

# Physical, Functional and Sociocultural Parameters That Predict Fall in Elderly: Multicenter Study

## Yaşlılarda Düşmeye Yol Açan Fiziksel, Fonksiyonel ve Sosyokültürel Parametreler: Çok Merkezli Çalışma

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### ABSTRACT

**Objective:** To investigate the association between fall and demographic, clinical and psychosocial characteristics in elderly people.

**Methods:** The study was conducted in 11 different physical medicine and rehabilitation clinics in Turkey. Two hundred seventy five patients who were 65 or older were included into this study. The history of fall in the last year were obtained. The demographical and clinical properties, cognitive function, quality of life, disability and level of depression were noted.

**Results:** Sixty five patients had fall experience in the last year. Falls are common in patients with weakness, fatigue, dizziness, swelling in legs and subjects with appetite loss. The fallers had lower functional status than non fallers (p=0.028). Fallers had more depressive symptoms than the nonfallers (p=0.019). Quality of life (NHP) especially physical activity, energy level and emotional reactions subgroups were different (p=0.016,0.015, 0.005 in order). Disability and mental status were similar in groups (p=0.006).

**Conclusion:** Falls are common in elderly patients and a variety of factors affect the situation. Musculoskeletal problems, functional status and social status might be some of the contributors. Although there are some investigations the results are contradictory about this subject. Further investigations for the determination of risk factors for fall in elderly people is required.

**Keywords:** Falls, elderly, risk factors, quality of life

### ÖZET

**Amaç:** Bu çalışmada yaşlılarda düşmeye yol açabilecek demografik, klinik ve psikososyal etkileri araştırdık.

**Yöntemler:** Bu çalışma 11 fiziksel tıp ve rehabilitasyon kliniğindeki yatan hastalar üzerinde yapılmış gözlemsel araştırmadır. Çalışmaya 65 yaş ve üzeri 275 hasta alındı. Olgulara son bir yıl içerisinde düşüp-düşmediği soruldu. Kişilerin demografik ve klinik özellikleri, bilişsel fonksiyon durumu, yaşam kalitesi ve depresyon varlığı belirlendi.

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**Bulgular:** Altmış beş hasta son bir yıl içerisinde düşmüştü. Güçsüzlük, bitkinlik baş dönmesi olanlarda bacaklarda şişlik ve baş dönmesi olanlarda düşme daha sık bulundu. Düşme deneyimi olanların fonksiyonel durumu olmayanlara göre daha düşük ( $p=0.028$ ), depresif semptomları daha fazla ( $p=0.019$ ) ve NHP ile ölçülen yaşam kalitesinin fiziksel aktivite, enerji düzeyi ve emosyonel reaksiyon subgrupları daha kötüydü ( $p=0.016,0.015,0.005$ ). Yetiyitimi ve mental durum gruplarında benzerdi ( $p=0.006$ ).

**Sonuçlar:** Yaşlılarda düşmeye sık rastlanır ve bir dizi etmenler bu duruma yol açabilir. Kas-iskelet sistemi sorunları, fonksiyonel durum ve sosyal durum bunlardan birkaçıdır. Bu konuda çalışmalar olsa da sonuçları çelişkilidir. Bu nedenle yaşlılarda düşmeye yol açan risk etmenlerinin belirlenmesi amacıyla ileri araştırmalara gereksinim olduğu kanısındayız.

**Anahtar sözcükler:** Düşme, yaşlı, risk etmenleri, yaşam kalitesi

## Introduction

Falls are a major health problem and often cause serious injuries (especially fracture of proximal femur) which leads longstanding pain, functional impairment, disability and mortality (1-3). Incidence of fall is increasing strongly with age and 30 % of elderly have at least one fall worldwide (4-5). A successful aging requires proper function, psychological well-being and social integration.

Determining the factors to fall risk seems essential especially for physicians for appropriate treatment and rehabilitation. Previously numerous factors were reported as associated with fall risk among the elderly. Increased age, muscle weakness, balance and gait problems, poor vision, cognitive and functional impairment and other comorbidities such as dementia, depression are risk factors for falling in elderly (6-7). However, all of the risk factors for falls have not been identified sufficiently in order to prepare efficient prevention programmes (8).

Among older people mobility impairment is widely reported and may lead limitation in physical activity and decrease quality of life (QOL) (9-10). This can also lead to depression, feelings of helplessness and social isolation (1). This vicious circle may be hazardous for the elderly. Supervised and individually tailored exercise programme and proper assistive device use may improve balance and proprioception of the elderly (11).

Some sociocultural variables also contribute this problem (7,12). Inadequate food intake is common in elderly because of alterations in smell, taste, mental status, medications etc. Poor nutrition may lead sarcopenia and weakness of the muscles and predispose to fall risk (13).

The purpose of this multicentric cross-sectional study was to determine the relationship between falls and demographic characteristics, clinical variables, psychosocial properties as well as QOL of the elderly patients.

## Methods

This cross-sectional observational study was conducted over a 15-month period among elderly individuals 65 years and over, who were hospitalized in

clinics of physical medicine and rehabilitation units in 11 health centers. The study was conducted in accordance with ethical standards of Helsinki Declaration, approved by the Ethics Committee of Clinical Research. Informed consent was obtained from each participant.

A total of 275 patients participated into this study. An investigator applied a questionnaire in order to obtain information on demographic variables including age, gender, living style and educational level.

A comprehensive geriatric assessment were performed by the responsible physician of each center. Functional level of the patients, the presence of osteoporosis, deformities in upper, lower extremities and in the body, concomitant diseases, walking difficulty and use of assistive devices were noted.

The history of incident fall in the previous year was obtained from all participants. A fall was defined as unintentionally coming to the ground or some lower level, excluding the consequence of sustaining a violent blow, loss of consciousness or sudden onset of paralysis, such as during a stroke or epileptic seizure (14). Specific risk factors for falling comprising disability, depression status, cognitive functions, musculoskeletal pain and QOL of the patients were also recorded.

Functional level was graded from 1 (only daily activities) to 6 (heavy sports at least once a week). Cognitive functions of the patients were assessed by minimal state examination (MMSE) (15). The Turkish validation was done by Keskinoglu et al. (16) The total score of MMSE is 30 and scores <24 indicate cognitive impairment. The level of depression was assessed using the short form of Geriatric Depression Scale (GDS15) also known as Yesavage depression scale which includes 15 items questionnaire (17). Score  $\geq 5$  suggest depressive symptoms and scores >10 suggest definite depression in this questionnaire. Turkish validation was performed by Ertan et al. (18). The disability of the subjects was assessed by using 19-items self reported physical function questionnaire also known as self reported disability (SRD). SRD contains 5 major subgroups including activity of daily living, general physical activities, leisure and social activities and lower limb mobility (19).

Turkish version of Nottingham Health Profile (NHP) was used to assess the QOL. NHP measures functional ability, pain, sleep, energy, emotional problems, and participation (work and social activities). Each subheading is scored ranging from 0 to 100, higher scores indicating the deterioration of QOL (20).

The demographical and clinical properties, and specific risk factors were compared in patients with history of falling and non-fallers.

Univariable logistic regression analysis was implemented for numeric variables (age, height, BMI and functional status etc). Pearson's Chi-square or Fisher's exact tests were used for association between fall and categorical variables. Determining the most important predictors which discriminate fallers from non-fallers was evaluated by Multiple Logistic Regression analysis. Any variable whose univariable test had a p value <0.25 was accepted as a candidate for the multivariable model along with all variables of known clinical importance. Odds ratio, 95% confidence intervals for each independent variable were also calculated. p<0.05 was accepted as statistically significant.

## Results

A total of 275 patients (207 female and 68 male) were included to the study. Three patients were excluded from the study because of distortion analysis. Table 1 indicates the demographic characteristics of the participants. Of these 272 patients, 65 had fall experience in the last year. The level of income is significantly associated with history of fall but education level, marital status, gender, living style, social security are not statistically different between groups (p<0.05) (Table 1). When fall history was compared between two age groups (65-75 and ≥75) no significant difference was determined (p>0.05).

Walking difficulty may contribute fall risk. When we classify the groups 1= walking without difficulty; 2= difficulties in spite of assistive device use and 3= difficulty with walking but no device use, the fall percentage in groups are 27.7%, 26.1% and 32.3% in order. There are no significant difference between groups. (p= 0.103, 0.071 and 0.978 in order) .

The clinical findings, concomitant diseases and conditions according to falls are shown in Table 2. As indicated the patients who had deformity in upper extremity and lower extremity and spine had a greater fall experience in last year. Also falls were common in patients with weakness, fatigue, dizziness, swelling in legs and subjects with decreased appetite.

When we compare the functional levels; the fallers had lower functional status and the difference is significant (p=0.028).

The mean scores of SRDI, GDS15, NHP, pain and MMSE were given in Table 3. Fallers had more depressive symptoms than the nonfallers (p=0.019). There is no significant difference between the two groups about SRDI and MMSE (p=0.729, and 0.589). But there were significant difference between fallers and non fallers with respect to QOL scored by NHP especially physical activity, energy level and emotional reactions subgroups (p=0.016, 0.015, 0.005 in order).

## Discussion

Researches have identified many risk factors that contribute falling of elderly. Fall preventive strategies can be developed once the risk factors for falling are established (1-3). In the present study, we evaluated various intrinsic risk factors for fall in elderly patients who were hospitalized in rehabilitation clinics.

Although age is independent risk factor for falling especially after age 90 we didn't find any association between fall risk age group and education level. This may be due to our population was between age group 65-75 mostly (21,22).

**Table 1. The sociodemographic characteristics of the patients.**

Sociodemographic characteristics	Nonfallers (n=207)	Faller (n=65)	p-value †
<b>Gender</b>			0.065
Female	152 (73.4%)	55 (84.6%)	
Male	55 (26.6%)	10 (15.4%)	
<b>Marital status</b>			0.450
Married	130 (64.0%)	44 (69.8%)	
Single	1 (0.5%)	1 (1.6%)	
Widowed/divorced	72 (35.5%)	18 (28.6%)	
<b>Level of income</b>			0.022
Bottom wage	40 (21.3%)	22 (36.7%)	
Middle	106 (56.4%)	33 (55.0%)	
High	34 (18.1%)	3 (5.0%)	
Very high	8 (4.3%)	2 (3.3%)	
<b>Living style</b>			0.527
Alone	43 (21.6%)	17 (26.2%)	
With a spouse	64 (32.2%)	24 (36.9%)	
With their children	91 (45.7%)	24 (36.9%)	
Nursing home	1 (0.5%)	-	

†: Chi-square test.

**Table 2. Distribution of diseases and symptoms according to fall history.**

Variables	Nonfallers (n=207)	Fallers (n=65)	p value
Sleep disturbance	97 (46.9%)	37 (56.9%)	0.157 <sup>†</sup>
Deformity upper extremity	27 (13.0%)	17 (26.2%)	<b>0.012<sup>†</sup></b>
Deformity lower extremity	45 (21.7%)	25 (38.5%)	<b>0.007<sup>†</sup></b>
Spine deformity	45 (21.7%)	24 (36.9%)	<b>0.014<sup>†</sup></b>
<b>Concomitant diseases</b>			
Hypertension	144 (69.6%)	44 (67.7%)	0.776 <sup>†</sup>
Neurologic diseases	21 (10.1%)	8 (12.3%)	0.622 <sup>†</sup>
Stroke	17 (8.2%)	8 (12.3%)	0.319 <sup>†</sup>
Eye problems	54 (26.1%)	17 (26.2%)	0.991 <sup>†</sup>
Vascular diseases	10 (4.8%)	2 (3.1%)	0.737 <sup>†</sup>
Diffuse body pain	103 (49.8%)	37 (56.9%)	0.313 <sup>†</sup>
Weakness	128 (61.8%)	52 (80.0%)	<b>0.007<sup>†</sup></b>
Fatigue	135 (65.2%)	51 (78.5%)	<b>0.045<sup>†</sup></b>
Loss of appetite	42 (20.3%)	25 (38.5%)	<b>0.003<sup>†</sup></b>
Joint pain	156 (75.4%)	55 (84.6%)	0.119 <sup>†</sup>
Headache	61 (29.5%)	23 (35.4%)	0.368 <sup>†</sup>
Dizziness	61 (29.5%)	28 (43.1%)	<b>0.041<sup>†</sup></b>
Balance impairment	76 (36.7%)	32 (49.2%)	0.072 <sup>†</sup>
Memory loss	109 (52.7%)	37 (56.9%)	0.547 <sup>†</sup>
Decreased vision	108 (52.2%)	41 (63.1%)	0.123 <sup>†</sup>
Hearing loss	81 (39.1%)	34 (52.3%)	0.061 <sup>†</sup>
Swelling in legs	36 (17.4%)	23 (35.4%)	<b>0.002<sup>†</sup></b>

There are studies that claim assistive devices (mobility aids) may reduce fall risk (23). Dean et al, (24) reported some benefits of assistive device for functional improvement. However, we determined no significant difference between two groups when fall risk is considered. This might be due to improper use or prescribing of these devices (25). At the same time people who use these devices tend to be single, poorer and more frail.

As the years passed by, sarcopenia and advanced phase muscle weakness may occur and this interfere activities of daily living. Muscle strength is associated with lower extremity performance. Neurodegenerative diseases, inadequate nutrition disuse, age related changes contribute sarcopenia and muscle weakness in elderly (26,27). We also determined significant association between fall experience and weakness and fatigue. Recently, Jeejeebhoy (28) reported that fatigue sarcopenia and cachexia may often overlap and share similar pathophysiologic mechanisms.

As the years passed posture and some skeletal deformities occur due to concomitant diseases such as osteoporosis or osteoarthritis. These deformities affect posture and interfere with the balance of the individual (29). We also determined positive relation between deformities (upper, lower extremities and spine) and fall history.

In old ages people have lower functional activity because of fear, lack of motivation and concomitant diseases and muscle weakness and fatigue etc. (30,31). Exercises may improve muscle strength, speed and

**Table 3. Clinical Indices and fall risk.**

Variables	Nonfallers (n=207)			Faller (n=65)			p=	OR (95 CI)
	Mean	st dev	Range	Mean	st dev	Min-max		
SRDI	8.78	2.88	0-12	8.65	2.43	1-12	0.729	0.983 (0.890-1.085)
GDS15	6.28	3.51	0-15	7.48	3.51	1-15	<b>0.019</b>	1.099 (1.016-1.190)
MMSE	25.07	4.75	10-30	25.48	5.82	3-30	0.589	1.017 (0.957-1.080)
<b>NHP (subgroups)</b>								
Pain	59.87	28.97	0-100	65.50	28.01	0-100	0.173	1.007 (0.997-1.017)
Physical activity	58.79	23.57	0-100	66.98	22.20	0-100	<b>0.016</b>	1.016 (1.003-1.029)
Energy level	62.19	40.79	0-100	76.56	33.30	0-100	<b>0.015</b>	1.010 (1.002-1.018)
Sleep	41.78	35.46	0-100	49.69	36.16	0-100	0.122	1.006 (0.998-1.014)
Social isolation	25.80	31.33	0-100	31.07	33.67	0-100	0.253	1.005 (0.996-1.014)
Emotional reactions	36.04	34.45	0-100	50.20	33.96	0-100	<b>0.005</b>	1.012 (1.003-1.020)
Total	46.94	22.35	0-100	55.88	21.32	2.38-100	<b>0.006</b>	1.018 (1.005-1.032)

**SRDI:** Self reported disability index, **Yesavage:** Yesavage depression scale, **MMSE:** Mini mental state examination, **NHP:** Nottingham health profile.

balance in elderly. We determined a positive association between exercises status of the participants and fall history.

Advanced age and concomitant problems leads distortion in QOL (5-7). NHP is an efficient scoring system for QOL and clinical applicity is easy. So we applied the NHP. The total NHP and physical activity, fatigue, emotional status subgroups significantly associated with fall risk. The results support the report of patients about musculoskeletal findings and exercises habit.

Cognitive system have a critical role for proper interaction with the environment. Especially gait and balance are affected by cognitive system but also medications and neurovascular instability contribute the fall tendency (32,33). We didn't find any significant association between cognitive status scored by MMSE and fall experience. The fallers and nonfallers have mostly mild cognitive impairment. As in the literature the subgroups of the cognitive impairment should be investigated for proper to come in a conclusion (34,35). Also cognitively impaired individuals may have better nursery services or family support in our region.

Depression is associated with falls in elderly. We also determined a significant association between fall and depression which was evaluated by GDS15. Although the etiology is not clear it is associated with chronic pain, lower socioeconomic status, disability and co-morbidity (36,37). Emotional status scored by NHP may give a hind about the depressive symptoms that was found correlated with fall risk. The evaluation of depression seems essentials for falls and other geriatric syndromes.

Nutritional status correlate psychological stress, muscle weakness, cognitive status and functional level (38). Vitamin D improve muscle strength at the same time stabilize postural equilibrium via decreasing reaction time. Another interesting finding of our search is no correlation with fall and nutritional status of the patients. This can be explained wide-spread nutrition deficiency in our country.

Disability and fall risk widely studied and found correlated. But the disability evaluated by SRDI should be done preclinical or before fall experience. We performed the questionnaire when the patients were hospitalized. So no difference was found between groups. This is limitation of our study.

This study is a multicentric and comprehensive risk determination study for fall in elderly. The establishment of risk factors may be the first step for prevention of falling and their hazaourds results in Turkey and other countries.

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