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ASSOCIATION BETWEEN SLEEP QUALITY AND GERIATRIC SYNDROMES IN NURSING HOME RESIDENTS

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ABSTRACT

Background: With aging, an increase is observed in some geriatric syndromes as well as sleep disorders.
Objective: The aim of this study is to investigate the relationship between sleep quality and geriatric syndromes (dementia, depression, sarcopenia, malnutrition, and frailty) in nursing home residents.
Methods: The participants' demographic characteristics, comorbid diseases, number of drugs, cognitive performance, mood and nutritional states, sarcopenia and frailty screening tests and sleep quality test were evaluated by two geriatricians. The participants were divided into two groups as good sleep quality and poor sleep quality. Correlation analysis of sleep quality and geriatric and mental functionality tests was performed with Spearman correlation analysis.
Results: A total of 104 nursing home residents (34 females, 74 males, aged 61-98) participated in the study. Sleep quality was found to be worse in the elderly between the ages of 75-84, with a higher number of children, using assistive devices, and taking selective serotonin reuptake inhibitors. In addition, in participants with poor sleep quality, SARC-f (strength, assistance with walking, rising from a chair, climbing stairs, and falls) and geriatric depression scale scores were significantly higher. The Pittsburgh Sleep Quality Index global score was negatively associated with total sleep time and positively associated with geriatric depression scale score and SARC-f score.
Conclusion: Findings from the present study in relation between poor sleep quality and some geriatric evaluation parameters suggests that there may be a common pathophysiological alteration with aging.

Keywords: Depression, elderly, geriatric syndroms, nursing home, sarcopenia, sleep quality

Introduction

Sleep is an important process that is necessary for the body to maintain its circadian rhythm and has a restorative function for many physiological mechanisms. The frequency of sleep disorders rises with increasing age, and they can be seen in more than 55% of older people.[1] In older individuals, sleep disorders are caused by two main factors, including primary (insomnia, sleep apnea, periodic sleep movements and restless leg syndrome) or secondary factors (pharmacological interactions, physical disease, psychiatric conditions, or psychosocial factors).[2]

In literature, sleep disturbances are associated with depressive symptoms, physical disabilities, respiratory symptoms, nonprescription medications and mobility.[3] Also poor sleep quality is associated with insomnia throughout the day, chronic fatigue, accidents and falls, and it may also increase by inflammation, reduced melatonin production and disrupted circadian rhythm.[4,5] Relatively little is known about the association between sleep quality and geriatric syndromes in older adults in long-term care facilities, despite the growing literature on sleep disturbance and disability.

As expected, life expectancy increases gradually, elderly population and the accompanying disabilities will inevitably increase. The fact that most of important geriatric syndromes, namely depression, sleep disturbance and sarcopenia, have commonalities such as increasing prevalence with age, causing functional impairment, and being associated with poor quality of life and mortality. In this cross-sectional study, we aimed to investigate the conditions affecting sleep quality in nursing home residents.

Methods

Patients

The research was carried out in the nursing home division of the Ankara Seyranbalar Nursing Home Elderly Care and Rehabilitation Center between June and December 2018. This study included 104 participants from the nursing home department who agreed to participate in the study, were

able to sign the informed consent form, and completed the inclusion criteria. Participants were questioned through a series of questions and replies. Patients with severe cognitive and mental impairments determined as exclusion criteria and those with advanced vision and hearing problems were excluded from the study. Demographic data were obtained from the participants during the face-to-face interview. The drugs used by the participants were obtained from patient follow-up files in the nursing home.

Tests

Cognitive function evaluation of each participant was done with the Mini-Mental Status Assessment test, which was previously validated in Turkish. The cut-off score for mild to moderate dementia in Turkey is 23/24.[6]

Geriatric depression scale-short form Turkish version was used for depression, and the cut-off value was accepted as ≥5.[7]

Mini Nutritional Status assessment short form, which is validated in Turkish, was used to evaluate the nutritional status of the participants. A score of 0-7 points was evaluated as malnutrition, a score of 8-11 points was evaluated as malnutrition risk and a score of 12-14 points was evaluated as normal nutrition according to this form.[8]

Katz daily living activity test gives information about 6 activities including bathing, toileting, dressing, transferring, feeding and continence. The test is scored with yes/no answers given for the ability of doing these activities independently. 6 points were evaluated as fully independent, 4 points as moderate disorder, and less than 2 points as severe functional disability.[9] To assess the participants' instrumental activities of daily living, the Lawton-Brody instrumental activities of daily living scale, which includes activities such as phone use and shopping, was used.[10]

SARC-F test is performed by scoring the answers given to 5 components including strength, falls, assistance in walking, climbing stairs, rising from a chair and reflects the results of health status changes and sarcopenia.[11,12] Scoring ranges from 0 to 10, and a score of 4 and above indicates symptomatic status whereas a score of 0-3 indicates healthy status.[13]

FRAIL test was used to screen for frailty in the elderly. This test consists of 5 components that question weight loss, fatigue, low walking speed, disease and weight loss, and a score of 3 or more is associated with frailty, whereas a score of 1 or 2 points is evaluated as prefrail.[14]

Sleep quality was assessed using the Pittsburgh sleep quality index (PSQI). In 1996, Aargün et al. conducted validity and reliability tests on the Turkish version. PSQI contains questions about the average estimated sleep time and last month's normal sleep time and waking time. 7 characteristics of PSQI includes; subjective sleep quality, sleep duration, sleep latency, sleep disturbance, habitual sleep efficacy, use of sleep medication and daytime dysfunction. A total score above 5 indicates poor sleep quality.[15]

Statistical Analysis

For the statistical analysis, SPSS 20 statistical analysis software was employed. To present quantitative data, mean, standard deviation, and median (minimum-maximum) were employed. The number n (%) was used to indicate categorical variables. Distribution of data was investigated by Shapiro-Wilk's test. When comparing the data of those with and without sleep disorders based on PSQI scores, the mean values of regularly distributed variables were compared using the student's t-test, and the median values of non-normally distributed variables were compared using the Mann-Whitney U test. Frequency comparison of categorical variables was performed with Pearson chi-square test and Fischer's exact test. Correlation analysis of sleep quality and geriatric and mental functionality tests were performed with Spearman correlation analysis since the data was not normally distributed. Also multiple linear regression models performed to test these associations after adjusting by demographic data which was statistically significant between two groups.

Logistic regression models with crude and adjusted odd ratios (OR) and 95% confidence intervals (CI) were used to assess factors influencing sleep quality. In two models, variables such as age, gender, BMI, marital status, education level, physical activities, alcohol drinking status, hypnotic use, self-reported sleep quality, cognitive state, nutrition status, and depression were adjusted. The estimation of Spearman correlation coefficients was used to test for covariate collinearity. $p < .05$ was regarded as statistically significant.

Results

The mean age of the participants was 77.4 ± 8.2 (range: 61-98). The average length of stay in the nursing home was 23 (1.5-192) months. 32.7% of the participants were women, 41.3% were smoking, and 4.8% were using alcohol more than three days a week. 16.3% of the participants were married, 7.7% were single, 51% were widowed and 25% were divorced. The average number of children was 2 (0-7), and the average length of stay in the nursing home was 23 (1.5-192) months. 12.5% of the participants were illiterate and 44.3% had more than a high-school education. 73.1% of the participants were not using assistive devices. The most used assistive vehicle was walking stick with 24%. 15.4% of the participants has fallen 2 or more times during the last year.

As a result of the multidimensional geriatric evaluation, depression (GDS≥5) was detected in 48.4%, sarcopenia (SARC-F≥4) was detected in 16.3%, and frailty (Frail ≥3) was detected in 16.3% of the participants. Nutritional assessment revealed malnutrition (MNA≤7) in 4.8% and malnutrition risk (MNA: 8-11) in 28.8% of the participants.

Two groups with good and poor sleep quality (74% vs. 26%) were compared for demographic and characteristic features. Sleep quality was significantly impaired in the 75-84 age group compared to the 65-74 and ≥85 age groups ($p = 0.021$). Furthermore, when two groups with good and poor sleep quality were compared, a significant difference was found in the number of children [2 (0-7) and 3 (0-7), $p = 0.009$] and the use of assistive devices (20.8% and 44.4%, $p = 0.017$) was statistically significantly different. The comparison of demographic and characteristic features between two groups with good and poor sleep quality are shown in Table 1.

Table 1. Comparison of the demographic characteristics of the participants according to their PSQI scores

	PSQI ≤5 (n:77,%74.1)	**PSQI >5 (n:27,%25.9)**	**p**
Age (year)	77,53±8,52	76,81±7,37	0,698
65-74	31(40,3)[a]	6(22,2)[a]	
75-84	25(32,5)[a]	17(63)[b]	***0,021***
>=85	21(27,3)[a]	4(14,8)[a]	
Gender			
Female	25(32,5)	9(33,3)	0,934
Male	52(67,5)	18(66,7)	
Smoking			
No	46(59,7)	15(55,6)	0,704
Yes	31(40,3)	12(44,4)	
Alcohol Consumption			
None	59(76,6)	23(85,2)	0,349
Yes	18(23,4)	4(14,8)	
Marital Status			
Married	16(20,8)	1(3,7)	
Single	7(9,1)	1(3,7)	0,120
Widowed	37(48,1)	16(59,3)	
Divorced	17(22,1)	9(33,3)	
Number of children	2(0-7)	3(0-7)	***0,009***
Nursing home stay (months)	20(1,5-192)	24(5-180)	0,081
Educational Status			
Illiterate	9(11,7)	4(14,8)	
Literate	4(5,2)	3(11,1)	
Primary School	19(24,7)	9(33,3)	0,595
Middle School	8(10,4)	2(7,4)	
High School	18(23,4)	6(22,2)	
University	19(24,7)	3(11,1)	
Use of assistive devices			
None	61(79,2)	15(55,6)	***0,017***
Yes	16(20,8)	12(44,4)	
Number of falls in the last year	0(0-10)	0(0-5)	0,403
<2	66(85,7)	22(81,5)	0,757
≥2	11(14,3)	5(18,5)	

†Findings are presented with n (%), mean ± SD or median (min-max) values.
‡Mann-Whitney U test, Student's t-test, Pearson chi-square tests are used.
§Statistically significant differences are shown in different lower-case letters, *NA* Not applied.

Table 2. Comparison of diseases and medications according to participants' PSQI scores

	PSQI ≤5 (n:77), n (%)	**PSQI >5 (n:27), n (%)**	**p**
Urinary incontinence	26(33,8)	13(48,1)	0,184
Hypertension	41(53,2)	15(55,6)	0,836
Diabetes mellitus	19(24,7)	8(29,6)	0,613
Heart failure	8(10,4)	2(7,4)	0,999
Cardiovascular disease	20(26)	9(33,3)	0,463
Cerebrovascular disease	10(13)	1(3,7)	0,281
COPD / Asthma	18(23,4)	8(29,6)	0,519
Depression	7(9,1)	4(14,8)	0,470
Benign prostatic hyperplasia	21(27,3)	5(18,5)	0,366
Hypothyroidism	5(6,5)	4(14,8)	0,234
Hyperthyroidism	0(0)	1(3,7)	0,260
Chronic renal failure	5(6,5)	5(18,5)	0,121
Osteoporosis	7(9,1)	6(22,2)	0,095
Malignancy	3(3,9)	3(11,1)	0,179
Parkinson	4(5,2)	0(0)	0,570
Number of medications	5(0-17)	6(0-15)	0,329
Anti-parkinson	4(5,2)	0(0)	0,570
Antipsychotics	5(6,5)	1(3,7)	0,999
Antiepileptic	14(18,2)	3(11,1)	0,549
Benzodiazepine	1(1,3)	0(0)	0,999
Insomnia drug	6(7,8)	3(11,1)	0,693
SSRIs	8(10,4)	7(25,9)	***0,048***
Antihistaminic	2(2,6)	1(3,7)	0,999

†Findings are presented with n (%) or median (min-max) values. Pearson chi-square test, Fisher's exact test.
NA Not applied, *PSQI* Pittsburgh sleep quality index, *COPD* chronic obstructive pulmonary disease, *SSRI* selective serotonin reuptake inhibitor

Table 3. Comparison of geriatric functionality and mental tests according to participants' PSQI scores

	PSQI ≤5 (n:77)		PSQI >5 (n:27)		p
	Mean±SD	**Median (min-max)**	**Mean±SD**	**Median (min-max)**	
Hand-grip test (kg)	23,76±8,76	25,1(7,9-47,3)	23,24±7,32	23,5(8,7-34,9)	0,790
Walking speed (m/sec)	0,75±0,25	0,78(0,16-1,32)	0,68±0,22	0,67(0,26-1,19)	0,229
<0,8	43(57,3)	-	18(72)	-	0,193
≥0,8	32(42,7)	-	7(28)	-	
Katz ADL	5,6±0,6	6(4-6)	5,5±0,8	6(3-6)	0,477
Lawton-Brody IADL	12,7±4,6	14(2-17)	12±4,4	13(2-17)	0,276
MNA	11,8±2,1	12(6-14)	12±1,8	13(7-14)	0,979
SARC-F	1,6±1,8	1(0-8)	2,6±2,3	2(0-8)	***0,048***
Frail test	1±1,3	0(0-5)	1,3±1,2	1(0-4)	0,142
Non-frail	39(50,6)	-	9(33,3)	-	
Pre-frail	27(35,1)	-	12(44,4)	-	0,281
Frail	11(14,3)	-	6(22,2)	-	
Total sleep time	7,9±1,6	7,5(5-12)	7,3±2,3	7,5(2-10,5)	0,338
MMSE	25,7±4,1	27(10-30)	25,4±3,5	26(16-30)	0,473
GDS	4,7±3,7	4(0-12)	6,4±3,8	5(1-14)	***0,038***

†Findings are presented with n (%),mean±SS or median (min-max) values. Mann-Whitney U test, Student' t test, Pearson chi-square test are used.

ADL Activities of daily living, *IADL* Instrumental activities of daily living, *MNA* Mini nutritional assesment *SARC-F* Sarcopenia screening test, *FRAIL* frailty screening test, *MMSE* Mini-mental status examination, *GDS* geriatric depression score.

Table 4. Correlation between sleep quality and geriatric and mental functionality tests

	r	p
Hand-grip test	-0,035	0,727
Walking speed	0,150	0,132
Katz ADL	-0,108	0,273
Lawton-Brody IADL	-0,144	0,148
MMSE	-0,007	0,941
GDS	0,199	***0,048***
MNA	-0,004	0,968
SARC-F	0,245	***0,012***
FRAIL	0,191	0,053
Total sleep time	-0,202	***0,040***

†Spearman correlation test

ADL Activities of daily living, *IADL* Instrumental activities of daily living, *MMSE* Mini-mental status examination, *GDS* geriatric depression score, *MNA* Mini nutritional assessment, *SARC-F* Sarcopenia screening test, *FRAIL* frailty screening test

Table 5. Evaluation of factors affecting sleep quality with Multiple logistic regression analysis

	OR(95%CI)	p-value
Age	0,900(0,828-0,979)	**0,014**
Gender	0,985(0,301-3,219)	0,980
Use of assistive devices	2,085(0,629-6,907)	0,229
Number of children	1,818(1,244-2,658)	**0,002**
SSRI	1,545(0,399-5,993)	0,529
GDS	1,066(0,914-1,243)	0,415
SARC-F	1,435(1,033-1,994)	**0,031**

SSRI selective serotonin reuptake inhibitor, *GDS* geriatric depression score, *SARC-F* sarcopenia screening test

In terms of chronic diseases, no statistically significant difference was identified between the two groups with good and bad sleep quality.

When the two groups were compared in terms of the drugs they used, the use of selective serotonin reuptake inhibitors was significantly higher in the group with poor sleep quality (10.4% vs. 25.9%, p = 0.048). Comparison of the disease status and drug use rates according to the PSQI scores of the participants are shown in Table 2.

When the geriatric evaluation tests were compared between the two groups, SARC-F test score was significantly higher in the group with poor sleep quality (1.6 ± 1.8 vs. 2.6 ± 2.3, p = 0.048).

When the mental assessment tests were compared between the two groups, GDS score was significantly higher in the group with poor sleep quality (4.7 ± 3.7 vs. 6.4 ± 3.8, p = 0.038). The comparison between geriatric functionality and mental assessment tests and sleep quality is shown in Table 3.

The relationship between sleep quality and geriatric and mental functionality tests was investigated with Spearman correlation analysis, and the results revealed a positive correlation between PSQI score and GDS score (r: 0.199, p = 0.048) and SARC-F score (r: 0.25, p = 0.012), and a negative correlation between PSQI score and total sleep time (r: -0.202, p = 0.040) (Table 4).

Table 5 shows the results of the multiple logistic regression analysis. While age is negatively correlated with poor sleep quality (OR: 0.9; 95% CI 0.828-0.979 p = 0.014), there are positive correlation between poor sleep quality and number of children (OR: 1.818; 95% CI 1.244-2,658; p = 0.002) and SARC-f score (OR: 1,435; 95% CI: 1,033-1,994; p = 0,031).

Discussion

The aim of this study was to examine the factors that impair sleep quality in nursing home residents. The group of elderly individuals with no known severe cognitive impairment were evaluated with PSQI test and comprehensive geriatric assessment and were divided into two groups as those with good sleep quality and poor sleep quality. 26% of the participants in the study were found to have poor sleep quality.

Depression is the most important of psychiatric diseases seen in the elderly and it may be the cause of morbidity for many medical diseases. As well as mood, a significant decrease in function and quality of life is observed in depressed elderly individuals. Depressed elderly individuals

experience more loss of function compared to young people, and these losses can be deep and permanent.[16] In one study, the frequency of depressive symptoms was shown to be associated with poor sleep quality or chronic insomnia, which were evaluated as the main risk factors for depression.[17] Obayashi et al. showed associations of higher physiological melatonin levels with lower prevalence of cognitive impairment and depressed mood in a large general elderly population.[18] Two results in our study, the GDS scores of those with poor sleep quality were statistically higher and sleep quality was positively correlated with GDS; elucidate a strong relationship between sleep and depression among older people.

In a review investigating the prevalence of depression in nursing home residents, the prevalence was found to be between 6-26% for major depression, 11-50% for minor depression and 30-48% for depressive symptoms.[19] In our study, 44.6% of the participants had clinical symptoms of depression (GDS≥8) according to the geriatric depression test and 13% of these patients had severe depression (GDS≥12); however, only 14.5% of all participants were using SSRIs. In addition, although SSRI's impair sleep quality[20]; 89.1% of the participants in our study with high geriatric depression test scores were not using SSRIs. As a result, our study reveal that SSRIs are not used in appropriate patients, also older adults staying in nursing home should be intermittently screened for depression.

Sarcopenia is a geriatric syndrome that includes a decrease in skeletal muscle mass and age-related decrease in muscle strength and/or function.[21] In the elderly, risk of fall, disability and mortality increase with sarcopenia.[22] In a review and a cross sectional study it was shown that poor sleep quality increases the risk of sarcopenia and associated with low muscle mass by increasing insulin resistance.[23,24] Although the prevalence of sarcopenia varies according to geographical regions, it is seen in 1% - 29% of community-residing elderly and in 14% - 33% of nursing home residents.[25] In our study, the sarcopenia screening test SARC-F revealed that 15.4% of the participants were sarcopenic. In addition, in our study, we found SARC-f to be significantly associated with poor sleep quality by correlation tests and multiple logistic regression analysis. Also, the use of assistive devices disrupts sleep quality may supports sarcopenia. In a recent study by Tuna et al., poor sleep quality and sarcopenia were found to be correlated in the elderly.[26] The fact that sarcopenia and sleep quality are so strongly correlated in our study and this correlation suggests the deficiency of a common molecule which decreases with aging in both of two problems, such as melatonin. In addition to regulating sleep, there is scientific evidence showing that melatonin reduces sarcopenic changes in skeletal muscle by preventing mitochondrial damage, reducing oxidative stress, and making autophagic changes in muscle cells.[27]

Our biological clock is controlled by changes in the level of melatonin hormone and by daylight.[28,29] Melatonin is produced primarily in the pineal gland in the brain as well as the retina and gastrointestinal tract, and is a serotonin derivative hormone.[30,31] The concentration of melatonin, which is released at night, rises rapidly in children and peaks at the age of 2-4, and quickly falls in puberty and plateaus.[32] This steady decline continues from puberty to old age.[33,34] It is controversial whether these age-related changes are the cause or the result of aging.[35] Due to its strong antioxidant capacity, melatonin appears to be an effective and safe option that can be used to delay aging, increase life span and prevent age-related diseases.[36]

In our study, the increase in the number of children was found to be associated with poor sleep quality, but no supporting data was found in the literature. Since a higher number of children increase the risk of child loss and family problems, this may impair sleep quality by making people more prone to depression.

Limitations: Firstly, we could not clarify whether poor sleep quality contributes to maintenance sarcopenia and depression or whether melatonin medication has a positive influence on sleep quality, sarcopenia, and depression. Secondly, it must be used muscle strength and/or walking speed tests with one of the objective methods such as DEXA / Magnetic resonance / Computed tomography / Bioelectrical impedance for diagnosis of sarcopenia.[21] SARC-f test was used for the subjective diagnosis of sarcopenia in our study, which may be another limitation.

Conclusion

The reason why some problems such as insomnia, depression and sarcopenia are seen more frequently with aging may be the decrease in hormone reserves such as melatonin. Therapeutic approaches, such as drugs containing melatonin, which target circadian rhythms and sleep disorders, may be a novel strategy for improving muscle health and depression in older adults. Further research is needed to identify the mechanisms linking poor sleep quality to have depression and sarcopenia in this population.

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Conflict of Interest

There are no conflicts of interest in this study, all authors declare.

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