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Özden ÖZYEMİŞCİ-TAŞKIRAN
Zafer GÜNENDİ
Nihal TAŞ

RESEARCH

ASSESSMENT OF ISOKINETIC KNEE FLEXOR AND EXTENSOR STRENGTH AND BALANCE ABILITY IN THE ELDERLY

ABSTRACT

Introduction: To investigate the possible risk factors for falls and the effect of laboratory and performance-based measures of balance and isokinetic muscle strength on fall risk assessment in persons aged over 65 years.

Materials and Method: Postural stability was assessed by Berg Balance Scale (BBS) and also by static and dynamic balance tests on Kinesthetic Ability Trainer-3000 (KAT). Muscle strength was assessed for knee flexion and extension using isokinetic dynamometer.

Results: Fifty-five subjects aged between 65 and 80 years were included. Fall rate was 27.3%. In the faller group, osteoarthritis and assistive device use, total number of systemic diseases and drugs were significantly higher ($p<0.05$). In the faller group, BBS scores were lower ($p=0.035$); static (SBI) and dynamic (DBI) balance indexes measured on KAT were significantly higher (SBI $p=0.038$; DBI $p=0.047$). The difference of peak torque (PT) at 180°/sec angular velocity was statistically significant (flexion PT, $p=0.006$; extension PT, $p=0.026$; flexion work, $p=0.008$; extension work, $p=0.034$).

Conclusion: Elderly people with a high risk of falling have decreased muscle strength and balance ability. Physiatrists and other health professionals treating geriatric population should be aware of the importance of this public health problem which can be prevented with appropriate measures.

Key Words: Muscle Strength; Postural Balance; Resistance Training; Aged.

ARAŞTIRMA

YAŞLILARDA İZOKİNETİK DİZ FLEKSÖR VE EKSTENSÖR KAS KUVVETLERİ İLE DENGE YETENEĞİNİN DEĞERLENDİRİLMESİ

ÖZ

Giriş: Altmışbeş yaş üzeri kişilerde düşmeye yol açabilecek risk faktörlerini incelemek ve laboratuvar ve performans temelli denge ölçümleri ile izokinetik kas kuvvetlerinin etkilerini araştırmak amaçlandı.

Gereç ve Yöntem: Postüral stabilite Berg Denge Skalası ile değerlendirildi. Statik ve dinamik denge testleri ayrıca Kiestetik Beceri Eğitim Cihazı-3000 (KAT) aracılığıyla değerlendirildi. Diz fleksör ve ekstensör kas kuvvetleri izokinetik dinanometre ile ölçüldü.

Bulgular: Yaşları 65 ile 80 arasında olan 55 kişi çalışmaya dahil edildi. Düşme sıklığı %27.3 idi. Düşme öyküsü olan grupta osteoartrit ve yardımcı cihaz kullanımı, sistemik hastalık ve kullanılan ilaç sayısı anlamlı olarak daha yüksekti ($p<0.05$). Düşme öyküsü olan grupta Berg Denge skoru daha düşük ($p=0.035$); KAT'ta ölçülen statik (SBI) and dinamik (DBI) denge indeksleri anlamlı olarak daha yüksekti (SBI $p=0.038$; DBI $p=0,047$). 180°/sn açısal hızda ölçülen tepe tork (PT) değerleri arasındaki fark statistiksel olarak anlamlı idi (fleksiyon PT, $p=0.006$; ekstansiyon PT, $p=0.026$; fleksiyon güç $p=0.008$; ekstansiyon güç $p=0.034$).

Sonuç: Düşme riski yüksek olan yaşlılarda daha fazla kas güçsüzlüğü ve denge sorunları bulunmaktadır. Fiziatristler ve geriatrik yaş grubunun sağlık sorunları ile ilgilenen diğer hekimler uygun yöntemlerle önlenebilen bu önemli sağlık sorunu hakkında daha dikkatli olmalıdırlar.

Anahtar Sözcükler: Kas Kuvveti; Postural Denge; Rezistans Eğitim; Yaşlı.

İletişim *(Correspondance)*

Özden ÖZYEMİŞCİ-TAŞKIRAN
Gazi Üniversitesi, Fiziksel Tıp ve Rehabilitasyon
ANKARA
Tlf: 0312 202 52 19
e-posta: ozdenozyemisci@yahoo.com

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Gazi Üniversitesi, Fiziksel Tıp ve Rehabilitasyon
ANKARA

INTRODUCTION

Falls are an important public health issue that can be prevented with appropriate intervention programmes in older adults over the age of 65 (1). According to the relevant literature; 30-60% of community-dwelling elderly persons experience at least one fall and 10-20% of these result in injury, hospitalization or death (2). In Finland, the number of fall-induced deaths doubled among elderly people in the last 3 decades (1). Fall frequency has been demonstrated to be one of the important independent determinants of fracture which leads to debilitating outcomes in the elderly (3). Jarvinen et al reported that fall history is a better predictor of fractures than low bone mineral measurements and the association between 'falls and fracture' is resembled to 'smoking and lung cancer' (4). Increased hospitalization rates and health service utilizations create a considerable impact on the health care expenditure (5).

Besides these well recognized complications, falls and their consequences also exert some profound but under-appreciated effects on the health of the elderly subject. Fear of recurrent fall and decline in perceived self-control limit daily activities of living (2). Even in the absence of physical injury, elderly patients experiencing falls are more likely to be admitted to nursing homes and institutions (6). This further leads to decreased self-esteem, social isolation, and reduced life satisfaction.

Falls and related factors that may lead to disability and handicaps late in the course of life should be found out and managed carefully to help individuals in successful adaptation to aging. Besides management, proper prevention programmes are extremely worthy. Applying prevention programmes to the whole population will not be a realistic goal for financial reasons. Intervention programmes targeted to subpopulations at high risk of falling may be a rationalistic approach. Besides multifactorial fall prevention programmes; focused programmes like physical exercise; reduction or withdrawal of psychotropic medications may also be implemented (7, 8). Those who had lower balance scores showed larger improvements after exercise (7). Exercise improves balance ability and muscle strength that are affected physiologically due to advancing age and also pathologically by some degenerative and/or systemic diseases. Improvements caused by exercise programmes lasted up to 9 months after the completion of the programme (7).

In many studies, muscle strength is evaluated as an important component of fall risk assessment (2,7,9-13). However number of isokinetic muscle strength measurements in the elderly at high risk of falls is limited in the literature (10-13).

Allander et al pointed out that a large variation exists between countries regarding the risk factors affecting falls that lead to hip fracture (14). Genetics, cultural and demographic characteristics may play role in this diverse pattern of risk factors, frequencies and consequences of falls. Health policies should concentrate on building guidelines for assessment and management of falls in the national perspective.

Data regarding fall frequency and related risk factors from Turkey has been recently advancing (10,15-17). In a cross-sectional study of 2322 patients, fall frequency was 28.5% in the previous one year (17).

In this study, we aimed to investigate the frequency of previous falls and related risk factors in older persons in a Turkish university outpatient setting. Another goal was to investigate the associations between isokinetic muscle strength measurements, balance scores measured on a balance platform and balance scores measured by clinical tests in the faller and non-faller group.

MATERIALS AND METHOD

This study was conducted in Department of Physical Medicine and Rehabilitation in Gazi University Medical School. Fifty-five participants were recruited among persons aged 65 years or older that admitted to our outpatient clinic. Informed consent was obtained from all subjects.

All subjects were relatively healthy volunteers who were able to answer the questions independently and had no memory difficulties. Patients with behavioural and cognitive impairments, serious medical disorders (uncontrolled diabetes mellitus, acute myocardial infarction, etc.) and severe neurologic disorders that interfere cooperation in the assessments were excluded from the study.

All subjects completed a questionnaire including demographic information on age, gender, marital and residential status, educational level, occupation and current coexisting medical conditions that might predispose individual to fall. Presence of hypertension, cardiovascular and pulmonary diseases, diabetes mellitus, stroke, cancer, thyroid disease, inflammatory joint disease and current medications used were recorded. Subjects were asked whether they had fallen one or more times within the previous year. Number, place (indoor or outdoor, familiar place or not) and nature of fall were further questioned.

Blood pressures were measured in supine position after 5 minutes of supine rest and repeated at 1 and 3 minutes after standing. A decline of ≥20 mmHg in systolic blood pressure or a decline of ≥10 mmHg in diastolic blood pressure was defined as orthostatic hypotension (18).

Detailed musculoskeletal and neurologic examinations were performed. Geriatric Depression Scale (GDS) (19) and Mini-Mental State Examination (MMSE) (20) were used to evaluate depressive state and cognitive function, respectively. Instrumental Activities of Daily Living (I-ADL) were performed to assess functional capabilities like housework, meal preparation, use of telephone, shopping and medication use (21).

Postural stability was assessed using static and dynamic balance tests on Kinesthetic Ability Trainer-3000 (Berg, Vista, CA). It consists of a movable platform and a computerized data processing unit. Movements of the platform are controlled by changing the pressure in the pneumatic cushion between the platform and base of the unit. A sensor located in front of the platform gives information about the deviations of the platform from the reference position. This information is processed in the computer. In static balance test, subjects tried to maintain their balance on the platform on both feet for 30 seconds, and visual feedback from the computer screen was allowed. Foot displacement was not allowed. Static balance index was measured regarding the deviations of centre of gravity (COG) forward, backward and sideways from the centre. Test was repeated three times after practise trials. The best of the three scores was included in the statistical analysis.

In the dynamic balance test, subjects were asked to chase the target represented by 'X' mark viewed on the computer screen moving in a circle with a speed of 360º/10 seconds, by tilting the movable platform via shifting his or her COG. Dynamic balance index was derived from the deviations of the COG of the subject from the target. Again, test was repeated three times and the best score was put in analysis.

From performance-based balance tests, Berg Balance Scale (BBS) was used. It measures the postural stability by challenging the balance of the subjects with activities requiring narrow base of support (22). It consists of 14 items, each graded from 0 to 4 as the task is performed more successfully.

Muscle strength of knee flexion and extension was measured by Cybex 770 NORM Isokinetic Dynamometer (Lumex, Ronkonkoma, NY, USA). After each opening of the machine, calibration of the unit was run. Each subject performed the test in the sitting position, with back support set at 85º. Subjects were stabilized via the use of chest, pelvic and thigh straps. The mechanical axis of the dynamometer was aligned with the transverse line passing through the femoral epicondyles. Lever arm lengths of the dynamometer were adjusted according to the leg length of each individual and legs were secured to the lever arm with straps proximal to the ankle. Full extension of knee was considered anatomic zero position. Ranges of motion of both knees were measured by the dynamometer. Test was performed in subject-specific range of motions. Test protocol started with knees fully flexed, the first movement was extension. Reciprocal concentric knee flexion and extension were evaluated at 60º/sec and 180º/sec angular velocities. To familiarize with the test, subjects were allowed to practise submaximally four times before each test. Between these practise and the test trials, subjects rested for a period of 10 seconds.

For isokinetic testing at 60º/sec, subjects were instructed to extend and flex their knee as forcefully as possible. Five maximal contractions were recorded. Before proceeding to the second part of the examination, subjects were allowed to rest for 20 seconds. At 180º/sec, subjects were instructed to perform 20 repetitions as fast as possible. All the tests were applied by the same researcher. To achieve maximal torque, verbal encouragement and visual feedback were used. Peak torque (PT) values of both extremity recorded in foot-pounds (FtLbs) by the Kincom's software were used in the analysis.

Data was analysed using 'SPSS 10.0 for Windows' package programme. Participants were divided into two groups as 'subjects with fall history'-fallers and 'subjects without fall history'-nonfallers. The normality of the distribution was checked with Kolmogorov-Smirnov test. Descriptive statistics, chi-square test and Fischer's Exact test were used as appropriate to describe group characteristics and examine the differences in the distribution of risk factors between groups, respectively. Mann Whitney-U test was run to assess the difference between the continuous variables of the two groups. Spearman correlation coefficients were computed to analyse the relationship between balance measurements and peak torque values, since the distribution of variables were nonhomogenous. $p<0.05$ was considered level of significance.

Results

Fifty-five subjects (39 female, 16 male) between 65 and 80 years of age (mean 71.3 years) were participated in this study. Fifteen participants experienced falls (27.3 %). Among them, 7 participants experienced one fall and 8 of them two or more falls during the preceding year adding up to a total of

Table 1— Characteristics of the Subjects

Characteristics	(+) Fall History n=15	(-) Fall History n=40	p value
Age (years) (mean; sd)	70.0 (4.8)	71.8 (4.6)	0.239
Male/Female	2/13	14/26	0.184
BMI (g/cm^2) (mean; sd)	29.84 (5.68)	28.23 (4.62)	0.748
No of Chronic Diseases (mean; (sd)	5.7 (2.6)	4.1 (1.8)	0.037
Hypertension	11 (73.3%)	25 (62.5%)	0.452
Cardiovascular Disease	6 (40%)	11 (27.5%)	0.514
Pulmonary Disease	5 (33%)	7 (17.5%)	0.075
Diabetes Mellitus	3 (20%)	5 (12.5%)	0.669
Thyroid Disease	2 (13.3%)	5 (12.5%)	0.934
Cerebrovascular Accident	—	2 (5%)	0.378
Malignity	2 (13.3%)	- (-)	0.071
Hepatic Disease	1 (6.7%)	1 (2.5%)	0.475
Renal Disease	—	1 (2.5%)	0.727
Inflammatory Joint Disease	1 (6.7%)	1 (2.5%)	0.475
Orthostatic Hypotension	1 (6.7%)	3 (7.5%)	0.384
Cataract	4 (26.7%)	15 (37.5%)	0.508
Urinary Incontinence	6 (40%)	14 (35%)	0.693
Polyneuropathy	1 (6.7%)	1 (2.5%)	0.462
Osteoarthritis (in lower extremity)	13 (86.7%)	23 (57.5%)	**0.043**
Use of Assistive Device	3 (20%)	- (-)	**0.018**
No of Medications (mean; sd)	3.87 (2.29)	2.51 (1.99)	**0.05**

SD: standard deviation, BMI: body mass index

31 falls. There was no difference in age and gender between faller and nonfaller group (Table 1).

Of the 31 falls, 10 took place at home, and the remaining fall events occurred away from home. The most common cause of falls was foot slipping followed by tripping of foot. No serious complication following falls was noted; only mild soft tissue injuries were reported.

There was no statistically significant difference in the educational status, marital status, occupation and number of children (p>0.05). Mean monthly income value was lower in the faller group; however the difference did not approach statistically significance.

Comparison of systemic diseases between fallers and nonfallers are also presented in Table 1. Presence of osteoarthritis and use of assistive device were higher in the faller group (p=0.043 and p=0.018, respectively). Most of the other systemic diseases were also more common among faller group, but the difference did not reach statistically significant level. Total number of systemic diseases was significantly higher in the faller group (p=0.037).

Total number of medications used including nonsteroidal anti-inflammatory drugs and vitamins was statistically significantly higher in the faller group (p=0.05). Frequencies of diuretics, digital and bronchodilator use were higher in the faller group, but the difference was not significant.

Mean scores (standard deviation) of MMSE were 26.5 (2.4) and 26.8 (2.4) in the faller and nonfaller group, respectively and I-ADL mean scores were 7.2 (1.3) and 7.1 (1.2) respectively; scores were very similar between groups. Faller group had lower GDS mean scores [8.8 (6.9) vs 11.5 (4.9)], but the difference was not significant.

Table 2 shows that BBS were lower (p=0,035) and balance indexes measured on KAT were significantly higher in the faller group (SBI p=0.038; DBI p=0.047).

Right and left knee flexion and extension peak torque values (PT) were strongly correlated and to prevent numeric confusion, only values of right knee were demonstrated here (Table 3). All PT were lower in the faller group, but the difference of PT at 180º/sec angular velocity were statistically significant (for flexion, p=0.006; for extension, p=0.026).

Table 2— Berg Balance Scale Scores, Static and Dynamic Balance Indexes.

Score	(+) Fall History Mean (SD)	(-) Fall History Mean (SD)	p value
BBS	49.6 (5.7)	53.1 (2.9)	0.035
SBI	396.5 (121.9)	339.4 (139.5)	0.038
DBI	2179.8 (602.5)	1818 (474.7)	0.047

SD: standard deviation, BBS: Berg Balance Scale, SBI: Static Balance Index, DBI: Dynamic Balance Index.

Tablo 3— Peak Torque Values of Right Knee Flexion and Extension at 60°/sec and 180°/sec Angular Velocities.

Value	(+) Fall History Mean (SD)	(-) Fall History Mean (SD)	p value
60°/sec Angular Velocity			
Flexion PT	13.32 (6.57)	15.87 (6.99)	0.160
Extension PT	25.50 (9.85)	27.31 (11.12)	0.658
Flexion/Extension PT	52.89 (15.85)	60.81 (29.70)	0.170
180°/sec Angular Velocity			
Flexion PT	5.54 (3.23)	8.27 (3.39)	**0.006**
Extension PT	11.31 (4.13)	14.93 (5.67)	**0.026**
Flexion/extension PT	49.31 (20.22)	55.82 (12.74)	0.184
Flexion work	3.82 (3.26)	6.39 (3.40)	**0.008**
Extension work	9.71 (4.45)	14.10 (6.97)	**0.034**
Flexion/extension work	38.69 (21.40)	45.52 (16.31)	0.295

SD: standard deviation, PT: peak torque.

Knee flexion and extension work at 180°/sec angular velocity were also statistically significantly lower in the faller group (for flexion work, p=0.008; for extension work, p=0.034).

Correlations between the balance scores and peak torque values and work of right knee flexion and extension at 180°/sec angular velocity are shown in Table 4. There was weak negative correlation between BBS score and SBI (r= -0.368; p= 0,021). Moderate negative correlation was found between BBS score and DBI (r= -0.524; p= 0.001). There were weak to moderate correlations between BBS score and PT values. There was no correlation between balance indexes measured on KAT and PT values.

Discussion

We aimed to investigate the possible risk factors for falls and the effect of laboratory and performance-based measures of balance and isokinetic knee muscle strength on fall risk assessment in this study. The fall incidence of 27% in this study is consistent with the literature concerning community-dwelling elderly people (5,9).

Information about falls in the current study was gathered retrospectively via self-report of subjects. Potential inaccurate recollection of fall history might cause underestimation of fall frequency. Falls, especially if they do not come out with fracture or injury, are likely to be ignored and forgotten. Age-associated memory impairment is also an important factor even if falls have resulted with some consequences. Complications like fracture and severe soft tissue injury following falls did not occur in our study population. In our study, elderly adults were relatively younger than those enrolled in other studies (6, 12); frequency of cognitive impairment and other systemic diseases affecting the complication rate in our participants was also lower (6).

Studies offer several predisposing factors for falls; like age, gender, cognitive impairment, depression, visual and hearing impairments, muscle weakness, gait and balance disorders, orthostatic hypotension, medications used and environmental factors (2, 6, 8, 9, 12). In each of the research studies, different parameters appear to predict falls more strongly than others.

Tablo 4— Correlation Coefficients of Berg Balance Scale Scores, Static and Dynamic Balance Index and Peak Torque Values and Work at 180°/sec angular velocity.

	SBI	DBI	Flexion PT	Flexion Work	Extension PT	Extension Work
BBS score	**r = -0.368**	**r = -0.524**	**r = 0.474**	**r = 0.453**	**r = 0.533**	**r = 0.517**
	p = 0.021	**p = 0.001**	**p = 0.003**	**p = 0.005**	**p = 0.001**	**p = 0.001**
SBI		**r = 0.611**	r = -0.158	r = -0.152	r = -0.148	r = -0.110
		p = 0.000	p = 0.274	p = 0.293	p = 0.305	p = 0.448
DBI			r = -0.240	r = -0.215	r = -0.145	r = -0.172
			p = 0.101	p = 0.142	p = 0.325	p = 0.241
Flexion PT				**r = 0.974**	**r = 0.783**	**r = 0.776**
				p = 0.000	**p = 0.000**	**p = 0.000**
Flexion work					**r = 0.782**	**r = 0.798**
					p = 0.000	**p = 0.000**
Extension PT						**r = 0.961**
						p = 0.000

SD: standard deviation, BBS: Berg Balance Scale, SBI: Static Balance Index, DBI: Dynamic Balance Index, PT: peak torque.

In our study, number of systemic diseases and use of assistive device were associated with falls. Total number of medications used were also significantly higher in the faller group. All medications including nonsteroidal anti-inflammatory drugs and vitamins were recorded. Digitals, diuretics and oral bronchodilators were higher in the faller group but difference was not significant. None of the patients in the study used benzodiazepine or neuroleptics that might increase fall risk. Increase in number of chronic diseases definitely increases many risk factors related to balance, gait, vision, etc and hence elderly patients are expected to be more susceptible to falls. This relationship between chronic diseases and falls is in accordance with the study of Lawlor et al, however they did not find such relation for the number of drugs used (23). However hypnotics, anxiolytics and antidepressants were independently associated with falls in that study.

In this study, most of the systemic diseases were higher in the elderly fallers, however osteoarthritis was the only disease that was statistically significantly more prevalent in fallers. It is well known that osteoarthritis in the lower extremity joints cause pain, muscle weakness and decrease in proprioception. Thus it is not surprising that lower extremity osteoarthritis results in gait and balance impairments leading to increased risk of falling. In a prospective study of 6641 men and women, knee osteoarthritis and knee pain were associated with an increased risk of falling and an increased risk of non-vertebral fracture (24). Osteoarthritis of knee decreases obstacle avoidance by decreasing the ability to react quickly to obstacle because of pain and improved gait and attention allocation (25).

Benjuya et al demonstrated that somatosensory and visual contribution to postural stabilization diminish with aging and muscle cocontraction gains importance in order to adapt to changing conditions (26). Especially soleus and tibialis anterior muscle cocontract to develop a strategy for maintaining balance. Van der Esch suggested that in patients with poor proprioception, decrease in muscle strength has more challenge on functional ability (27). Evaluation of muscle strength in lower extremity may predict functional limitations and thus, risk for falls.

In our study, knee extensor and flexor muscle strength measurements were lower at both angular velocities in the faller group, but only the difference between peak torque values at 180°/sec angular velocity was statistically significant. We think differences in other values might also reach significance if the sample size was larger. In the study of Sieri et al, males with fall history had lower knee flexion peak torques at 120°/sec angular velocity whereas fallen females had lower knee extension peak torques at 120°/sec angular velocity (12). This difference observed in higher velocities is similar with our results. Skelton et al showed that fallers tended to have weakness in knee extensor and flexor strength, but ankle dorsiflexor weakness was statistically significant. In that study, decrease in explosive power and leg asymmetry is more prevalent in faller elderly (11). Keskin et al have found no significant difference in muscle strength of knee flexor and extensors between elderly females who had a history of fall and who did not (10).

Muscle strength is important in the proper functioning of the efferent system of balance. This is supported by the presence of the correlation between BBS scores and knee muscle PT values in the current study. However, there was no correlation between balance indexes measured on KAT and muscle PT. Explanation for this finding may be that balance test on KAT requires ankle strategy more than other strategies, and therefore ankle muscle strength may be more associated with this balance test. We believe this hypothesis needs support by further studies. Isokinetic knee muscle strength was preferred in this study, because it is a reliable and valid measurement, and easier to perform than other muscle groups for elderly and knee muscle weakness might endanger an elderly to fall, especially in daily activities like chair-rising and stair climbing.

This study is unique in balance tests on KAT in elderly. The correlation between SBI, DBI and BBS shows that this test can be used in the elderly. However, reliability studies of balance tests on KAT are needed in the elderly subjects.

Different fall rates were reported in studies from different countries. In community-dwelling Chinese older adults, fall rate was 19.7% (5). Similarly, in Japan 9% of men and 19% of women reported one or more falls (28). Frequency of falls among community-dwelling Indian older women was reported 45% and among long-tem care settings this rate increased to 64% (29). However, Caucasians (24.7%) and African Americans (27.4%) had similar fall rates in another study (30). These considerable variations in fall frequency among different populations may be explained by genetic factors, different traditional habits and potential culture specific protective factors as well as environmental factors.

In a cross-sectional study of 2322 patients from Turkey, fall frequency was 28.5% in one year (17). Inal et al have reported that among functionally independent elderly living in an institution in Istanbul, Turkey, 21.8% had a fall in the previous year (15). Aslan et al have found a similar fall rate, 25.1% among elderly living in another city of Turkey, Denizli (16). Keskin et al have reported that 38.7% of the female participants experienced a fall in one year, but their study sample was small (10). However subjects of these studies are mostly recruited from healthy volunteers, so generalization of the results to whole population seems inacceptable. Population-based randomly selected studies should be conducted.

The main limitation of our study was the small size of study group. The extent of the balance and strength tests prevented enlarging our study group because of time and economic concerns. That is why we can not also generalize the findings directly to all community-dwelling elderly people in Turkey.

Another limitation was the method used to select the participants in the present study. Subjects were recruited from all patients who admitted to the outpatient clinic but patients with severe neurologic problems that interfere with cooperation were excluded. This may also lead to selection bias.

Health professionals who give care to geriatric population should be aware of the importance of this issue. Most elderly individuals do not demand help for previous falls, as they do not accuse their health status, but instead accept this as a natural consequence of aging. So, every patient should be asked about fall history on routine clinical assessments. Especially elderly persons with balance problems and diseases causing muscle weakness are at higher risk for fall than others. Physiatrists managing musculoskeletal problems of geriatric patients should be cautious in this public health problem.

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