RESEARCH

PREDICTORS OF FUNCTIONAL BALANCE IN OLDER ADULTS LIVING IN A COMMUNITY

Abstract

Introduction: Various factors may affect the functional balance of older adults. This study aimed to investigate the factors associated with functional balance in older adults living in a community.

Materials and Method: In total, 160 people ≥65 years of age were included in the study. The Cumulative Illness Rating Scale was used for scoring comorbidities. Functional balance was evaluated with the Activities-specific Balance Confidence scale. The Hospital Anxiety and Depression Scale was used for assessing emotional state. Finally, cognitive status was evaluated with the Mini-Mental State Examination. The factors associated with functional balance were determined using multivariate logistic regression analysis in patients with lower balance confidence.

Results: The mean age was 71.3±5.8 years. The group of participants with lower balance confidence (Activities-specific Balance Confidence score ≤67) had increased age, height, lower extremity pain, sleeplessness, falling frequency, hypertension, ischaemic heart disease and anaemia ratios, number of drugs used, female ratio and single living ratio; higher Cumulative Illness Rating Scale, Hospital Anxiety and Depression Scale scores and significantly lower ($p<0.05$) Mini-Mental State Examination scores. The multivariate reduced model analysis revealed that age, height, marital status, number of drugs, number of comorbidities and the anxiety score had statistically significant effects ($p<0.05$) on functional balance.

Conclusion: In clinical practice, it will be useful to consider such factors while evaluating balance in older adults. In this study, the predictors of balance confidence in older adults included age, height, marital status, number of drugs used, number of comorbidities and anxiety level.

Keywords: Aged; Accidental falls; Balance, Postural

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- Nurdan PAKER[1]
- Ekin İLKE ŞEN[2]
- Derya BUĞDAYCI[1]
- Arzu FERHATOSMANOĞLU[1]

CORRESPONDANCE

Ekin İLKE ŞEN
İstanbul University İstanbul Faculty of Medicine, Department of Physical Medicine and Rehabilitation, İstanbul, Turkey

Phone: 02125315533
e-mail: ekinozgorgu@gmail.com

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[1] İstanbul Physical Medicine and Rehabilitation Training and Research Hospital, Physical Medicine and Rehabilitation, İstanbul, Turkey
[2] İstanbul University İstanbul Faculty of Medicine, Department of Physical Medicine and Rehabilitation, İstanbul, Turkey

ARAŞTIRMA

YAŞLILARDA FONKSİYONEL DENGENİN BELİRLEYİCİLERİ

Öz

Giriş: Yaşlılarda fonksiyonel dengeyi etkileyebilecek çok sayıda faktör mevcuttur. Bu çalışmanın amacı toplumdaki yaşlılarda fonksiyonel denge ile ilişkili faktörlerin araştırılmasıdır.

Gereç ve Yöntem: Çalışmaya dahil edilme kriterlerine uyan 65 yaş ve üzeri olan 160 kişi alındı. Komorbiditelerin değerlendirilmesinde Kümülatif Hastalık Değerlendirme Skalası kullanıldı. Fonksiyonel denge, Aktivitelere-özgü Denge Güven Skalası ile değerlendirildi. Emosyonel durumun değerlendirilmesinde Hastane Anksiyete ve Depresyon Ölçeği kullanıldı. Kognitif durum ise Mini Mental Durum Değerlendirmesi ile değerlendirildi. Denge güveni düşük, düşme riski yüksek olan hastalarda çok değişkenli lojistik regresyon analizi ile fonksiyonel denge ile ilişkili bileşenler belirlendi.

Bulgular: Katılımcıların ortalama yaşı 71.3±5.8 yıl idi. Denge güveni düşük olan (ABC skoru≤67) grupta yaş, boy, alt ekstremite ağrısı, uykusuzluk, düşme sıklığı, hipertansiyon, iskemik kalp hastalığı ve anemi oranları, kullanılan ilaç sayısı, bayan cinsiyet, tek başına yaşama oranları daha fazla idi; Kümülatif Hastalık Değerlendirme Skalası, Hastane Anksiyete ve Depresyon Ölçeği skorları anlamlı olarak daha yüksekti, Mini Mental Durum Değerlendirmesi skoru ise anlamlı olarak daha düşüktü ($p<0.05$). Çok değişkenli indirgenmiş modelde fonksiyonel denge üzerinde yaş, boy, medeni durum, ilaç sayısı, ek hastalık sayısı, anksiyete düzeyinin anlamlı ($p<0.05$) etkinliği gözlenmiştir.

Sonuç: Yaşlılarda fonksiyonel denge üzerinde birçok faktörün etkili olabileceği klinik pratik yaklaşımda göz önünde bulundurulmalıdır. Bununla beraber bu çalışmada yaşlılarda denge güveninin belirleyicileri yaş, boy, medeni durum, kullanılan ilaç sayısı, ek hastalık sayısı ve anksiyete düzeyi olarak belirlenmiştir.

Anahtar sözcükler: Yaşlı; Düşmeler; Denge

INTRODUCTION

Aging is associated with progressive decline in physical and psychological health, increased risk of disability and the number of comorbidities. Balance disorder and related complications rise in parallel with the size of the ageing population. More than 27% of the 37.3 million adults aged ≥65 years have reported balance problems according to data obtained from the National Health Interview Survey conducted in the United States (1). It has also been reported that of the more than seven million older adults with balance problems, only half have sought medical advice for the deficit (2). Futhermore, it has been shown that approximately one-third of older adults fall (3). Injurious fall is a problem that causes serious disability, that is why fall prevention and balance assessment are important in older adults. Higher postural sway, balance and walking problems are related to the fall risk (4). Balance has been shown to be an important predictor of falls within the elderly population.

There are many intrinsic factors for balance disorder in older adults, such as vestibular or visual disorders, neurological disorders such as Parkinson's disease or peripheral neuropathy, psychological problems, dizziness, low blood pressure, cognitive disorders and muscle strength decrease (4,5). Certain drugs can result in balance disorders either directly or by causing dizziness. In addition, some characteristics of the person, such as posture, mobility or trunk muscle strength, may affect balance (6). Older adults with a recurrent history of falls may experience increased mediolateral sway during narrow base stance (7). Postural stability is required for safe walking and to prevent falls.

Routinely evaluating the balance status of elderly patients should be integrated into primary care practice in order to diagnose increased fall risk and prevent falls. The aim of this study is to identify and evaluate factors that affect the functional balance status of older adults living in a community. In this context, we would like to predict important intrinsic factors allowing health care professionals to successfully monitor balance confidence for the older adults.

MATERIALS AND METHOD

A total of 200 adults aged 65 years or older living in a community referred to the outpatient clinics of our rehabilitation hospital between 25/02/2016 and 08/03/2017 were screened for this cross-sectional study. Those with communication problems, serious visual disorders and/or neurological problems such as Parkinson's disease or history of stroke were not included in the study. The remaining 160 subjects were included in the study cohort. Informed consent was obtained from all participants. This study was approved by the hospital ethics committee.

Evaluations were conducted by face to face interviews. Demographics and prescription drug use were recorded. The Cumulative Illness Rating Scale (CIRS) was used for scoring comorbidities. Functional balance was evaluated with the Activities-specific Balance Confidence (ABC) scale. The Hospital Anxiety and Depression Scale (HADS) was used for assessing emotional state. Finally, cognitive status was evaluated with the Mini-Mental State Examination (MMSE).

The ABC scale is a preferred test for the evaluation of balance confidence, particularly in active older adults (8). The 16-item ABC scale assesses balance impairment and fall risk. The scale quantifies subject confidence in performing specific indoor and outdoor activities and is suitable for older adults whose activity level is moderate to high. Total scores range between 0 and 100. Scores <50 indicate a low functional level, between 50 and 80 a moderate functional level and >80 a high functional level (9). Furthermore, Lajoie et al. reported that a score of 67 was indeed a reliable means of predicting a future fall (10). The test has been translated into various languages. The reliability and validity of the Turkish version of the

ABC scale has been studied in symptomatic knee osteoarthritis. Interclass correlation coefficient (ICC) value was 0.95. Test-retest reliability of ABC-Turkish version was high (t=1.90, p=0.063). ABC-Turkish version had a high internal consistency reliability. Cronbach α value was 0.97 (11).

The CIRS was developed by Linn et al. to investigate the comorbidities associated with multiple health conditions (12). The original CIRS evaluated comorbidities related to 13 systems, whereas the modified CIRS consisted of the 14 systems including cardiac, vascular, haematologic, respiratory, otorhinolaryngologic, upper gastrointestinal, lower gastrointestinal, hepatic and pancreatic, renal, genitourinary, musculoskeletal, dermatologic, neurologic, endocrine, metabolic, breast and psychiatric systems (13). A higher CIRS score indicates a higher number of comorbidities for the subject.

The HADS is an easy and reliable screening test to assess symptoms of anxiety and depression. The scale can be used both for inpatients and outpatients and can be completed within 2 to 5 minutes. The test has a two-factor structure with 14 items. Seven items assess anxiety while seven items assess depression. The items are scored on a four-point scale with the total score ranging between 0 and 21. Scores between 0 and 7 indicate normal emotional status, whereas scores greater than 7 reveal an anxiety or depression disorder (14). The reliability and validity of the Turkish version of HADS has been studied in healthy college students and inpatients (15).

The MMSE is a reliable test for the evaluation of cognitive function (16). Orientation, memory, attention, calculation, language and construction functions are assessed with total scores ranging between 0 and 30. Higher scores indicate better cognitive functions. The reliability and validity of the Turkish version of the MMSE test has been studied (17).

Statistical analysis

Power analysis was performed. Sixty percent power was calculated for 164 persons. For definitive statistics of data, mean, standard deviation, median, minimum, maximum, frequency and ratio values were utilised. The distribution of the variables was scored by the Kolmogorov–Smirnov test. The Mann–Whitney U test was used for analysis of the quantitative independent data, while the Chi-square test was used for the analysis of qualitative independent data. Considering that the fall risk is high for the patients with an ABC score below 67 (10), the components related with functional balance were stated by multivariate logistic regression analysis. The SPSS 22.0 programme was used for the analysis. P<0.05 was considered statistically significant.

RESULTS

Participant demographic and clinical features are shown in Table 1. Patients were classified according to balance confidence measured by ABC scale. The percentage of older adults with ABC scores ≤67 was 37,5% (n=60). Age, height, female, single living, lower extremity pain, sleeplessness, fall frequency, hypertension, ischaemic heart disease, anaemia, daily medicine amounts and number of additional diseases were significantly higher (p<0.05) in the lower balance confidence (LBC) group (ABC score ≤67) than in the higher balance confidence (HBC) group (ABC >67). The features for the participants of both groups are shown in Table 2. The CIRS scores and the HADS anxiety and depression scores were significantly higher (p<0.05) in the LBC group than in the HBC group. MMSE test scores were significantly lower (p<0.05) in the LBC group than in the HBC group (Table 3). In the multivariate reduced model, age, height, marital status, daily medicine amount, number of additional diseases and anxiety level were found to have a significant (p<0.05) effect on balance confidence (Table 4).

Table 1. Demographic and clinical characteristics.

Variable		Min-max	Mean (SD)/n-%
Age,y		65-87	71.3 (5.8)
Sex	Male		39 - 24.4%
	Female		121 - 75.6%
Height, m		140-185	158.3 (8.9)
Weight, kg		40-112	77.6 (14.0)
BMI, kg/m^2		0-50	30.9 (6.1)
Marital status	Single		53 - 33.1%
	Married		107 - 66.9%
Walking distance, m		5-5000	628 (737)
Lower extremity pain			127 - 79.4%
Insomnia			87 - 54.4%
Falls			58 - 36.3%
Hypertension			123 - 76.9%
Ischemic heart disease			41 - 25.6%
COPD			18 - 11.3%
Depression			25 - 15.6%
Diabetes			54 - 33.8%
Anemia			16 - 10.0%
Hip and/or knee OA			70 - 43.8%
Number of drugs used		0-15	4.4 (2.8)
Number of additional diseases		0-7	3.0 (1.5)
ABC scale		11-100	76.0 (23.9)
CIRS		0-9	4.3 (1.8)
MMSE		8-30	20.9 (5.0)
HADS- Anxiety		0-18	6.2 (4.7)
HADS-Depression		0-20	6.3 (4.3)

sd, standard deviation; BMI, body mass index; COPD, chronic obstructive pulmonary disease; OA, osteoarthritis; ABC, Activities-specific Balance Confidence; CIRS, Cumulative Ilness Rating Scale; MMSE, Mini Mental State Examination; HADS, Hospital Anxiety and Depression Scale.

Table 2. Clinical characteristics according to the balance confidence.

Variable		Lower Balance Confidence Group (ABC score ≤ 67)	Higher Balance Confidence Group (ABC score >67)	p
		Mean (sd)/n-%	Mean (SD)/n-%	
Age		73.4 (6.9)	70.1 (4.7)	***0.003*** [m]
Sex	Male	8 - 13.6%	31 - 30.7%	***0.015*** [X²]
	Female	51 - 86.4%	70 - 69.3%	
Height, m		160.3 (9.3)	155.0 (9.3)	***0.000*** [m]
Weight, kg		78.2 (13.0)	76.5 (15.6)	0.451 [m]
BMI, kg/m^2		30.5 (5.0)	31.5 (7.7)	0.150 [m]
Marital status	Single	31- 52.5%	22 - 21.8%	***0.000*** [X²]
	Married	28 - 47.5%	79 - 78.2%	
Walking distance, m		307 (373)	815 (829)	***0.000*** [m]
Lower extremity pain		52 - 88.1%	75 - 74.3%	***0.036*** [X²]
Insomnia		42 - 71.2%	45 - 44.6%	***0.001*** [X²]
Falls		28 - 47.5%	30 - 29.7%	***0.024*** [X²]
Hypertension		51 - 86.4%	72 - 71.3%	***0.028*** [X²]
Ischemic heart disease		21 - 35.6%	20 - 19.8%	***0.024*** [X²]
COPD		8 - 13.6%	10 - 9.9%	0.480 [X²]
Depression		11 - 18.6%	14 - 13.9%	0.421 [X²]
Diabetes		19 - 32.2%	35 - 34.7%	0.752 [X²]
Anemia		10 - 16.9%	6 - 5.9%	***0.025*** [X²]
Hip and/or knee OA		24 - 40.7%	46 - 45.5%	0.549 [X²]
Number of drugs used		5.5 (3.2)	3.8 (2.3)	***0.000*** [m]
Number of additional diseases		3.4 (1.6)	2.7 (1.4)	***0.009*** [m]

[m]Mann-Whitney U test / [X²] Chi-square test.
ABC, Activities-specific Balance Confidence; BMI, body mass index; COPD, Chronic obstructive pulmonary disease; OA, osteoarthritis.

Table 3. Comorbidity, cognitive and emotional status according to the balance confidence.

Variable		Lower Balance Confidence Group (ABC score ≤ 67)	Higher Balance Confidence Group (ABC >67)	p
		Mean (sd)/n-%	Mean (SD)/n-%	
CIRS		4.8 (1.8)	3.9 (1.7)	***0.002*** [m]
MMSE		19.1 (4.9)	21.9 (4.8)	***0.000*** [m]
HADS- Anxiety		7.9 (5.1)	5.1 (4.2)	***0.000*** [m]
	≤7	30 - 50.8%	74 - 73.3%	
	8-10	9 - 15.3%	15 - 14.9%	***0.003*** [X²]
	≥11	20 - 33.9%	12 - 11.9%	
HADS- Depression		8.4 (4.5)	5.1 (3.6)	***0.000*** [m]
	≤7	19 - 32.2%	74 - 73.3%	
	8-10	21 - 35.6%	16 - 15.8%	***0.000*** [X²]
	≥11	19 - 32.2%	11 - 10.9%	

[m]Mann-Whitney U test / [X²] Chi-square test.

ABC, Activities-specific Balance Confidence; CIRS, Cumulative Ilness Rating Scale; MMSE, Mini Mental State Examination; HADS, Hospital Anxiety and Depression Scale

DISCUSSION

Functional balance predictors identified in this cohort were age, height, marital status, number of daily prescription drugs used, number of comorbidities and HADS anxiety scores. Many factors affect balance in older adults. The ability to identify such factors is an important step toward fall risk prevention and reduction.

In accordance with our results, ageing may lead to both balance disorder and a slowing of mobility (18-20). Balance disorder incidence increases as the population ages, as does the frequency of comorbidities. In addition, the amount of daily prescription drug usage increases in parallel with increasing age. Due to the side effects of certain medicines, dizziness or a balance disorder can be observed. Previous studies have also stated that ageing and the amount of daily drug intake are important factors for balance disorder in older adults (18-21). Polypharmacy and the combination of certain medicines such as opioids should be considered as a risk factor for balance and falls in older adults (22).

In a previous study, the predictors of balance measured by the Berg Balance test were reported as age, medicine and daily activities measured by the Barthel index in older adults (18). Moreover, fall risk was higher in older adults utilising ≥3 prescription medicines daily. Another study reported that factors related with balance measured by the Berg Balance Scale were age and level of independence in the performance of daily activities measured by the Barthel index in 70 years or older adults with a mean age of 70.5±5.0 years (20). The side effects of some drugs, internal ear infection, heart diseases and ear crystal disorders are other factors that may lead to balance problems (2).

In this study, one of the predictors of functional balance was the presence of an anxiety disorder. Psychological factors such as depression, anxiety and stress can accelerate sensorimotor and cognitive disorders in older adults (23). Anxiety and depression are often observed in older adults. The association between dizziness, balance disorders and anxiety disorders was noted. In a previous study, depression and anxiety rates were reported as 11% and 18%, respectively, in patients with dizziness complaints (24). In our study, the depression ratio was 15.6%. In the group with higher fall risk, depression and anxiety scores were also high. Although the anxiety score was deterministic on balance, there was no such correlation with depression scores. The possible reason for this might be the positive response to antidepression drug treatment.

Balance disorders were diagnosed in nearly half of the group of elder patients with type II diabetes. Cordiero et al. studied a cohort of 91 older adults with type II diabetes and a mean age of 74.4±5.9 years. Factors associated with functional balance were daily activities, step strategy, proprioception, orthostatic hypotension and sensory disorders. In addition, the factors related with mobility were age, daily activities, step strategy and proprioception (19). The ratio of balance disorder measured by TUG has been reported as 44.4% in elder patients with chronic obstructive pulmonary disease (COPD). In the same study, it was concluded that the predictors of functional balance disorder are body mass index, number of prescription medicines used daily, decreased recreational activities and depression status (21). Diabetes and COPD were not determined as a predictor of balance disorder in the present study. This may be due to the difference in disease severity and/or the lack of sensorimotor examination in our study.

In this study, the balance confidence was good in 55.6% of the older adults studied. Balance confidence was moderate or poor in the remaining, and such results are consistent with the previous studies' results. In the group with higher falling risk and lower balance confidence, age, height, female ratio, being single ratio, lower extremity pain, sleeplessness, hypertension, ischaemic heart disease and anaemia ratios, amount of daily drug intake and number of comorbidities were higher. In a study published by Patel et al. with 7601 patients ≥65 years of age with medicare beneficiaries, the recurrent fall ratio for the past year was higher in patients with chronic pain (25). In addition, the number of painful regions was propounded to be related with both balance and falling prevalence. Paker et al. reported that the mean ABC score was 53.5% in patients with knee osteoarthritis with a mean age of 64.7 years (11). This situation indicates that the mean balance confidence is moderate in patients with symptomatic knee osteoarthritis.

This study has some strong and weak points. The strong ones are the adequacy of the number of participants and the power of the study. However, due to the cross-sectional design of the study, the causality related to the factors that affect balance in elders could not be explained, and factors that might affect balance, such as vestibular and visual functional disorders, osteoarthritis severity and polyneuropathy existence could not been evaluated.

In conclusion, factors associated with balance confidence in older adults were age, height, marital status, number of daily prescription drugs used, number of comorbidities and HADS anxiety scores. These factors may be utilised in clinical practice to identify patients with functional balance disorders. Furthermore, this type of analysis can be implemented in an effort to prevent falls in older adults.

Table 4. Predictors of balance confidence.

Variable	Univariate Model			Multivariate Model		
	OR	%95 CI	p	OR	%95 CI	p
Age	0.905	0.852 - 0.961	***0.001***	0.918	0.852 - 0.989	***0.025***
Sex	0.354	0.150 - 0.834	***0.018***			
Height, m	0.923	0.965 - 0.884	***0.000***	0.938	0.987 - 0.892	***0.013***
Weight, kg	0.991	1.015 - 0.969	0.462			
BMI, kg/m^2	1.027	1.083 - 0.973	0.337			
Marital status	3.976	1.982 - 7.974	***0.000***	2.647	1.123 - 6.239	***0.026***
Walking distance, m	1.002	1.001 - 1.003	***0.000***			
Lower extremity pain	0.388	0.157 - 0.961	***0.041***			
Insomnia	0.325	0.164 - 0.646	***0.001***			
Falls	0.468	0.240 - 0.910	***0.025***			
Number of drugs used	0.798	0.701 - 0.908	***0.001***	0.807	0.693 - 0.939	***0.006***
Number of additional diseases	0.749	0.600 - 0.935	***0.009***	0.852	0.674 - 0.942	***0.012***
Hypertension	0.389	0.165 - 0.921	***0.032***			
Ischemic heart disease	0.447	0.217 - 0.921	***0.029***			
COPD	0.701	0.260 - 1.887	0.481			
Depression	0.702	0.296 - 1.667	0.423			
Diabetes	1.116	0.564 - 2.210	0.752			
Anemia	0.309	0.106 - 0.902	***0.032***			
Hip and/or knee OA	1.220	0.636 - 2.338	0.550			
CIRS	0.751	0.619 - 0.911	***0.004***			
MMSE	1.124	1.049 - 1.204	***0.001***			
HADS-Anxiety	0.880	0.819 - 0.945	***0.000***	0.867	0.796 - 0.944	***0.001***
HADS-Depression	0.821	0.753 - 0.896	***0.000***			

BMI, body mass index; COPD, chronic obstructive pulmonary disease; OA, osteoarthritis; CIRS, Cumulative Ilness Rating Scale; MMSE, Mini Mental State Examination; HADS, Hospital Anxiety and Depression Scale.

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