked to perform the eyes-closed process by getting support and, when needed, pass the eyes-closed process and perform the eyes-open one. In order to increase the motivation of participants, a follow-up table or label to be attached to the mirror while brushing the teeth was prepared. The participants were asked to mark the table after every tooth brushing and single leg stance procedure. In order to support participants to not forget the practice, a warning “open/close eye and lift up the leg” was added to the label. In order to prevent an effect on the results, the participants were asked to avoid standing on one foot except for the 4-min tooth brushing practices if possible and to continue their normal daily activities.

Control group received no special program and they maintained their normal daily lives.

Weight/height measurements: The measurements were performed using Seca 769 digital body weight/height measurement device automatically calculating body height, weight, and BMI values.

Data Collection Tools: In the present study, the static and dynamic balance skills were measured using Functional Reach Test [42], Timed up and go Test [43], and Single Leg Stance Tests. The data were collected between May 2018 and June 2020. Before the test, each test item was demonstrated in practice and attention was paid that participants were not tired.

Functional Reach Test (FRT): Developed by Pamela W. Duncan, an American researcher, in year 1990, FRT is a motoric function test used for measuring the personal posture limits in daily life (42) and this test is used while measuring the risk of fall due to the lack of balance. In determining the balance problems in elderly adults, it is a very easy, rapid, and practical single-item dynamic balance test scored with simple norm values. The subject stands upright nearby a wall while keeping legs at shoulder width and single arm extended at the shoulder height. The subject should be as close to the wall as possible without touching it. The extended hand is kept in fist form and the subject is asked to extend his fist as further as possible without losing balance. The distance reached is measured using a ruler from the upper bone of the middle finger. In order to achieve the maximum extension, the feet should be level on the floor, no step must be taken, and the hand should be kept at the level of ruler without touching the wall. In order not to influence the test result, turning the body is not allowed. The distances shorter than 15.2 cm refer to high risk of fall, whereas the distances between 15.2 and 25.4 cm refer to moderate risk, and the distances longer than 25.4 cm refer to a low risk of fall [44].

Weiner et al. [45] reported that individuals having extension lengths more than 25 cm have low risk of fall, and this risk increased by two folds for those with extension length of 15–25 cm and four folds for those having extension length of 5–15 cm, whereas those having 0 cm extension length have eight times higher risk. The longer the length is, the lower the risk of fall is [42]. The distance shorter than 17.5 cm refers to a limitation of movement and it is at a level that would negatively affect

the daily life activities [42]. Every participant was given three chances and the best score was considered. For the individuals with risk of fall, cross belts were attached at the shoulder and back positions and interventions were made by pulling backwards in cases of any risk.

Timed up and go Test (TUG): Developed in 1986 [46] with the name of “Get up and Go”, this test was modified by Podsiadlo and Richardson [43] as “Timed up and go” test.

Used in determining the mobility, body balance, and risk of fall occurring consequently, TUG can be applied easily and fast without need for any special instrument of field information. The subject is sat on a chair, which has approx. 46 cm of height, leaning back. Without any external help, the subject stands up, walks 3m distance, and comes and sits back again [47]. The duration of this process is recorded. Podsiadlo and Richardson [43] recommend making evaluations considering the following points.

- Duration shorter than 10 seconds: Elderly adults have unlimited mobility and they can independently move,
- 11 – 20 seconds: Elderly adults have a very slight limitation of movement,
- 20 – 29 seconds: Elderly adults have limitation of balance, walking, and function, support might be needed,
- Longer than 30 seconds: There is a significant movement disorder and intense support and care are needed [43].

A 46 cm-high chair has been used in the original test. However, considering the differences between participants’ heights and in order to ensure the standards for each participant, a chair with adjustable height was used in order to obtain 90° angle between upper and lower legs in sitting position. In order to prevent slides, the chair was fixed on the floor and the test procedure was conducted with shoes on. Each participant was given a single chance and the time was measured using chronometer. When the test couldn’t be understood or when there is an obvious problem (such as released shoelaces), the test was repeated. The measurement was started when the back left the backrest unit and ended when the hips contacted the chair.

Single Leg Stance Test (SLST): In addition to the tests performed, a single leg stance test was conducted with participants with eyes open and closed. Single leg stance has been implemented in many studies and has no standard. In the present study, both legs were separately tested with eyes open and closed. The studies have been carried out determining different durations such as 5 seconds [48], 10 seconds [49], 15 seconds [50], 20 seconds [51], 25 seconds [52], 30 seconds [53], 45 seconds [54], and the longest duration possible [55]. However, the test procedure remained similar in tests. The subject wearing no shoe lifts one leg on a hard floor and stands in that position for the requested time. The result is recorded as success or failure. In the present study, no second limitation was applied and the duration of keeping the position was recorded in seconds. The participant started

the test with the leg they desired. The test was ended when the foot was lifted or moved. Every participant was given a single chance and the time was recorded using chronometer.

The tests were performed in the order of FRT, TUG, and then SLST. Test items were applied separately for every participant. One week before the test, the participants were asked to participate in the application with no fatigue, if possible. In order to minimize the errors, the participants were informed about each test item in practice, necessary explanations were made, and the questions of participants were answered. All the tests were performed without warming up or practicing.

Statistical Analysis

The data analyses (IBM SPSS 26-for Mac) were performed using descriptive statistical analysis (mean, standard deviation, minimum, and maximum) in order to define the characteristics of the study group. The skewness-kurtosis values were used in order to determine if the data were normally distributed. Since the normality test (Skewness-Kurtosis) yielded a result between -2 and +2 [56], the data distribution was accepted to be normal and the difference between experiment and control groups was analysed using independent sample Student-t test, whereas dependent sample Student-t test was used in examining the intragroup pretest-posttest difference. The statistical significance was set at $p < 0.05$ for the comparisons.

Results

The study involved a total of 360 elderly adults aged between 70 and 80 years, 187 individuals (99 women/88 men) in experiment group and 173 individuals (94 women/79 men) in control group. Of the participating elderly adults, weight, height, age, and Body Mass Index (BMI) are presented in Table 1 as mean/standard deviation and minimum and maximum values.

Given the values in Table 1, it can be seen that, in experiment group, the mean age and height values of women were higher than men, whereas women have

lower mean weight and BMI values. In control group, men had higher mean body height and weight values and lower mean age and BMI.

The mean values and standard deviations obtained from intragroup pretests and posttests in experiment and control groups are presented in Table 2. According to the statistical analysis of intragroup comparisons in experiment group, in which the 4 min/day (2 minutes in morning and 2 minutes in evening) single leg stance practice was applied while brushing teeth at home for 50 weeks, no statistically significant difference was observed in TUG test among women in experiment group ($p > 0.05$), it was determined that there were statistically significant differences in pretest-posttest comparisons in all the remaining tests (*FRT, eyes open right leg, eyes open left leg, eyes closed right leg, eyes closed left leg*) ($p < 0.05$).

According to the pretest and posttest results, there was a statistically significant difference in *eyes open right leg* test in control group ($p = .038$), whereas there was no statistically significant difference in *FRT, TUG, eyes open left leg, eyes open right leg, eyes closed right leg, and eyes closed left leg* tests ($p > 0.05$).

In Table 3, there are the independent sample t-test mean values and standard deviations obtained from pretest and posttests in experiment and control groups. The results suggested that there was no statistically significant difference between women and men in experiment and control groups in all the pretests ($p > 0.05$), whereas there was a statistically significant difference in TUG posttest among women ($p < 0.05$).

It was determined that there was no significant difference between men in TUG ($p = .059$) and *eyes open left leg* ($p = .056$) posttests, whereas there were statistically significant differences between the groups in *FRT, eyes open right leg, eye open left leg, and eyes closed right leg* tests ($p < 0.05$).

In general, it was determined that the balance skills of women and men developed in all the tests and men had higher scores than women.

Table 1. Mean, standard deviation, minimum, and maximum height, weight, age, and BMI values of participants in experiment and control groups

Items	Gender	Experiment Group (Women n=99, Men n=88)			Control Group (Women n=94, Men n=79)		
		Mean±SD	Min	Max	Mean±SD	Min	Max
Age (years)	Women	75.6±3.00	70.0	80.0	75.2±2.12	70.0	80.0
	Men	73.9±2.93	70.0	80.0	74.3±3.36	70.0	80.0
Height (cm)	Women	165.9±6.34	156.0	178.0	165.2±8.22	151.0	190.0
	Men	175±7.30	159.0	190.0	173.4±9.63	157.0	193.0
Weight (kg)	Women	72.6±8.68	58.00	98.0	73.6±11.1	55.0	106.0
	Men	76.7±6.42	66.00	96.0	75.4±9.27	58.0	94.0
VKI (kg/m ²)	Women	26.3±2.24	22.10	33.1	27.1±4.12	22.5	40.1
	Men	25.0±1.79	21.9	31.2	25.1±3.20	21.34	34.8

SD: standard deviation, BMI: Body mass index (weight/height²), Min: Minimum, Max: Maximum

Table 2. Pretest and posttest results of experiment and control groups in FRT, TUG, eyes open right leg, eyes open left leg, eyes closed right leg, eyes closed left leg (Paired Sample t-Test)

Items	Gender	Experiment Group (n=187)				Control Group (n=173)			
		pretest	posttest	t	p	pretest	posttest	t	p
		Mean±SD	Mean±SD			Mean±SD	Mean±SD		
FRT (cm)	Women	20.0±4.21	23.4±3.44	-8.02	.000**	19.7±3.78	20.1±3.63	-1.69	.094
	Men	25.9±2.85	29.7±3.35	-8.86	.000**	26.3±3.02	25.9±2.85	1.97	.052
TUG (s)	Women	14.1±1.89	13.6±2.10	1.67	.097	14.3±1.92	14.2±2.26	.461	.646
	Men	12.8±2.28	12.1±2.43	2.64	.010*	12.6±2.19	12.8±2.43	-1.15	.251
Eyes open right leg (s)	Women	14.3±2.45	19.5±4.98	-9.25	.000**	13.9±2.24	14.5±3.63	-2.10	.038*
	Men	19.1±5.49	26.9±6.76	-8.34	.000**	19.8±5.28	20.1±5.11	-1.72	.089
Eyes open left leg (s)	Women	8.29±2.09	11.3±2.72	-10.1	.000**	8.45±2.13	8.34±2.11	.491	.624
	Men	10.2±3.24	12.3±2.69	-6.11	.000**	9.91±3.33	10.1±2.96	-1.06	.292
Eyes closed right leg (s)	Women	3.35±1.28	4.62±1.70	-5.47	.000**	3.22±1.40	3.12±1.40	1.57	.118
	Men	4.20±1.69	7.43±2.52	-11.7	.000**	4.43±1.63	4.50±1.73	-.668	.495
Eyes closed left leg (s)	Women	1.96±1.04	3.41±1.96	-6.57	.000**	2.15±1.11	2.08±1.08	.943	.348
	Men	4.02±1.87	4.65±2.02	-2.64	.10*	4.22±1.78	4.08±1.77	1.65	.101

*p<0.05, **p<0.001, SD: standard deviation, FRT: Functional Reach Test, TUG: Timed Up & Go test

Table 3. Independent sample t-test results of pretest and posttest in experiment and control groups (Women-Men)

Items	Gender	Test	Experiment Group	Control Group	t	p
			Women n=99	Women n=94		
			Men n=88	Men n=79		
FRT (cm)	Women	pretest	20.0±4.21	19.7±3.78	.421	.674
		posttest	23.4±3.44	20.1±3.63	6.55	.000
	Men	pretest	25.9±2.85	26.3±3.02	-.931	.353
		posttest	29.7±3.35	25.9±2.85	7.92	.000
TUG (s)	Women	pretest	14.1±1.89	14.3±1.92	-.837	.403
		posttest	13.6±2.1	14.2±2.26	-1.80	.073
	Men	pretest	12.8±2.28	12.6±2.19	.663	.508
		posttest	12.1±2.47	12.8±2.43	-1.90	.059
Eyes open right leg (s)	Women	pretest	14.3±2.45	13.9±2.24	1.04	.296
		posttest	19.5±4.98	14.5±3.63	7.87	.000
	Men	pretest	19.15±5.49	19.8±5.28	-.854	.394
		posttest	26.9±6.76	20.1±5.11	7.30	.000
Eyes open left leg (s)	Women	pretest	8.29±2.09	8.45±2.13	-.540	.590
		posttest	11.3±2.72	8.34±2.11	8.41	.000
	Men	pretest	10.2±3.24	9.91±3.33	.687	.493
		posttest	12.1±2.69	10.1±2.96	4.55	.000
Eyes closed right leg (s)	Women	pretest	3.35±1.28	3.22±1.40	.670	.503
		posttest	4.62±1.70	3.12±1.40	6.63	.000
	Men	pretest	4.20±1.69	4.43±1.63	-.873	.384
		posttest	7.43±2.52	4.50±1.73	8.64	.000
Eyes closed left leg (s)	Women	pretest	1.96±1.04	2.15±1.04	-1.22	.222
		posttest	3.41±1.96	2.08±1.08	5.77	.000
	Men	pretest	4.02±1.87	4.22±1.78	-.721	.472
		posttest	4.65±2.02	4.08±1.77	1.92	.056

*p<0.05, **p<0.001, SD: standard deviation, FRT: Functional Reach Test, TUG: Timed Up & Go test

Discussion

In general, the lower level of body oscillation is related to a high level of postural control [57]. By applying the accurate tests, this association can be analyzed at the highest level and, by determining how a program should be prepared, it might be useful in reducing the health risks [58, 59]. It was reported that the balance skill decreases with advancing age [12] and the static balance level of an elderly adult at 60-70 years of age equals to a 10-year-old child [19], it should be considered that the difficulty of the test applied to determine the balance skills of elderly adults might positively or negatively affect the results [20, 6]. When compared to other motor skills, the balance skill can be trained faster [60] and it might be advantageous if the practices performed during balance training are in form of non-tiring exercise for elderly adults [20, 55]. It was stated that the reduction in balance skill depending on the motor skills degrading with advancing age might be compensated via regularly performed balance exercises [12, 19, 20, 61, 62]. In the present study, it is found that a simple exercise by standing on one leg for 4 minutes a day while brushing the teeth for 50 weeks positively contributes to the balance skills of elderly adults aged between 70 and 80 years.

In their studies, Aksay [20], Belurosova [63], Espenschade and Eckert [64], Heidemann [55], Rikli and Edwards [65] and Wydra [50], reported that coordination exercises yielded very good results in terms of improving the balance skills and these results are similar to those reported in the present study.

In their study, Weiner et al. [45] examined the elderly men's risk of fall by using *FRT* and they reported that those reaching forward by 25 cm have a low risk of fall. The results obtained showed that men can reach forward by 29.7 cm and this finding indicates that they have a low risk of fall.

Duncan et al. [66] reported that the longer the distance covered in *FRT* test is, the lower the risk of fall is and that the values lower than 17.5 cm negatively affect the mobility and daily life activities. The *FRT* scores obtained in the present study were higher than 17.5 and it can be interpreted that the mobility and daily life activities of participating elderly adults are not negatively affected. Similarly, Rookwood et al. [67] carried out a study on a group with a mean age of 78.1 years and they reported similar results by determining the *FRT* score to be 29 cm. However, in their study on a group with a mean age of 81.4 years, Thomas and Lane [68] reported the *FRT* scores to vary between 15.5 and 19.4 cm, which were lower than the results obtained in the present study.

There are remarkable differences between the *TUG* results reported in previous studies. Rookwood et al. [67] reported 12 seconds for a group with a mean age of 78.1 years, whereas Thomas and Lane [68] reported a time of 29 seconds for a group with a mean age of 81.4 years. The results obtained in the present study were in parallel with those reported by Rookwood et al. [67] and lower than the results reported by Thomas and Lane [68].

It can be stated that different durations were applied

in assessing the single-leg-stance test in literature. It can be seen that, in the previous studies, the assessments were performed over 30 seconds and it was reported that elderly adults with single leg stance duration longer than 30 seconds have higher balance capacity and lower risk of fall [54, 69, 70] and this rate is higher among elderly individuals aged older than 70 years [71]. Lower values of single leg stance were obtained in the present study in comparison to the previous studies.

However, in their study carried out on 316 subjects, Vellas et al. [48] took 5-sec as a basis and they reported that 267 subjects could stand on one leg for 5 seconds unassisted, whereas 49 subjects could less than 5 seconds and showed that they have a higher risk of fall [48]. The data obtained from the present study were higher than those reported by Vellas et al. [48] and it can be assumed that the participating elderly adults have a low risk of fall.

Similarly, in their study carried out with 482 elderly adults with a mean age of 74 years and having a risk of fall, Vellas et al. [72] reported that single leg stance exercises can positively contribute to the balance skills of elderly adults and they reported results that are similar to the results reported in the present study.

In their studies, Bohannon et al. [70] and Verma et al. [73] reported that there was no difference between right leg and left leg. However, in the present study differing from the previous ones, it was determined in the posttests of experiment group that women's score in *eyes open right leg* was 7 seconds higher than *eyes open left leg* and the difference was 14 seconds for men.

In the present study, it was observed in the single leg tests that the participants had lack of confidence and this lack of confidence was, as expected, at a higher level in *eyes-closed* practices. Woollacott and Jensen [37] reported that, when compared to young individuals, elderly adults had a slower transmission of sensorial information in the eyes-closed exercises and, thus, the balance performance decreased with increasing lack of confidence. Similarly, Bernstein [74] pointed out that the optic analyzers become more important as the age advances, while Meusel [12] emphasized that the balance performance of elderly adults significantly decreased when visual control was shot down and, from this aspect, the risk of fall increased at low light or at darkness. In tests performed with eyes closed, Verma et al. [73] obtained lower scores when compared to the tests performed with eyes open. The results obtained in the present study show that, in parallel with the results reported in previous studies, the values obtained from the exercises performed with eyes closed were lower.

Conclusion

In conclusion, implementing target-oriented simple practices to be performed on regular basis was found to have a statistically significant relationship with balance skill improvements of elderly adults. Besides that, undoubtedly, the uncertainties in balance increase with advancing age and, consequently the risk of fall increases. Based on the data obtained, it can be assumed that, by making use of simple exercises in daily life such as lifting

one leg while brushing the teeth, the balance skills of elderly adults can be improved without making an extra effort, the risk of fall can be reduced, and they can be assisted for an independent life. For this reason, the balance training to be added to the exercise program of elderly adults should be considered as an integral part of the program.

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Conflicting interest

The author declares no conflict of interest.

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