EXCESSIVE DAYTIME SLEEPINESS IS ASSOCIATED WITH AN INCREASED FREQUENCY OF FALLS AND SARCOPENIA

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Abstract

Background: This cross-sectional study aimed to examine associations between excessive daytime sleepiness (EDS) with falls and falls related conditions in older adults.

Methods: To assess EDS, the Epworth Sleepiness Scale was used, with a score of ≥ 11/24 points indicating EDS. Number of falls and fall history (at least one) in the last year were recorded. Timed Up and Go test (TUG) was used to assess fall risk. Sarcopenia was defined by SARC-F tool. A grip strength score of the dominant hand, measured with a hand-grip dynamometer, less than 16 kg in females and 27 kg in males was accepted as dynapenia. Frailty status was defined by five dimensions including shrinking, exhaustion, low levels of activity, weakness, and slowness with those scoring positive on ≥ 3 dimensions being categorized as frail. The relationship between EDS with outcomes including fall, number of falls, falls risk, dynapenia, sarcopenia and frailty was investigated.

Results: Of the 575 outpatients (mean age 78.7±7.5 years, female:70.4%), the prevalence of EDS was 19.8%. In the multivariable model adjusted for age, sex, living status, marital status, polypharmacy, osteoarthritis, Parkinson disease, depression and dementia; EDS was significantly associated with the number of falls last year (IRR=1.94, 95% CI:1.42-2.65) and sarcopenia (OR=2.41,95% CI:1.41-4.12). EDS was not significantly associated with TUG based fall risk, frailty and dynapenia.

Conclusions: EDS was observed in approximately one in every five older adults. EDS should be evaluated as part of geriatric assessment. Moreover, older patients with EDS should be further assessed for falls and sarcopenia.

Keywords: Excessive daytime sleepiness, falls, sarcopenia, dynapenia, frailty

1. INTRODUCTION

Sleep is a factor that may impact motor learning and improve spatiotemporal gait parameters that have been used to assess gait performance as well as risk of fall, fear of falling, and community ambulation ability in middle-aged and older adults (Al-Sharman & Siengsukon, 2014). Increasing but insufficient evidence shows that sleeping habits, insomnia or excessive sleep increase the risk of falls and injury (Robillard et al., 2011; Stone et al., 2014; Tyagi et al., 2017). Sleep problems can cause adverse effects on postural control, attention and cognition required to maintain a healthy balance and optimal walking performance (Ma et al., 2009; Stevens et al., 2020). Excessive daytime sleepiness (EDS), commonly a secondary symptom of sleep disorders, is characterized by difficulty in staying awake during the wake period, and frequency increases exponentially with age (Hublin et al., 1996). In those aged 30-60 years, the prevalence of EDS is 11.0% in female and 6.7% in male, while this rate increases to almost one in three people in either sex over 80 years (Hayley et al., 2014; Hublin et al., 1996). Limited literature has found that EDS is associated with low physical activity levels (Odds ratio [OR]:1.62), disability in daily activities (OR:1.53), depression (OR:1.83) and 4-year mortality rate (OR:1.73) (Gooneratne et al., 2003; Ohayon & Vecchierini, 2002). To the best of the authors' knowledge just two studies have reported that napping for long periods during the day is related to an increased risk of falls and EDS is associated with poor balance and slower gait speed (St George et al.; Tyagi et al., 2017).

Indeed, the relationship between falling and EDS is of importance as more than one-third of adults aged 65 years and over fall each year (Hausdorff, Rios, &Edelberg, 2001). One study evaluating geriatric syndromes by age, found the frequency of falls to be 25%, 31%, and 44% for those aged 60-70 years, 70-80 years and 80 years, respectively (Ates Bulut et al., 2018). Falls have been found to be associated with reduced functional capacity, disability, fractures, increased healthcare costs, and a high risk of mortality in older adults (Kannus et al., 1999; Kannus et al., 2005; Arik et al., 2020; Bloch et al., 2014). Owing to all the above, it is of importance to identify whether EDS may be a risk factor for falls among older adults.

Importantly, frailty, sarcopenia and dynapenia are clinical conditions that are quite common in older adults, and related with falls, bone fractures, depression, orthostatic hypotension, and disability (Tarantino et al., 2013; Soysal et al, 2020; Soysal et al., 2016; Soysal et al., 2017; Kocyigit et al., 2019). Considering that EDS may form a part of sedentary lifestyle, there is limited evidence about how sarcopenia, decreased muscle strength (dynapenia) and frailty are affected by EDS, which may be related to this condition, share many common features, and increase the risk of falls (Cao et al., 2019; Diniz et al.; 2016; St George et al., 2009; Smith et al., 2020).One study found that EDS accompanied with snoring or apnea was associated with the lowest handgrip strength (Cao et al., 2019). Another study showed that older adults reporting 8 or more hours of sleep had an almost twofold increased risk of sarcopenia (Chien et al., 2015). However, findings from studies examining the relationship between frailty and EDS are inconsistent (Endeshaw et al.,2009; Ensrud et al., 2009). Given both the high frequency of EDS and the health burden associated with falls and falls related conditions including risk of falling, dynapenia, sarcopenia and frailty in older adults, direct assessment of the relationship between these factors may assist in identifying possible modifiable factors, and thus, substantially improve primary preventative strategies for falls in these populations.

We hypothesize that higher EDS may be related with the higher falls and falls-related conditions, because it may lead to a low level of physical activity and a more sedentary life during the hours when a person should be awake and active, thereby increasing the development of both falls and falls related conditions. Therefore, the aim of this study is to examine associations between EDS with history and frequency of falls, as well as risk of falling, dynapenia, sarcopenia and frailty.

2. METHOD

The present cross-sectional study included 575 outpatients ≥65 years who were admitted to one geriatric outpatient clinic for any health issue in Turkey between January 2019 and September 2020, and who did not have any of the exclusion criteria. University Ethics committee approved this study (2018/297).

Exclusion criteria: Severe and moderate dementia (n =180), patients who can not walk even with an assistive device (n =10), those who have localized muscle strength loss due to stroke (n=21), those who have severe vision and hearing impairment that prevent communication and understanding commands during the examination (n=19), those who refused to participate (n =17), those who have terminal disease (n=6), a life-threatening disease in the last 6 months or those hospitalized for major surgery (n=6) were not included in the study. Finally, 259 of 834 registered older patients were excluded, and 575 were included. No patient included in the present study used any medication, such as such as methylphenidate and modafinil, for the treatment of EDS.

All patients provided written informed consent before the study was initiated. A geriatrician evaluated the patients, and a gerontologist collected study data. Age, sex, education, marital and living status, number of medications, and comorbid diseases (hypertension, diabetes mellitus, chronic obstructive pulmonary disease, congestive heart disease, dementia, Parkinson's disease (PD), osteoarthritis) were recorded. Information on nocturia was collected and nocturia was defined by the International Continence Society (van Kerrebroeck P et al., 2007). The question, ‘‘Generally, during the past 30 days, how many times do you usually urinate after you have gone to sleep at night until the time you got up in the morning?’’ was used and at least one void per night was accepted as nocturia (Dutoglu et al., 2019). A geriatrician interviewed family members or people who live with the patients to obtain information on course of patients’ cognitive functioning and activities of daily living over the past years, and neurocognitive assessment was carried out on patients who may have cognitive impairment. Dementia was diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders—Fifth Edition major cognitive impairment diagnostic criteria. All patients with dementia underwent neuroimaging investigation, such as cranial magnetic resonance imaging or computed tomography, to rule out other causes of cognitive impairment (such as a brain tumor). Depression was diagnosed using the geriatric depression scale-15 (GDS-15). A score of $\geq$5 on the GDS-15 was accepted as depression (Durmaz et al., 2018). Using five or more drugs was considered polypharmacy (Ates Bulut et al, 2018).

2.1. Excessive daytime sleepiness (EDS)

EDS was assessed using the Epworth Sleepiness Scale (ESS). The ESS is a 4-point Likert-style questionnaire composed of eight items, in which the subject marks the possibility of napping in routine situations, such as watching television, lying down to rest, and while being a passenger in a vehicle. The scoring for each item varies from 0 (no chance of napping) to 3 (great probability of napping). The total score is based on a scale of 0 to 24. A score of ≥ 11 points indicates EDS. ESS has a high sensitivity (93.5%) and high specificity (100%) with a cut-off score of ≥ 11 for an abnormal level of daytime sleepiness (Izci et al., 2008; Johns, 2000). The informant-completed ESS was administered for patients with dementia (Kasanuki et al., 2018).

2.2. Evaluation for Fall and risk of falling

A fall is defined as an event which results in a person coming to rest unintentionally on the ground or other lower level, not due to any intentional movement, a major intrinsic event or extrinsic force. The number of falls in the last year was obtained by asking the patients themselves or their caregivers. To perform the Timed Up and Go test (TUG) as described in the original derivation study, the patient is timed while they rise from an armchair, walk at a comfortable and safe pace to a line on the floor 3 m away, turn and walk back to the chair, and sit down again. The subject walks through the test once before being timed to become familiar with the test. Times of ≥13.5 second are defined as a risk of falling (Dokuzlar et al., 2020a; Dokuzlar et al., 2020b; Shumway-Cook et al., 2000).

2.3. Dynapenia, Sarcopenia and Frailty

Grip strength of the dominant hand measured with a hand-grip dynamometer less than 16 kg in females and 27 kg in males was categorized as having dynapenia (Borges et al., 2020). The SARC-F was developed as a brief diagnostic tool for sarcopenia. The lowest score is zero and highest 10 for the 5-item tool. A score ≥4 is predictive of sarcopenia and poor outcomes (Malmstrom et al., 2016). We used SARC-F to detect sarcopenia. Frailty status was defined based on five dimensions of Fried frailty phenotype, including

shrinking, exhaustion, low levels of physical activity, weakness and slowness. A measurement of > 4.5 kg unintentional weight loss within the past year was categorized as shrinking. Exhaustion was defined based on the response to the question "Much or most of the time, have you felt tired or fatigued without reason during the past 2 weeks?" Weakness, assessed by grip strength of the dominant hand with a hand-grip dynamometer, was accepted to be less than or equal to the cut-off points according to sex and body mass. Low levels of activity was considered positive in patients who had no physical activity, spent most of the time sitting, or rarely had short walks in the past year. Low gait speed was evaluated by 4-m walking test, and if it was less than or equal to the cut-off points according to sex and height points, it was regarded as slowness. Older adults reporting ≥3 frail categorizes was accepted as frail (this measure of frailty has been reported in detail in previous studies) (Ates Bulut et al., 2018).

2.4. Statistical analysis

Descriptive statistics for patients' characteristics and pre-existing chronic disease conditions were calculated in the overall population as well as by daytime sleepiness status. Mean and standard deviation were summarized and compared using t-test for age, and proportions were summarized and compared using chi square tests for the rest of the categorical variables. We estimated associations of daytime sleepiness with a range of outcomes of interests, including falls last year (yes/no), number of falls last year (continuous), TUG based fall risk (yes/no), sarcopenia (yes/no), frailty (yes/no), and dynapenia (yes/no). The mean number of falls last year were presented as mean and range by whether daytime sleepiness was reported, and the rest of the outcomes were presented as frequencies and proportions by whether daytime sleepiness were reported. Univariate, age-adjusted and multivariable-adjusted regressions were carried out to examine the association using Poisson regression (IRR and 95% CI) for number of falls last year due to the nature of count data and using logic regression (OR and 95% CI) for other outcomes. Because previous studies showed that the effect of EDS on frailty was different in males and females, we carried out sex specific association of EDS with each outcome (Supplementary Table 1). This is a post hoc analyses and findings should be interpreted for exploratory purpose only. The statistical analysis was conducted with Stata 16.0

(Stata Corp, LP, College station, Texas). The sample size needed was calculated to be 197 patients with an acceptable error of 5% and a 95% confidence level.

3. RESULTS

A total of 575 outpatients (mean age 78.7±7.5 years) provided completed data on sociodemographic characteristics, daytime sleepiness and data on outcomes of interests (falls last year, number of falls last year, TUG based fall risk, sarcopenia, frailty, and dynapenia). The prevalence of EDS was 19.8%. The majority of the patients were female (70.4%), living with a partner (46.3%) or family (36.9%), married (46.4%) or widowed (36.0%). Despite the majority of patients reporting polypharmacy (65.2%), most were free of osteoarthritis (87.4%), PD (91.3%), depression (66.1%), and dementia (73.9). Notably, age, sex, polypharmacy, PD and dementia differed by whether daytime sleepiness was reported (Table 1).

Table 1: Patients' Characteristics

		Excessive Daytime Sleepiness		P-value
Characteristics	Total	No	Yes	
Age (mean, SD	78.7 (7.5)	78.2 (7.6)	80.6 (6.6)	0.002
Sex n (%)				<.001
Female	405 (70.4)	344 (74.6)	61 (53.5)	
Living status n (%)				0.074
Alone	82 (14.3)	72 (15.6)	10 (8.8)	
With partner	266 (46.3)	217 (47.1)	49 (43.0)	
With family	212 (36.8)	162 (34.1)	50 (43.8)	
With caregiver	15 (2.6)	10 (2.2)	4 (4.4)	
Marital status n (%)				0.263
Not married	101 (17.6)	86 (18.7)	15 (13.2)	
Married	267 (46.4)	215 (46.6)	52 (45.6)	
Widowed	207 (36.0)	160 (34.7)	47 (41.2)	
Polypharmacy n (%)				0.001
	375 (65.2)	286 (62.0)	89 (78.1)	
Hypertension n (%)				0.332
	397 (69.0)	314 (68.1)	83 (72.8)	
Diabetes Mellitus n (%)				0.547
	203 (35.3)	160 (34.7)	43 (37.7)	

Chronic Obstructive Pulmonary Disease n (%)				0.443
	50 (8.7)	38 (8.3)	12 (10.5)	
Congestive Heart Failure n (%)				0.802
	64 (11.2)	52 (11.4)	12 (10.5)	
Nocturia n (%)				0.624
	491 (85.4)	392 (85.0)	99 (86.8)	
Osteoarthritis n (%)				0.093
	72 (12.6)	63 (13.7)	9 (7.9)	
Parkinson disease n (%)				0.001
	50 (8.7)	31 (6.8)	19 (16.7)	
Depression n (%)				0.338
	195 (33.9)	152 (33.0)	43 (37.7)	
Dementia n (%)				<.001
	150 (26.1)	103 (22.3)	47 (41.2)	

Descriptive statistics are shown as proportion for categorical variables and as mean ± standard deviation for age; Chi-square test compared the difference of categorical variables between excessive daytime sleepiness (yes/no), t-test was used for age.

At the univariate level, EDS was associated with falls last year, higher number of falls last year, TUG based fall risk, sarcopenia, frailty and dynapenia (see Table 2 for descriptive and IRR [95% CI] and OR [95% CI]). Associations remained significant after adjusting for age, and attenuated to null in most outcomes after further adjusting for sex, living status, marital status, polypharmacy, osteoarthritis, PD, depression and dementia. In the multivariable adjusted models, the number of falls last year (IRR=1.94, 95% CI: 1.42 to 2.65) and sarcopenia (OR=2.41, 95% CI: 1.41 to 4.12) remained significantly associated with EDS. The p values are as follows: 0.112 (falls last year), <.001 (number of falls last year), 0.077 (TUG based fall risk), 0.001 (sarcopenia), 0.074 (frailty), and 0.106 (dynapenia).

Supplementary Table 1. shows sex specific association of EDS with falls and falls related measures.

Table 2. The presence and association of excessive daylight sleepiness with falls and related measures

	Daytime sleepiness, n(%)		Logistic/Poisson regression, OR/IRR (95% Confidence Interval)		
	No (n=461)	Yes (n=114)	Univariate	Age-adjusted	MV-adjusted[a]
Falls last year (yes/no)	177 (38.6)	58 (52.3)	1.74 (1.15 to 2.65)	1.63 (1.07 to 2.49)	1.44 (0.92 to 2.26)
P-value			0.009	0.023	0.112
Number of falls last year (#)	0.9 (1.7)[b]	2.1 (3.3)[b]	1.96 (1.47 to 2.62)[c]	1.97 (1.48 to 2.64)[c]	1.94 (1.42 to 2.65)[c]
P-value			<.001	<.001	<.001
Timed Up and Go based fall risk (yes/no)	212 (46.0)	76 (66.7)	2.35 (1.53 to 3.61)	2.00 (1.27 to 3.16)	1.58 (0.95 to 2.61)
P-value			<.001	0.003	0.077
Sarcopenia (yes/no)	235 (51.0)	87 (76.3)	3.10 (1.93 to 4.95)	2.71 (1.67 to 4.41)	2.41 (1.41 to 4.12)
P-value			<.001	<.001	0.001
Dynapenia (yes/no)	250 (54.2)	85 (74.6)	2.47 (1.56 to 3.92)	2.08 (1.28 to 3.38)	1.54 (0.91 to 2.61)
P-value			<.001	0.003	0.106
Frailty (yes/no)	223 (48.4)	79 (69.3)	2.41 (1.55 to 3.73)	2.07 (1.31 to 3.27)	1.65 (0.95 to 2.87)
P-value			<.001	0.002	0.074

a. Multivariable (MV) Adjusted for age, gender, living status, marital status, polypharmacy, osteoarthritis, Parkinson disease, depression, dementia

b. Mean and standard deviation

c. Poisson regression

Supplementary Table 1. Sex specific association of excessive daylight sleepiness with falls and falls related measures.

	Logistic/Poisson regression, OR/IRR (95% Confidence Interval)					
	Female			Male		
	Univariate	Age-adjusted	MV-adjusted[a]	Univariate	Age-adjusted	MV-adjusted
Falls last year (yes/no)	1.35 (0.77 to 2.36)	1.23 (0.70 to 2.17)	1.23 (0.68 to 2.23)	2.16 (1.11 to 4.19)	2.13 (1.10 to 4.14)	1.86 (0.89 to 3.90)
P-value	0.298	0.477	0.492	0.023	0.026	0.098
Number of falls last year (#)	1.89 (1.34 to 2.66)[b]	1.86 (1.32 to 2.66)[b]	2.07 (1.38 to 3.11)[b]	1.89 (1.16 to 3.07)[b]	1.91 (1.19 to 3.05)[b]	1.86 (1.08 to 3.18)[b]
P-value	<.001	<.001	<.001	0.10	0.007	0.024
TUG based fall risk (yes/no)	2.45 (1.37 to 4.39)	1.99 (1.07 to 3.70)	1.57 (0.81 to 3.05)	2.48 (1.27 to 4.86)	2.47 (1.22 to 5.01)	1.39 (0.40 to 3.21)
P-value	0.002	0.029	0.178	0.008	0.012	0.435
Sarcopenia (yes/no)	3.51 (1.80 to 6.83)	2.92 (1.46 to 5.85)	2.43 (1.16 to 5.07)	3.39 (1.68 to 6.84)	3.37 (1.64 to 6.95)	2.35 (1.04 to 5.31)
P-value	<.001	0.002	0.018	0.001	0.001	0.040
Dynapenia (yes/no)	2.15 (1.19 to 3.88)	1.70 (0.91 to 3.18)	1.39 (0.71 to 2.75)	2.66 (1.24 to 5.68)	2.60 (1.18 to 5.73)	1.94 (0.82 to 4.59)
P-value	0.011	0.095	0.337	0.012	0.018	0.132
Frailty (yes/no)	2.68 (1.46 to 4.93)	2.17 (1.14 to 4.15)	1.66 (0.77 to 3.59)	2.67 (1.36 to 5.22)	2.61 (1.31 to 5.19)	1.74 (0.74 to 4.08)
P-value	0.001	0.018	0.193	0.004	0.006	0.202

TUG: Timed Up and Go

a. Logistic regression multivariable (MV) adjusted for age, living status, marital status, polypharmacy, osteoarthritis, Parkinson disease, depression, dementia

b. Poisson regression

4. DISCUSSION

This study observed EDS in approximately one in every five older adults and EDS was associated with a higher number of falls and a higher presence of sarcopenia for both older males and females.

The prevalence of EDS in older adults may vary according to the difference in the evaluation scale used and the cut-offs applied. For example, in one study that used ≥11 above the ESS as criteria for EDS, as in the present study, the prevalence was similar to the present results (18%) (Lima et al., 2015). However, in another study, which used a different questionnaire, the prevalence was smaller (13%), potentially owing to the measure recording the presence of sleepiness occurring three or more times per week (Hayley et al., 2015). The relationship between sex and EDS is not clear. Some studies have found that sleepiness is associated with being male, while others have found that it is more common in females (Lima et al., 2015). In the present study, the frequency of EDS was found to be higher in older males. Some hormonal and biological differences between the sexes may affect sleep disorders (Mong & Cusmano, 2016).

Our study investigated whether there was a relationship between EDS and falling history and number of falls in the last year, fall risk (evaluated with TUG), sarcopenia and frailty. While a significant relationship was observed when models were adjusted for age, after further adjustment most associations were attenuated to the null, but the association held between number of falls and sarcopenia. Therefore, these findings suggest that the presence of other factors (cognitive impairment, PD, drugs used, polypharmacy, depression) explain most of the observed associations. For example, EDS is a common nonmotor symptom in PD. However, EDS can be present already prior to the diagnosis of PD. Cross-sectional observations indicate that EDS seems to be associated with the postural instability, gait disorder, and the risk of falls through a variety of mechanisms such as impaired balance and slower reaction times (Spindler et al., 2013). Therefore, the presence of PD may be an important factor for both EDS and falls related conditions, and its effect on the observed associations should be eliminated in the studies.

To date, the relationship between EDS and falls has been investigated in few studies. In the study of Tyagi et al., there was no observed association between fall history and EDS, but sleepiness was associated with slower walking speed and poor balance confidence (Tyagi et al., 2017). In another study, no difference was found in terms of falls (at least one fall in the past year) among older males without EDS, whereas females with EDS had a higher frequency of falls (Hayley et al., 2015). The present study found that the number of falls was affected by EDS rather than the history of falling, and the same result was observed in males and females. EDS can increase the frequency of falls through several mechanisms. First, to achieve healthy mobilization and balance coordination, there must be integration of the visual, vestibular, and proprioceptive senses, which requires a high level of attention (Ma et al., 2009; Robillard et al., 2011). Indeed, EDS can negatively affect attention and increase falls. Second, the functioning of the motor and limbic areas required for postural control are also affected by sleep disorders (Ma et al., 2009; Tyagi et al., 2017). Third, it is possible that the observed relationship between EDS and sarcopenia in our study may partially contribute to the increase in the incidence of falls. One previous study found that sleeping 8 hours or more per day was associated with lower fat-free mass and higher fat mass, which supports the present conclusion (Tan et al., 2019). EDS may increase levels of physical inactivity and sedentary behavior during wake time, which may also increase the risk of developing sarcopenia. Moreover, people with falls or sarcopenia may avoid being mobilized and spend more time in bed and sleep more. However, longitudinal studies are needed to clarify the accuracy of all these possible mechanisms.

To the best of the authors' knowledge there is only one study investigating the relationship between handgrip strength and EDS. This study included 19,434 adults and found that EDS accompanied by snoring or apnea was associated with the lowest handgrip strength (Cao et al., 2019). However, in the present study, no relationship was found between EDS and dynapenia. The possible reason for the different results of these two studies may be that Cao et al. investigated EDS associated with obstructive sleep apnea (OSA) and therefore OSA itself, rather than EDS, may cause dynapenia by affecting metabolic and hormonal pathways (Cao et al., 2019).

The few studies examining the relationship between EDS and frailty have conflicting results. Three studies examined the association between frailty and EDS as assessed by ESS. Two studies only recruited older males and did not identify any association between EDS and higher presence of frailty using cross-sectional or longitudinal data, whereas another study which included almost 70% older females reported >3.5-fold increased risk of frailty among those who experienced EDS after adjusting for several demographic variables and clinical characteristics (Ensrud et al.,2009; Ensrud et al.,2012; Fragoso et al., 2009). Previous studies showed that the effect of EDS on falls and frailty were different in males and females. Therefore, the present study investigated sex specific association between EDS and each outcome. However, no differences were found in either females or males.

Findings from the present study must be observed in light of the studies limitations. First, the present study was cross-sectional in design, and the direction of the association is not known. That is, it is not known whether EDS leads to falls and sarcopenia or whether falls and sarcopenia lead to increase the development of EDS. It is possible that the relationship is bidirectional. Second, only the ESS was used for EDS; hence, future studies should consider using objective measures of sleep to diagnose daytime sleepiness, such as actigraphy. On the other hand, several factors (e.g., healthy mobilization, balance, coordination, postural control), which would be important for falls, were not detailed. Last, another limitation may be that lower limb strength was not evaluated, since a recent study showed that handgrip strength and standard strength measures of the lower limbs and functional tests presented a negligible/low correlation (Rodacki et al., 2020). The strengths of our study are as follows: not only falls, but also evaluations for frailty, muscle strength, and sarcopenia related to falling could be made simultaneously.

5. CONCLUSION

EDS is associated with higher number of falls and higher presence of sarcopenia for both older females and males, independent of a number of associated factors. In order to prevent falls and sarcopenia and related complications, daytime sleepiness should be routinely questioned during geriatric evaluation and patients should be recommended lifestyle advice that will aid in the reduction of daytime sleepiness. However,

further longitudinal studies and intervention trials are needed to elucidate the complex pathophysiology of daytime sleepiness and falls/sarcopenia in older adults. The effectiveness of interventions, such as exercise regularly during daytime hours, using wake promoting agents for EDS on falls and falls related conditions should be investigated.

Conflict-Of-Interest Statement

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