**Original Article**

# A Determinant for Falls and Risk Factors in the Elderly: Daytime Sleepiness

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**Abstract**

**Background:** The number of persons above the age of 65 years is fast growing, especially in Turkey. Falls are one of the major problems in the elderly and falls are a main cause of morbidity and disability in the elderly.
**Aim:** The aim of this study was to determine the risk factors of fall and to determine the effect of daytime sleepiness on fall in elderly people.
**Methodology:** This was a descriptive-relational study. The study was conducted with 397 elderly people. Data was collected data sheet and the Epworth Sleepiness Scale (ESS). Number, percentage, chi square, ANOVA and Mann Whitney U analysis methods were used in the statistical analysis.
**Results:** The fall rate in the elderly was found to be 49.4%. According to the analysis, the risk factors for falls include being ≥70 years old, being single, experiencing visual problems, and experiencing a chronic disease. In terms of the sleep-related features, those who slept after 10:00 pm; had difficulty falling asleep, woke up during the night, and experienced daytime sleepiness fell more often than the others in the study sample; the difference was statistically significant. In addition, it was found that as the total ESS score increased, the falls in the elderly increased and the difference between them was highly significant**.**
**Conclusions:** Falls are a common problem in the elderly; individual characteristics, sleep-related characteristics, and daytime sleepiness were found important to affect falls.

**Key Words**: Elderly, falls, daytime sleepiness, risk factors

## Introduction

Falls are an important public health problem causing mortality and morbidity in the elderly (Tinetti & Kumar, 2010). In addition, falls cause injury, fear of falling, functional deterioration, a decrease in quality of life, and a loss of independence in daily life activities in the elderly (Cınarlı & Koc, 2015; Kanzaki, Ikezoe & Nagase, 2014). The World Health Organization (WHO) reported that approximately 28%–35% of individuals aged 65 years and over fall each year and that this value is 32%–42% in the elderly over 70 years old (WHO, 2007). In a study conducted by an institution in Turkey, the fall incidence in the elderly, at least once during the past year, was found to be quite high in both males (47.5%) and females (56.0%) (Kibar et al., 2015). Previous studies have shown a wide range of risk factors for falls in the elderly; risk factors include loss of vision with age (Beyazova, 2012), deterioration of balance, difficulties while walking (Ceceli et al., 2007; Karatas & Maral, 2001), use of walking aids (Dhargave & Sendhilkumar, 2016), use of multiple drug (Pan et al., 2014), alcohol consumption (Ortabag, Ozdemir & Kılıc, 2011), inadequate exercise (Kara, 2009), socio-demographic and economic factors [such as sex, age, and body mass index (BMI)] (Karatas & Maral, 2001; Dhargave & Sendhilkumar, 2016; Patil et al., 2015). Daytime sleepiness, in addition to all these risk factors, increases the risk of falling (Hayley et al., 2015).

Epworth Sleepiness Scale (ESS) is the most common sleep-related symptom in individuals, and its prevalence in the community can be as much as 18% (Selvi, Kandeger & Asena Sayın, 2016). Additionally, ESS is a common problem in older adults, and studies show that about 15%–24% of individuals aged 65 years and above experience this problem (Hayley et al., 2014; Senol, Soyuer & Nar Senol, 2013; Onen, 2013). Among older individuals, ESS has been consistently and independently associated with an increased risk profile for several adverse health outcomes, such as reduced functional outcomes, depressive illness, deficits in cognitive abilities and cardiovascular mortality (Hayley et al., 2015; Merlino et al., 2010). ESS in elderly individuals increases the risk of falls along with numerous other adverse effects on daily life (Selvi, Kandeger & Asena Sayın, 2016; Merlino et al., 2010; Empana et al., 2009).

Increase in elderly population in Turkey, high fall incidence and ESS in the elderly, and the fact that falls cause various problems ranging from simple health problems to vital risks make determining fall-related risk factors a necessity. Therefore, this study aims to evaluate the fall frequency in the elderly, related risk factors, and its association with daytime sleepiness.

**Methodology**

This descriptive-relational study was conducted between May - July 2019. The aim of this study was to determine the risk factors of fall and to determine the effect of daytime sleepiness on fall in the elderly registered in a provincial center.

**Sample and Data collection:** A table "estimating a population proportion with specified absolute precision" was used to determine the sample size of the study (Lwanga & Lemeshow, 1991). WHO reported that the frequency of falls in individuals aged 65 years and above is about 28%–35% (WHO, 2007). In addition, 95% confidence level and 3% precision were taken into account and the sample size reported on the table was found to be 397.

A questionnaire prepared by the researchers was used to evaluate sociodemographic-economic status, sleep characteristics, and the history of falling of the participants; the Epworth Sleepiness Scale (ESS) was used to assess daytime sleepiness. *Data Sheet;* the data sheet is composed of questions on sociodemographic characteristics, history of falling and sleep characteristics of the elderly. History of falling: The elderly was asked "Have you experienced any falls in the past year?" The condition where the elderly have experienced one or more falls in the past year prior to the assessment date was classified as having experienced falls. The elderly's BMIs were calculated by the weight (kg)/height ($m^2$) formula; they were classified as normal, overweight, and obese according to WHO's obesity classification. Sleep-related characteristics were evaluated as time of going to sleep, difficulty in falling asleep, the problems of waking up in the middle of the night, and daytime sleepiness.

***Epworth Sleepiness Scale* (*ESS);*** The EES was developed by Johns in 1991 (Johns, 1991), and the validity and reliability studies of its Turkish version were conducted by Agargun et al (1999). It is a practical, widely used scale that is easy to apply and evaluate. The Cronbach's alpha coefficient (α), which quantitatively determined how sleepy the individual felt during their daily activities in the month previous to the study, was found to be 0.86 in the Turkish version. The questions on the scale are scored between 0–3, and the total score ranges from 0–24 (Agargun et al., 1999). Those with an ESS value of ≥10 are considered to have "excessive daytime sleepiness." In this study, a score of ≥10 points was considered indicating the presence of daytime sleepiness and a score of ≤9 points was considered indicating an absence of daytime sleepiness.

**Ethical Issues:** Ethical committee approval from the University Ethics Committee (2019-32/03) and informed consent of the participants after necessary clarifications during data collection were obtained before the study.

**Statistical analysis:** The data were analyzed using IBM SPSS Statistics 25.0 (IBM Corp., Armonk, New York, USA) statistical packaged software. All of the descriptive statistics were presented in a number of units (n) and percentage (%). The normal distribution of the data of numerical variance was assessed using both the Shapiro-Wilk normality test alongside *Q-Q* plots. Chi square test, ANOVA and Mann Whitney U were used in statistical analyses. In the statistical decisions, the significance level was set to $p < .05$

**Results**

The fall prevalence in the elderly participants was found to be 49.4%. Those who were ≥70

years old; single; the lower educational status; perceiving their health moderate/poor; experiencing a chronic disease; experiencing problems in balance walking, and vision; and using walking aids fell more frequently than the others. The difference was statistically significant ($p< 0.05$; Table 1).

**Table 1. Distribution of Elderly İndividuals in Terms of Falling Status, Baseline Characteristics**

| Baseline characteristics | Fallers (N=196) | Non-fallers (N=201) | P-value |
|---|---|---|---|
| Age (70 years and over; n,%) | 92, 46.9 | 72, 35.8 | <0.001 |
| Gender (women; n,%) | 96, 49.0 | 94, 46.8 | 0.367 |
| Education Status (primary education; n,%) | 107, 95.7 | 118, 90.9 | 0.08 |
| Marital Status (Single; n,%) | 72, 36.7 | 55, 27.4 | 0.029 |
| Number of chronic diseases, mean±SD | 2.6±1.0 | 1.7±0.8 | 0.020 |
| Side effect of Drugs* (Yes; n, %) | 32, 16.3 | 24, 11.9 | 0.133 |
| Perceived Health | | | |
| Very Good/Good | 85, 43.4 | 106, 52.7 | 0.039 |
| Moderate/Poor | 111, 56.6 | 95, 47.3 | |
| Body Mass Index | | | |
| 18.5-24.9 | 68, 34.7 | 68, 33.8 | 0.470 |
| ≥25.0 | 128, 65.3 | 133, 66.2 | |
| Physical Activities (Yes;n,%) | 60, 30.6 | 65, 32.3 | 0.397 |
| Walking aid** (Yes; n,%) | 53, 27.0 | 26, 12.9 | <0.001 |
| Problem of Vision (Yes; n,%) | 120, 61.2 | 36, 17.9 | <0.001 |
| Problems in Walking (Yes; n,%) | 95, 48.5 | 54, 26.9 | <0.001 |
| Problems in Balance (Yes; n,%) | 87, 44.4 | 45, 22.4 | <0.001 |
| Number of falls, mean±SD | 0.7±1.08 | 0.0 | <0.001 |

Note. Chi square, One-way ANOVA or non-parametric Mann-Whitney U tests were applied when appropriate.
* Dizziness, blackout, light-headedness ** Cane, walking stick, walker

**Table 2. Distribution of Elderly İndividuals in Terms of Falling Status, Sleep-Related Characteristics**

| Sleep-Related Characteristics | Fallers (N=196) | Non-fallers (N=201) | P-value |
|---|---|---|---|
| ESS, mean±SD | 12.1±1.0 | 8.4±2.0 | <0.001 |
| Time of Going to Sleep (After 10 pm; n,%) | 120, 61.2 | 88, 43.8 | 0.001 |
| Difficulty in Falling Asleep (Yes; n,%) | 116, 59.2 | 91, 45.3 | 0.004 |
| Waking Up During the Night (Yes; n,%) | 123, 62.8 | 96, 47.8 | 0.003 |
| Daytime Sleepiness (Yes; n,%) | 67, 34.2 | 9, 4.5 | <0.001 |

Note. Chi square or non-parametric Mann-Whitney U tests were applied when appropriate. ESS, Epworth Sleepiness Scale.

In terms of the sleep-related features, those who slept after 10:00 pm; had difficulty falling asleep, woke up during the night, and experienced daytime sleepiness fell more often than the others in the study sample; the difference was statistically significant. In addition, it was found that as the total ESS score increased, the falls in the elderly increased and the difference between them was highly significant ($p<0.001$, Table 2).

## Discussion

In this study, the rate of falls in elderly people was found to be 49.4%, which is higher than the rate reported in extant literature (Kibar et al.,

2015; Okuyan & Bilgili, 2018; Dhargave & Sendhilkumar, 2016; Patil et al., 2015). The rate of fall determined in our study seems to be affected by the fact that approximately half of the included elderly individuals were aged ≥70 (164 individuals) (Table 1). Consistent with the result of our study, other studies in the literature indicate that the prevalence of falls increase with age (Patil et al., 2015; Kaya et al., 2012). It is thought that the risk factors for falling are higher in older age groups (Ceceli et al., 2007; Hayley et al., 2015); as age increases, the increasing severity of these risk factors makes it easier to fall, consequently increasing the frequency of falls with age.

Some studies indicate that women are more likely to fall than men and gender is considered a risk factor for falling (Patil et al., 2015; Karatas & Maral, 2001; Dhargave & Sendhilkumar, 2016). In particular, Karatas and Maral concluded that sex is the only significant risk factor for falls; however our results do not corroborate the results of their study (Table 1).

Behavioral factors, a risk factor for falling, include activities beyond normal physical activities (such as cleaning the top shelf of a cupboard), daily works and inadequate exercise (Ortabag, Ozdemir & Kılıc, 2011; Kara et al., 2009). In this study, it was found that single individuals had a high rate of falling and that being a single increased the risk of falling (Table 1). It is known that with age, elderly people begin to have difficulty in fulfilling one or more activities such as housekeeping, cleaning, and shopping and become dependent on others. Therefore, old people living alone or who are single/widowed have to do these activities themselves, thereby increasing behavioral risk factors. It was also found in this study that while behavioral factors such as inadequate physical activity threaten the health of individuals (Table 1), increase the severity and ill effects of certain diseases, and adversely affect daily life activities, they do not affect fall incidence in the elderly.

A vast majority of elderly people have one or more chronic illnesses increasing in severity with age and therefore use multiple drugs (polypharmacy) (Pan et al., 2014; Unsal et al., 2011). A study determined that majority of elderly people (81.7%) had at least one chronic illness, 75.4% of them used drugs, and 4.5% of them experienced side effects of drugs, dizziness being one of them (Unsal et al., 2011). Another study indicated that use of multiple drugs increased fall-related fractures, and some drugs directly induced in falls (Pan et al., 2014). The present found that the elderly who had a chronic illness and perceived their health to be moderate/poor experienced falls more frequently ($p<0.05$; Table 1). Continuous medication required by the elderly to treat their chronic illness(es) may cause dizziness and vision and balance disorders among possible side effects, and such effects may pose a risk of falling. The risk of falling can be considerably reduced by regularly monitoring older people's medicines, minimizing the use of medicines when they can be done without, and developing rational drug use behaviors.

The aging process changes all systems of the human body. Balance and gait are also affected and are an important risk factor for falls (Akgul et al., 2018; Ceceli et al., 2007). As a matter of fact, while one study reported that the frequency of balance and gait disturbances was high among the group of patients who experienced falls (Karatas & Maral, 2001), another study reported that balance problem increased the risk of falls in the elderly by 3.1 times (Dhargave & Sendhilkumar, 2016). Balance is the ability to maintain control of the body to prevent falling; limitations in walking and balance functions may occur with age, and these limitations increase as the aging progresses. Therefore, the elderly often use walking aids to solve their balance, coordination, and walking problems. However, the use of walking aids was also identified as a risk factor for falls in a study (Pullum et al., 2018; Dhargave & Sendhilkumar, 2016), while in another study, it was reported that 8% of those using an ancillary device and 4.2% of those not using had a history of falling. Using walking aids was a risk factor identified in this study too, and it was determined that this factor increased the risk of falls. ($p<0.001$; Table 1). The high risk of falling despite using walking aids may be due to the failure to select a device appropriate for the elderly person; simultaneously, the elderly using walking aids could have a higher risk and prevalence of falling due to their balance and walking problems.In the aging process, visual acuity, depth perception, contrast sensitivity, and adaptation to the dark may deteriorate and the risk of falls increases (Beyazova, 2012). A previous study reported that visual impairment experienced by the elderly increases the risk of falls by 1.8 times (Dhargave

& Sendhilkumar, 2016); the present study found problems in vision to increase the risk of falls ($p<0.001$; Table 1). In our study, Sleeping habits such as time of going to sleep and sleeping problems such as having difficulty in falling asleep, waking up during the night, and daytime sleepiness were thought to be related to experiencing falls in the elderly. In addition, it was found that as the total ESS score increased, the falls in the elderly increased and the difference between them was highly significant ($p<0.001$, Table 2). It is known that going to sleep after 10:00 pm, having difficulty in falling asleep, and waking up during the night reduce the amount of sleep, indicate poor sleep quality, resulting in daytime sleepiness. It is known that ESS increases the risk of falls (Hayley et al., 2015) as well as has numerous adverse effects on daily life (Selvi et al., 2016; Merlino et al., 2010; Empana et al., 2009). To reduce the risk of falling in elderly individuals, it is important to determine whether the elderly who have fallen have ESS, and ESS should be clinically treated and resolved.

**Conclusion:** Falls are a common problem in the elderly; risk factors include being ≥70 years old, being single/widowed, experiencing visual problems, balance and walking problems, number of chronic diseases and using walking aids. This study concludes that sleep-related characteristics and ESS are a significant risk factor for falls in elderly people. These results suggest conducting more extensive research to prevent important risk factors for falls occurring in the elderly and determine the relation between falls and ESS.

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