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Evaluating Fall Risk Factors in Community-Dwelling Older Adults Aged 65 and Over

Vedat Altuntas[1], Aynur Karagoz[1], Selkin Yilmaz Muluk[2*]

[1] Department of Physical Medicine and Rehabilitation, Ministry of Health Ankara Training and Research Hospital, Ankara, Türkiye

[2] Department of Physical Medicine and Rehabilitation, Dokuz Eylul University Hospital, Izmir, Türkiye

*Corresponding author:

selkin.yilmazmuluk@saglik.gov.tr

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Abstract

Background and Aims: Falls are a major public health concern among older adults, leading to morbidity and mortality. This study aimed to identify the risk factors for falls by investigating demographic, clinical, and functional characteristics in a cohort of community-dwelling elderly individuals.

Materials and Methods: This retrospective study of 191 older adults (≥65 years) was conducted in an outpatient physiatry clinic. The participants were divided into two groups: those with a history of falls (n=83) and those without (n=108). Demographic characteristics, handgrip strength, mobility (Timed Up and Go test (TUG), Tinetti Balance and Gait Assessment), depressive symptoms (Geriatric Depression Scale (GDS)), activities of daily living (Barthel Index (BI) and Instrumental Activities of Daily Living (IADL)), and cognitive function (Mini Mental State Examination (MMSE)) were collected. Logistic regression identified fall predictors, and analyses explored the relationships between risk factors, including cut-off points.

Results: Fallers were significantly older (mean age 77.75 vs. 70.46 years) and more likely to be female (63.9% vs. 36.1%) ($p<0.05$). Illiteracy ($p<0.05$) and widowhood ($p=0.04$) were also associated with falls. Fallers had lower grip strength, longer TUG times, lower Tinetti, BI, IADL, MMSE scores, and higher GDS scores, indicating impaired strength, gait, balance, functional independence, and increased cognitive impairment and depressive symptoms ($p<0.05$). Aging was associated with poor mobility, balance, mood, function, and cognition. Stronger grip was associated with better balance and cognition. Cut-off values for increased fall risk were: age >73 years, TUG time >19 seconds, Tinetti <21, GDS >21, IADL <6, BI <90, MMSE <21.

Conclusion: Falls in the elderly are linked to age, sex, mobility impairments, depression, and functional and cognitive decline. Comprehensive geriatric assessments can help prevent falls and improve the quality of life.

Keywords: Fall risk; elderly; mobility; balance; strength

INTRODUCTION

Aging is a process characterized by a decrease in physiological function or an increase in mortality risk linked to advancing age [1]. It involves structural deterioration, functional impairment, phenotypic alterations, and an increased likelihood of mortality [2]. Common physical symptoms such as 'pain in arms, legs, or joints', 'feeling tired or having low energy', and 'back pain' reflect how aging significantly contributes to physical health deterioration [3].

By 2050, the global elderly population will surpass that of children under five and adolescents [4]. Rising median age is driven by declining fertility rates, a 20-year increase in life expectancy in the late 20th century, and the post-World War II "Baby Boom." By 2050, life expectancy is expected to rise by another decade, further straining health systems [5]. The 65+ population will rise from 761 million in 2021 to 1.6 billion by 2050, growing from 1 in 10 to 1 in 6 globally, while the 80+ population will triple to 426 million [6,7].

As the elderly population grows, age-related health challenges become more prominent, with falls being a major concern. Beyond affecting individuals, falls also present challenges for healthcare providers, with physicians playing a key role in improving older adults' quality of life [8]. Falls, affecting **one-third of adults over 65 annually,** are a major cause of morbidity and mortality [9-11]. They stem from age-related declines in vision, hearing, memory, muscle strength, balance, and mental health, posing a significant challenge to global healthcare systems [9]. Falls are a leading cause of injury and long-term disability among older adults, especially in institutional settings. They contribute significantly to mortality worldwide, with fatal falls occurring frequently [12]. Each year, millions of older adults require emergency care for fall-related injuries, leading to a substantial economic burden and high healthcare costs [12,13].

In fact, falls are not simply an inevitable consequence of aging. In those 85+, individuals in excellent health show no higher fall risk than younger ones. Therefore, identifying key risk factors such as poor health, insufficient sleep, cane use, alcoholism, and cerebrovascular disease is crucial for prevention [14]. Falls result from inherent (e.g., living alone, cane use, inactivity, poor nutrition, visual impairment, polypharmacy, and conditions like arthritis and cognitive decline) and environmental hazards (e.g., poor lighting, uneven flooring, slippery surfaces). Addressing these factors is key to prevention [15].

Given the physical and economic burden of falls, identifying high-risk individuals is essential for targeted prevention strategies. The aim of this study was to assess the frequency of falls and identify their risk factors among community-dwelling individuals aged 65 and older. The objective was to determine fall prevalence, examine its association with demographic, clinical, and functional risk factors, and identify high-risk individuals to support the development of targeted prevention strategies.

MATERIALS AND METHODS

This study included 191 individuals aged ≥ 65 years who were admitted to the Physical Therapy outpatient clinic of a regional hospital. This retrospective cohort study analyzed the participants based on their fall history and categorized them into groups with and without a history of falls prior to the study. The tests performed on the individuals were explained in detail and consent was obtained. This study was conducted in accordance with the principles set forth in the Declaration of Helsinki. This case-control study adhered to STROBE checklist for cohort studies in presentation. The flowchart is presented in Figure 1.

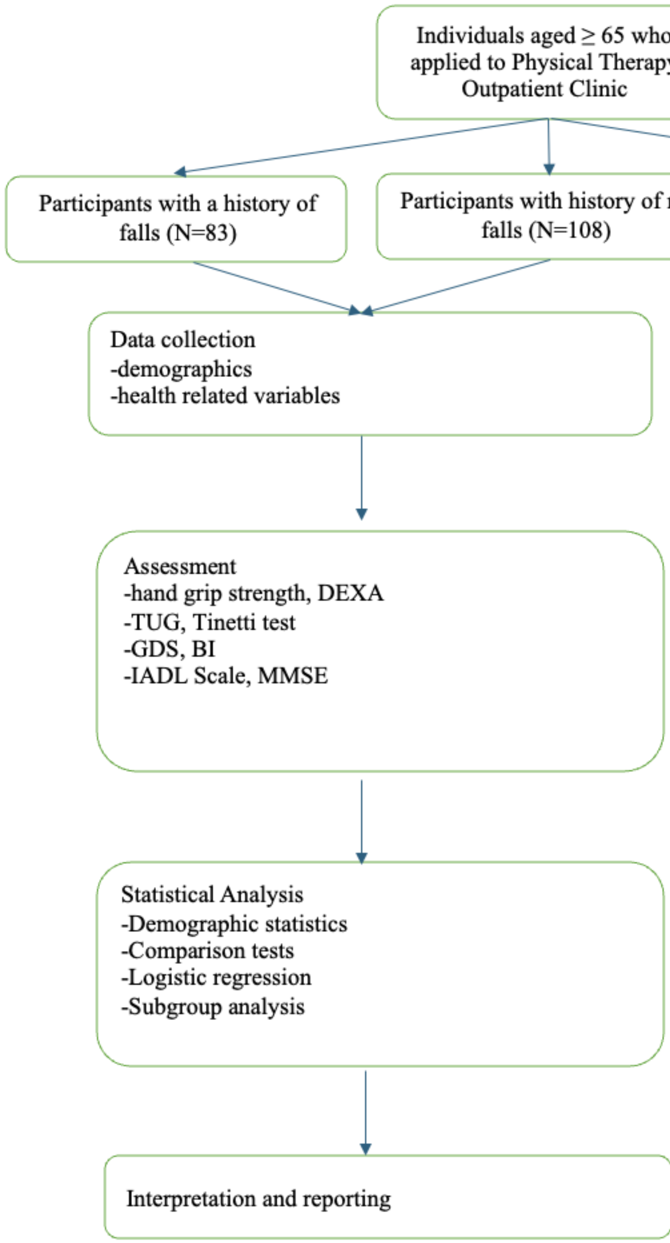

Figure 1: Flowchart of participants.

Individuals were excluded from the study if they met the following criteria: not living independently in society, using any psychotropic medications, having communication problems, diagnosed with progressive neurological diseases, unable to walk independently, having contractures or deformities that impeded walking, or having severe respiratory, central or peripheral vascular diseases. Those with severe metabolic diseases or significant visual or hearing impairment were also excluded.

Outcomes

Participants' history of falls was assessed through self-reported information regarding any falls experienced in the past year. These data were recorded on standardized forms, allowing for the differentiation between participants classified as fallers and non-fallers. The forms also recorded various demographic and health-related variables that could potentially confound the relationship between fall history and other assessed variables. These included age, sex, education level, marital status, occupation, chronic medical condition, use of walking aids, and medications. Demographic and health-related variables were recorded to identify potential confounders that influenced the outcomes. The bone mineral densities of the lumbar and hip regions were measured using a DEXA machine, with a T-score of -2.5 or lower indicating osteoporosis.

Muscle strength was evaluated by measuring handgrip strength using a Jamar dynamometer. Each hand was assessed three times, and the average of these measurements was recorded to provide a measure of overall grip strength.

The Timed Up and Go (TUG) test was administered to assess participants' mobility concerning speed, agility, and dynamic balance [16]. This test has high test-retest reliability in individuals aged 61-89, indicating that the TUG test is reliable for assessing mobility in elderly populations [17]. The Tinetti Balance and Gait Assessment Test was performed to evaluate balance and walking capabilities [18]. The validity and reliability of the Tinetti Balance and Gait Test for evaluating balance in the elderly have been established, with consistent and repeatable measurements demonstrating its utility in distinguishing between normal and impaired performance [19]. This is also valid for the Turkish population [20].

Depression levels were assessed using the Geriatric Depression Scale (GDS) designed by Yesavage et al. and validated for the Turkish elderly population [21,22].

For Activities of Daily Living (ADLs) Barthel Index (BI) measures a person’s ability to complete basic tasks like eating, transferring between bed and chair, personal care and hygiene, walking, dressing, and bowel and bladder control, with a total possible score of 100 points [23]. It has been found to be valid in geriatric population, and also in Turkish population [24,25]. The Lawton Instrumental Activities of Daily Living (IADL) Scale designed by Lawton and Brody evaluates individuals’ abilities to perform more complex tasks, such as using the telephone, shopping, preparing meals, managing medications, and handling financial transactions, with a total score of eight points [26]. It has validity and reliability for Turkish populations also [27].

Cognitive abilities were evaluated using the Mini-Mental State Examination (MMSE), a widely used tool to evaluate cognitive disturbances [28]. The Turkish version of the Mini Mental State Examination (MMSE) has been shown to have high reliability and validity for the diagnosis of mild dementia, with strong discriminant validity and inter-rater reliability in the Turkish population [29].

Several measures were implemented throughout the study to address potential sources of bias. Selection bias was minimized by ensuring that participants were recruited consecutively from the outpatient clinic, with the aim of encompassing a broad range of individuals aged 65 years and older. This approach helps capture a more representative sample of the community-dwelling elderly population. Recall bias was addressed by verifying self-reported fall histories through clinical assessments, whenever possible. Encouraging accurate reporting and using standardized forms guided the participants to recall their fall experiences, thereby enhancing the accuracy of the collected data.

Study Size

The study included 191 participants, and the sample size was calculated based on logistical constraints and the availability of eligible individuals within the study timeframe. Although a formal power calculation was not conducted beforehand, previous studies on fall prevalence in similar populations suggested that this sample size would be sufficient for robust statistical analyses to identify differences between fallers and non-fallers.

To confirm the correctness of the sample size, post-hoc power analysis was performed using G*Power (version 3.1). This analysis assessed the power of detecting differences between fallers and non-fallers using an independent samples t-test with the following parameters: effect size (Cohen's d) of 0.5 (medium effect size), significance level (α) of 0.05, two-tailed test, and sample sizes of 83 participants in the faller group and 108 in the non-faller group.

The achieved power ($1-\beta$) was 0.926 (92.6%), indicating that the study had a high probability (over 90%) of detecting statistically significant differences between groups if such differences truly existed. The critical t-value was 1.97, indicating that the observed t-values exceeding this threshold were considered statistically significant at the 5% level.

These results suggest that the sample size and design of the study were sufficient to detect medium effect sizes, thereby providing confidence in the reliability of the findings.

Statistical Analysis

Data were analyzed using the IBM SPSS for Windows (version 29.0.2.0 [20]). Descriptive statistics were employed to summarize quantitative data, such as age and various assessment scores (e.g., grip strength, TUG test results). Continuous variables were presented as means and standard deviations, categorical variables were reported as frequencies and percentages.

Differences in distribution between participants with and without a history of falls were examined using appropriate statistical tests: independent samples t-tests for normally distributed continuous variables, chi-square tests for categorical variables, and Mann-Whitney U tests for non-normally distributed data. A significance threshold of $p < 0.05$ was used for all analyses.

To account for potential confounders, logistic regression analysis was employed, incorporating relevant demographic and health-related variables (e.g., age, sex, education level, chronic medical conditions) into the model. This approach allowed for the examination of associations between risk factors and fall history, while controlling for these confounding variables. Interaction terms were included, where appropriate, to explore the combined effects.

Age was categorized to facilitate subgroup analyses, specifically distinguishing participants aged 75 years and older from those under 75 years, which is a common threshold in fall risk studies. Additionally, assessment scores (e.g., GDS, BI, IADL) were grouped based on clinically relevant cut-off values to enable the interpretation of risk and functional status.

Missing data were handled using listwise deletion for participants with incomplete assessments, ensuring minimal bias, while maintaining a sufficient sample size for statistical analysis. Given the nature of the study, loss to follow-up was not applicable. However, the dataset was thoroughly reviewed to confirm the completeness of the records for all included participants.

To test the robustness of the findings, sensitivity analyses were conducted. These included varying the cut-off values for risk factors and exploring different subgroup categorizations to assess the consistency of results across various scenarios.

RESULTS

This study included 191 participants aged 65 years and older. A total of 43.4% of the participants reported a fall history within the past year. No significant difference in age was present between males and females ($p>0.05$). Fallers were significantly older ($p<0.05$) and females had a significantly higher rate of falls ($p<0.05$) than male participants. Table 1 details the demographic characteristics of the participants.

Table 1: Demographic characteristics of the participants.

Characteristics	Counts (n)	Percentages (%)
Total participants	191	-
Participants with falls	83	43.4%
Participants without falls	108	56.6%
Average age (overall)	73.63 ± 5.53 years	-
Average age (fallers)	77.75 ± 4.55 years*	-
Average age (non-fallers)	70.46 ± 3.88 years	-
Females with falls	53	63.9%*
Males with falls	30	36.1%
Females without falls	56	51.9%
Males without falls	52	48.1%

* $p < 0.05$, for age comparison between fallers and non-fallers and for the higher fall rate among females compared to males.

Chi-square tests of independence revealed associations between fall history and several factors (Table 2, Figure 2). Fallers were more likely to be illiterate, widowed, use walking aids, and have osteoporosis compared to non-fallers. However, there were no significant differences in unemployment rates, chronic diseases (diabetes, hypertension, chronic heart disease, or chronic obstructive pulmonary disease), or regular medication use between the two groups.

Table 2: Risk factors in individuals with and without a history of falls.

Risk factor	No fall history (n=108)	Fall history (n=83)	p-value
Age (years, Mean)	70.46 ± 3.88	77.75 ± 4.55	<0.001
Sex (Female/ Male, %)	51.9/ 48.1	63.9/ 36.1	<0.001
Literacy (Illiterate/ Literate, %)	31.5/ 68.5	65.1/ 34.9	<0.001
Marital Status (Married / Widowed, %)	63.9/ 36.1	43.4/ 56.6	0.04
Occupation (Employed/ Unemployed, %)	50.9/ 49.1	33.7/ 66.3	0.34
Chronic Disease (Present/ Absent, %)	69.4/ 30.6	80.7/ 19.3	0.78
Mobility Aid Use (Yes/ No, %)	18.5/ 81.5	73.5/ 26.5	<0.001
Osteoporosis (Yes/ No, %)	35.2/ 64.8	72.3/ 27.7	<0.001
Regular Medication Use (Yes/ No, %)	60.2/ 39.8	66.3/ 33.7	0.39
Grip Strength (Right Hand, kg)	23.96 ± 7.98	17.54 ± 5.24	<0.001
Grip Strength (Left Hand, kg)	22.66 ± 8.04	16.11 ± 5.08	<0.001
TUG (seconds, Mean)	14.57 ± 3.15	24.7 ± 7.53	<0.001
Tinetti Balance (Mean)	14.25 ± 1.76	8.78 ± 2.90	<0.001
Tinetti Gait (Mean)	10.77 ± 1.40	5.76 ± 2.44	<0.001
Tinetti Total (Mean)	25.02 ± 3.03	14.54 ± 5.04	<0.001
GDS (Mean)	15.78 ± 7.56	21.54 ± 4.98	<0.001
BI (Mean)	97.22 ± 3.51	84.76 ± 8.22	<0.001
IADL (Mean)	7.42 ± 0.81	4.76 ± 1.29	<0.001
MMSE (Mean)	24.4 ± 4.46	18.13 ± 4.13	<0.001

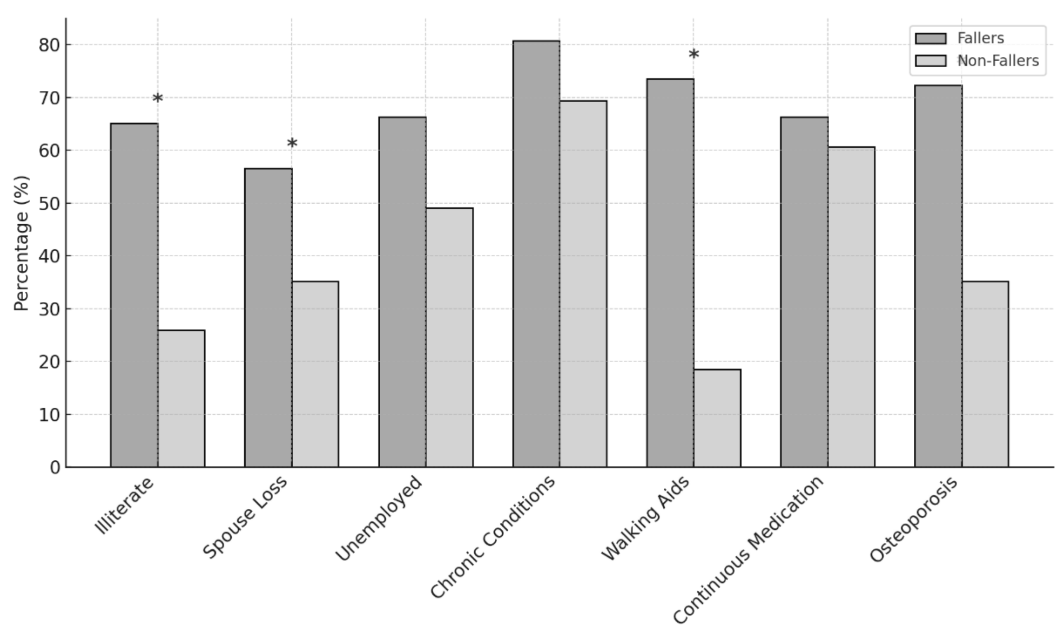

Figure 2: Comparison of fall history-related factors between fallers and non-fallers. The bars marked with* indicate statistically significant differences ($p < 0.05$).

Independent samples t-tests or Mann-Whitney U tests revealed significant associations between fall history and assessment methods. Fallers had significantly weaker grip strength, longer TUG times, lower Tinetti scores across all components (balance, gait, total), higher GDS scores, lower BI and IADL scores, and lower MMSE scores than non-fallers (p<0.05). These comparisons are presented in Table 2 and Figure 3.

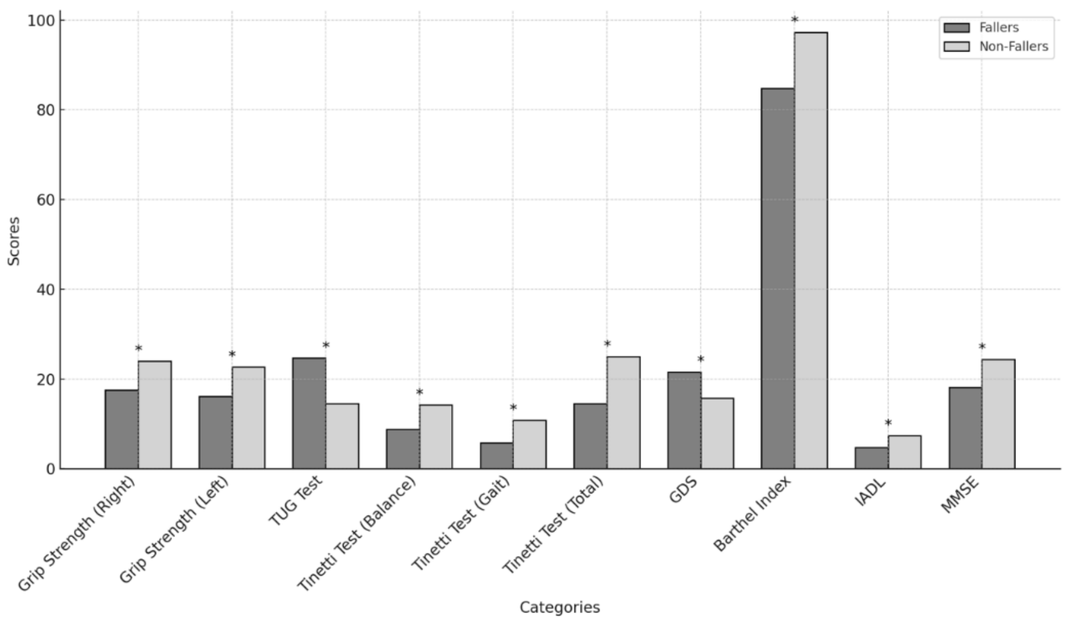

Figure 3: Comparison of assessments between fallers and non-fallers across various categories.

* All assessment categories showed statistically significant differences ($p < 0.05$) between fallers and non-fallers. Higher scores indicate better performance, except for the TUG test and GDS, where lower scores are more favorable.

The Spearman test revealed the following correlations between fall-related risk factors (Table 3). Age: positively correlated with TUG test times, negatively correlated with Total Tinetti scores, Barthel Index, IADL and MMSE scores. Grip Strength: right-hand grip strength was positively correlated with Total Tinetti and MMSE scores, left-hand grip strength was strongly positively correlated with Total Tinetti and MMSE scores. TUG Test: negatively correlated with Total Tinetti scores, positively correlated with Barthel Index, IADL and MMSE scores. GDS: positively correlated with age, negatively correlated with IADL scores. MMSE: positively correlated with Barthel Index, IADL and Total Tinetti scores.

Table 3: Correlation of fall-related risk factors.

Measure	Age (years)	Right grip (kg)	Left grip (kg)	TUG (sec)	Total Tinetti	GDS	BI	IADL	MMSE
Age (years)	1.00	0.30	0.31	**0.67**	**-0.52**	**0.51**	**-0.55**	**-0.60**	**-0.67**
Right grip (kg)	0.30	1.00	**0.96**	**0.57**	0.44	**-0.52**	0.47	0.43	**0.51**
Left grip (kg)	0.31	**0.96**	1.00	**0.54**	**0.84**	**-0.55**	0.45	0.43	**0.51**
TUG (sec)	**0.67**	**0.57**	**0.54**	1.00	**-0.85**	0.46	**0.84**	**0.76**	**0.60**
Total Tinetti	**-0.52**	0.44	**0.84**	**-0.85**	1.00	0.42	**0.85**	**0.84**	**0.60**
GDS	**0.51**	**-0.52**	**-0.55**	0.46	0.42	1.00	0.44	0.43	**0.57**
BI	**-0.55**	0.47	0.45	**0.84**	**0.85**	0.44	1.00	**0.85**	**0.63**
IADL	**-0.60**	0.43	0.43	**0.76**	**0.84**	0.43	**0.85**	1.00	**0.65**
MMSE	**-0.67**	**0.51**	**0.51**	**0.60**	**0.60**	**0.57**	**0.63**	**0.65**	1.00

Correlation coefficients (Spearman's rho) are shown**. Bolded values indicate strong correlations ($r \geq 0.50$ or $r \leq -0.50$).**

Cut-off values and odds ratios (ORs) were used to determine the effect of each fall-related risk factor (Table 4). Older age, longer TUG time, lower Tinetti score, higher GDS score, lower BI and IADL scores, and lower MMSE scores were significantly associated with an increased fall risk.

Being over 73 years of age increased the fall risk by approximately fourfold. A TUG time exceeding 19 seconds increased fall risk by approximately 4.5-fold. A total Tinetti score below 21 increased fall risk by approximately sevenfold. A GDS score below 21 increased fall risk by approximately fourfold. A BI score below 90 reduces the fall risk by approximately 33-fold. A IADL score below An IADL score below 6 increased the fall risk by approximately sevenfold. An MMSE score below 21 increased fall risk by approximately two-fold. Cut-off values, odds ratios (OR), 95% confidence intervals (CI), sensitivity, and specificity are presented in Table 4

Table 4: Cut-off values, odds ratios (OR), 95% confidence intervals (CI), sensitivity, and specificity for fall-related risk factors

Risk Factor	Cut-off	Sensitivity	Specificity	OR	95% CI
Age (years)	73	83%	81%	3.84	2.59-5.69
TUG (seconds)	19	93%	83%	4.49	3.25-7.52
Total Tinetti	21	90%	91%	6.69	3.94-11.35
GDS	21	65%	67%	3.72	2.03-6.80
BI	90	82%	88%	0.03	0.05-0.68
IADL	6	33%	97%	0.14	0.04-0.47
MMSE	21	84%	63%	2.3	1.77-3.00

OR, odds ratio; CI, confidence interval.

Beyond statistical significance, the observed differences demonstrated large effect sizes (Cohen's d ranging from 0.88 to 2.60), supporting clinical relevance. For instance, differences in Tinetti total scores (d=2.60), TUG (d=1.84), and BI (d=2.07) reflected substantial functional impairments in fallers. Moreover, identified thresholds (e.g., TUG >19 sec, Tinetti <21) were strongly associated with fall risk, with Odds Ratios ranging from 2.3 (MMSE <21) to 6.69 (Tinetti <21), underlining their importance as practical markers for fall risk assessment.

Data completeness was ensured for all participants. Missing data were minimal and did not significantly impact the study findings. As this was a retrospective cohort study, follow-up data collection was not required.

DISCUSSION

This study aimed to identify demographic, clinical, and functional factors associated with falls in a community-dwelling elderly population. Our findings highlight the multifactorial nature of fall risk, reflecting a combination of demographic characteristics, physical, cognitive, and psychosocial factors.

One of the most significant findings was the strong association between older age and falls, with participants who had fallen being older (mean age 77.75 years) than those without a history of falls (mean age 70.46) ($p < 0.001$). Additionally, participants over 73 years of age had a nearly fourfold increase in fall risk. These findings align with the existing literature, suggesting that advancing age is a critical risk factor for falls [30,31]. Reasons for elderly falls include accidents, gait and visual disorders, postural hypotension, vertigo, and syncope [32].

Sex differences were also observed, with a significantly higher rate of falls among females (63.9%) compared to males (36.1%), highlighting the vulnerability of older women to falls ($p<0.001$). This aligns with the literature about female predominance [31,33,34]. This may relate to lower muscle mass among women. Nevertheless, some studies have identified male sex is a risk factor [35]. This may be because of more alcohol consumption in males compared to females and more environmental accidents they face.

In our study, osteoporosis was more prevalent among fallers (72.3% vs. 35.2%, $p < 0.05$). This may be due to the link between osteoporosis and sarcopenia. Both conditions often coexist in the aging population and share several overlapping risk factors, including hormonal changes, nutritional deficiencies, and physical inactivity. This link is sometimes referred to as "osteosarcopenia." [36]. In contrast, in our cohort, employment/occupation, presence of chronic disease, and regular medication use did not differ between the groups.

This study revealed that cognitive disturbance, as measured by MMSE, was associated with an increased likelihood of falls. Participants with a history of falls had very low MMSE scores compared to those without a history of falls ($p < 0.05$). This indicates better cognitive function among non-fallers. Participants with MMSE scores below 21 were twice as likely to experience falls. This aligns with a review that claims that MMSE as a measure of cognitive problems is related to an increased risk of falls [37]. This may be because cognitive decline can impair an individual's ability to navigate their environment safely, thereby increasing the risk of falls.

Depressive symptoms, measured by the GDS, were more pronounced among fallers. Higher GDS scores were associated with a four-fold increased risk of falls. This aligns with a systematic review indicating that depressive symptoms were consistently linked to falls in older people [31,38,39]. The correlation between depression and falls may be due to decreased motivation, reduced physical activity, and impaired balance among individuals with depressive symptoms.

Functional assessments demonstrated that fallers had lower Tinetti scores, longer TUG test times, and reduced grip strength. The cut-off values identified in this study—TUG times exceeding 19 seconds and Tinetti scores below 21—underline the importance of examining mobility and balance in older adults in predicting fall risk. The inverse correlation between the TUG test times and Tinetti scores reinforces the relationship between impaired mobility and poor balance. These tests provide a comprehensive picture of an individual's physical function, focusing on strength, balance, mobility which impairment of these in the literature is linked to falls [31, 40-43].

Additionally, lower independence in daily activities, as indicated by lower BI and IADL scores, were associated with falls. The BI of fallers was higher in our study ($p < 0.05$), indicating that they were less independent in daily living activities compared to non-fallers. The IADL score of the non-fallers was higher ($p < 0.05$), indicating that they were more independent in instrumental daily living activities. Individuals with IADL scores below 6 had an increased fall risk, emphasizing the role of functional independence in preventing falls. In previous studies, falls have been associated with impairments in daily living activities, and functional decline is closely linked to an increased risk of falls. Furthermore, falls have been identified as an independent predictor of decline in both BI and Lawton IADL scores among older adults [35,44,45].

In this research, social determinants, including lower educational levels and widowhood, were also more common among fallers. A higher proportion of fallers were illiterate or widowed. This is in line with Xu et al., who stated that being a single person increases the risk of falls, and high education is protective against falls [31]. A study showed that women above 55 years and men above 60 years with a low educational level are the most at-risk population groups for falls [46,47]. The lack of social support in singles and widows may contribute to reduced physical activity and increased fall risk. Moreover, widowhood may be a risk factor for cognitive deterioration [48]. Additionally, a significant link was present between mobility aid use and falls, with 73.5% of fallers using such aids compared with only 18.5% of non-fallers ($p < 0.05$). This is consistent with other findings in literature and this could indicate that those using aids have pre-existing mobility impairments that predispose them to fall [35].

The results of our study highlight the associations between age, physical function, mobility, muscle strength, cognitive function, and psychological health. Advanced age was associated with slower mobility, poorer balance, reduced independence in daily activities, and cognitive deterioration. These findings emphasize the multifaceted impact of ageing on physical and cognitive health. High grip strength, particularly in the left hand, was strongly associated with better balance and cognitive function. This underscores the necessity of preserving muscle strength for overall functional capacity in older adults. The strong negative correlation between TUG time and Total Tinetti score indicates that slower mobility is linked to poorer balance. Furthermore, the positive correlations of TUG with BI and IADL suggest that improved mobility supports greater independence. The link between the TUG and MMSE scores highlights the interplay between physical mobility and cognitive function. Increased age correlates with depressive symptoms and higher GDS scores are associated with reduced independence in daily activities. These findings suggest that psychological health is critical for maintaining functional independence in older adults. Cognitive health supports independence and mobility, as evidenced by the positive correlations between MMSE scores and BI, IADL, and Total Tinetti scores.

Considering these associations, fall prevention strategies in older adults may benefit from a comprehensive approach addressing physical, cognitive, and psychological domains. Although causality cannot be confirmed within this study's design, interventions that combine strength training, balance exercises, cognitive stimulation, and psychosocial support may be beneficial. Multidisciplinary evaluations and personalized interventions remain essential to address the complex needs of older adults at risk of falls.

The observed differences in Tinetti, TUG, and BI scores between fallers and non-fallers are not only statistically significant but also clinically meaningful. In clinical practice, a change of 3 points in Tinetti, 3–3.5 seconds in TUG, and 9–10 points in the BI are generally considered meaningful [49–52]. In our study, the differences in Tinetti (10.5 points), TUG (10 seconds), and BI (12 points) far exceed these thresholds, highlighting the relevance of these assessments in identifying older adults at high risk of falls and functional decline. Integrating these simple and practical tools into routine geriatric assessments may facilitate early intervention to prevent falls.

The identification of age >73 years and TUG >19 seconds as significant fall risk thresholds provides practical markers for clinical use. These easily measurable indicators can guide early identification of high-risk individuals, enabling targeted interventions such as strength and balance training, cognitive assessments, and home safety modifications. Incorporating these simple tools into routine geriatric assessments may help prevent falls and maintain functional independence in older adults. Routine functional assessments, especially for individuals over 73 years and those with TUG >19 seconds, alongside improved social support and health literacy, could enhance fall prevention strategies. Integrating digital and wearable technologies into fall prevention may also offer an effective, personalized way to improve balance, strength, and confidence in older adults, and may enhance rehabilitation when included in comprehensive geriatric care [53,54].

The findings of this study should be interpreted within the specific context of Turkey's aging population and healthcare system. Turkey's elderly population (65+) increased by 21.4%, from 7.2 million in 2018 to 8.7 million in 2023, and is projected to reach 12.9% of the total population by 2030 and 25.6% by 2080. The median age has also risen from 32.0 to 34.0 in the same period, reflecting a demographic shift toward aging. Although Turkey remains younger than many developed countries, its population pyramid has transformed from a pyramid shape in 1935 and 1975 to a columnar shape in 2023, indicating an aging society [55]. Although Turkey has a growing elderly population, fall prevention programs are not yet fully integrated into routine care, and comprehensive geriatric assessments are often limited to specialized centers. Although traditional family care has historically protected older adults, urbanization and migration have weakened these supports, leading to greater isolation. Our study underlines that national fall prevention guidelines should be implemented.

There is rapid increase in aging populations worldwide, including in Western, Arab, and Muslim countries. Although older adults have valuable experience, skills, and time, they are often excluded from meaningful roles in society. Current efforts mostly focus on addressing their medical and social needs rather than engaging them as active contributors [56]. In fact, aging should be rethought — moving beyond simply caring for older adults to actively involving them in productive and meaningful roles.

Despite its strengths, this study has several limitations. First, the retrospective cohort design may have introduced recall bias, as participants self-reported their history of falls. Additionally, the study population was recruited from a single outpatient clinic, which may limit the generalizability of the findings to other settings or populations. Furthermore, although we controlled for several confounding factors, unmeasured variables such as dietary habits, physical activity levels, and environmental hazards may have influenced the results.

Future studies should consider a prospective design with a larger and more diverse sample size to validate these findings. Longitudinal studies can provide better insight into the causal relationships between risk factors and falls. Additionally, exploring the impact of tailored interventions such as strength training, balance exercises, and cognitive rehabilitation on reducing fall risk among high-risk older adults could be valuable.

CONCLUSION

In conclusion, this study highlights the multifactorial nature of fall risk in the elderly, emphasizing the roles of age, sex, cognitive function, depression, and physical limitations. These findings underline the necessity of comprehensive geriatric assessments to identify high-risk individuals and implement preventive strategies. By addressing these risk factors, healthcare providers can play pivotal role in reducing falls and enhancing the quality of life of older adults.

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تقييم عوامل خطر السقوط لدى كبار السن المقيمين في المجتمع الذين تبلغ أعمارهم 65 عامًا فما فوق

ودات ألطنتاش[1]*، أينور كاراجوز*[1]*، سلكين يلماز مو*[2]

[1] قسم الطب الفيزيائي وإعادة التأهيل، وزارة الصحة، مستشفى أنقرة للتعليم والبحوث، أنقرة، تركيا

[2] قسم الطب الفيزيائي وإعادة التأهيل، مستشفى جامعة دوكوز إيلول، إزمير، تركيا

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الملخص

الخلفية والأهداف :تُعدّ السقوط مشكلة صحية عامة كبرى بين كبار السن، حيث تؤدي إلى المرض والوفيات .وهدفت الدراسة إلى تحديد عوامل خطر السقوط من خلال دراسة الخصائص الديموغرافية والسريرية والوظيفية لدى مجموعة من كبار السن المقيمين في المجتمع.

منهجية الدراسة :أُجريت هذه الدراسة الاستعادية على 191من كبار السن 65≥)عامًا (في عيادة طب التأهيل الخارجية .تم تقسيم المشاركين إلى مجموعتين :من لديهم تاريخ سقوط (n=83)ومن ليس لديهم .(n=108)تم جمع بيانات حول الخصائص الديموغرافية، قوة قبضة اليد، الحركة) اختبار الوقوف والمشي Timed Up and Go، وتقييم التوازن والمشي لـ (Tinetti، أعراض الاكتئاب)مقياس اكتئاب الشيخوخة(، أنشطة الحياة اليومية)مؤشر Barthelوالأنشطة اليومية الآلية(، والوظيفة المعرفية)اختبار الحالة الذهنية المصغرة .(تم استخدام تحليل الانحدار اللوجستي لتحديد عوامل التنبؤ بالسقوط، كما تم تحليل العلاقات بين عوامل الخطر بما في ذلك نقاط القطع.

النتائج : كان الأشخاص الذين تعرضوا للسقوط أكبر سنًا بشكل ملحوظ)متوسط العمر 77.75 مقابل 70.46عامًا (وأكثر احتمالًا لأن يكونوا من الإناث 63.9%)مقابل 36.1%) (p<0.05). كما ارتبطت الأمية (p<0.05)والترمّل (p=0.04)بزيادة خطر السقوط .أظهر الساقطون ضعفًا في قوة القبضة، وزمنًا أطول في اختبار TUG، ودرجات أقل في تقييم Tinetti، BI، IADL، MMSE، ودرجات أعلى في GDS، مما يشير إلى ضعف في القوة والمشي والتوازن والاستقلالية الوظيفية وزيادة في الضعف الإدراكي وأعراض الاكتئاب (p<0.05).كانت الشيخوخة مرتبطة بضعف الحركة والتوازن والمزاج والوظائف العقلية .وُجدت علاقة بين قوة القبضة الأفضل وتحسن التوازن والوظيفة الإدراكية .كانت نقاط القطع المرتبطة بزيادة خطر السقوط هي :العمر 73<عامًا، زمن TUG >19ثانية، تقييم Tinetti <21، مقياس الاكتئاب 21<، 6> IADL <6، مؤشر Barthel <90، واختبار MMSE <21.

الاستنتاج :يرتبط السقوط لدى كبار السن بالعمر، والجنس، وضعف الحركة، والاكتئاب، والانحدار الوظيفي والمعرفي .يمكن أن تساعد التقييمات الشاملة للمسنين في الوقاية من السقوط وتحسين جودة الحياة.

الكلمات الدالة: خطر السقوط؛ كبار السن؛ الحركة؛ التوازن؛ القوة