

# Evaluation of the Relationship between insomnia and cognitive function

## Uykusuzluk ile kognitif fonksiyonlar arasındaki ilişkinin değerlendirilmesi

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### SUMMARY

**Aim:** The elderly population in the world is increasing every year. On the other hand, diseases with severe morbidity and mortality are associated with aging. Cognitive dysfunction and dementia play an important role in these syndromes. The awareness and prevention of the modifiable factors is very significant in this regard. Sleep disorders associated with aging are a frequent but often ignored problem in the geriatric population. The aim of the study was to investigate the relationship between insomnia and cognitive functions of patients.

**Methods and Materials:** Individuals over 65 years of age who applied to the internal medicine department with insomnia problem were included in the study. Patients who were currently diagnosed with dementia, mild cognitive disorder and depression and those diagnosed during their outpatient clinic applications were not included in the study. Katz Activities of daily Living Scale, Lawton Brody Instrumental Activities of Daily Living Scale were applied to all patients. The cognitive functions of the participants were evaluated by Mini Mental State Assessment Test (MMSE). The results and the relationship between insomnia and cognitive functions were evaluated.

**Results:** The mean age of the participants was  $71.5 \pm 5.4$  years and 311 (47.7%) patients were female. The number of patients with insomnia was 254 (39%). 568 (87.1%) people obtained 24 points or more from MMSE. Insomnia increases the deterioration in cognitive functions by 1.6 times (95% Confidence Interval; 1.1 -2.5,  $p: 0.04$ ).

**Conclusion:** The awareness and treatment of insomnia in elders may be useful in improving cognitive functions. Therefore, chronic insomnia should be paid attention in elderly people.

**Keywords:** Insomnia, Cognitive Functions, Dementia.

### ÖZET

**Amaç:** Dünyada yaşlı popülasyon her yıl artmaktadır. Bununla birlikte yaşlılıkla birlikte hastalıklar ciddi mortalite ve morbite ile seyretmektedir. Kognitif disfonksiyon ve demans bu sendromlar için önemli yer tutmaktadır. Modifiye edilebilen faktörlerin farkındalığı ve önlenmesi bu konuda oldukça önemlidir. Yaşlanma ile birlikte görülen uyku bozuklukları geriatric popülasyonda oldukça sık ancak sıklıkla göz ardı edilen bir problemdir. Çalışmada hastaların uykusuzluk ile bilişsel fonksiyonları arasındaki ilişkinin araştırılması amaçlanmıştır.

**Gereç ve yöntemler:** Uykusuzluk problemi ile dahiliye bölümüne başvuran 65 yaş üstü bireyler çalışmaya dahil edildi. Hali hazırda demans, hafif kognitif bozukluk ve depresyon tanısı bulunanlar ile poliklinik başvurusu sırasında tanı alanlar çalışmaya dahil edilmedi. Tüm hastalara Katz Temel Günlük Yaşam Aktiviteleri Ölçeği, Lawton Brody Enstrümental Günlük Yaşam Aktiviteleri Ölçeği uygulandı. Katılımcıların bilişsel fonksiyonları Mini Mental Durum Değerlendirme Testi (MMSE) ile değerlendirildi. Elde edilen sonuçlar ile uykusuzluk ve kognitif fonksiyonlar arasındaki ilişki değerlendirildi.

**Bulgular:** Katılımcıların yaş ortalaması  $71.5 \pm 5.4$  yıl olup, 311'i (% 47.7) kadındı. Uykusuzluk tarifleyen hasta sayısı 254'dü (% 39). MMSE'den 568 (% 87.1) kişi, 24 ve üzeri puan aldı. uykusuzluk bilişsel fonksiyonlarda kötüleşmeyi 1.6 kat artırmaktadır (%95 Güven Aralığı; 1.1 -2.5,  $p: 0.04$ ).

**Sonuç:** Yaşlı erişkinlerde uykusuzluğun farkındalığı ve tedavisi bilişsel işlevlerin iyileştirilmesinde yararlı olabilir. Bu nedenle, yaşlı kişilerde kronik uykusuzluğa dikkat edilmelidir.

**Anahtar sözcükler:** Uykusuzluk, Kognitif fonksiyon, Demans

## INTRODUCTION

Parallel to the increase in the elderly population in the world, the number of individuals 65 years of age or above increases in Turkey. According to the most recent data by the Turkish Statistical Institute, the rate of individuals older than 65 years old in Turkey is 8.3%. One of the important geriatric syndromes expected to increase parallel to the aging population is the decline of cognitive functions and dementia (2-3). Determining modifiable risk factors and taking the necessary precautions to prevent the decline in cognitive functions comprise the most significant strategy in the current situation.

Because of the physiological changes that emerge with aging, modifications are experienced in sleep cycle and sleep times decrease. The prevalence of sleep disorders, which cause quality of life to deteriorate, increases in advanced ages. Insomnia and problems in falling into or maintaining sleep were found related to memory and concentration issues in especially the elderly population (4-6). However, the sleep problems are frequently ignored in the examination of the patients and they are not looked into sufficiently.

Our study aimed at evaluating the relationship between the cognitive functions of the patients and insomnia.

## MATERIALS AND METHODS

652 individuals at the age of 65 and above who had applied to the internal diseases outpatient clinic with insomnia complaint were included in this cross-sectional and observational study. Patients who had already been diagnosed with dementia, mild cognitive impairment and depression or those who were diagnosed as such during their application to the outpatient clinic were excluded from the study. The detailed histories were collected from all participants and their detailed physical examinations were performed. The age, sex, marital status, the people they lived together, diagnosed diseases and the medications they used were recorded after detailed queries. The sleep habits of the participants were queried and they were recorded as participants subjectively described insomnia sensation, and those who did not. As part of the comprehensive geriatric assessment all participants were administered the Katz Activities of Daily Living Scale and Lawton Brody Instrumental Activities of Daily Living Scale (7). The cognitive functions of the participants were

evaluated using the Mini Mental State Examination (MMSE) test (8). In MMSE, comprising of 11 items and assessed over 30 points, orientation, memory, attention, calculation, recall, language, motor function, perception, and visuospatial abilities of the participant were tested and total scores were recorded. Participants that scored 24 and above were considered as having normal cognitive functions.

## Statistical Methods

The analysis of the data was conducted using the "SPSS 1.0 for Windows" software. The visual (histograms, probability charts) and analytical methods (Kolmogorov-Smirnov / Shapiro-Wilk tests) were used to determine the distribution of the numerical variables. The descriptive statistics were presented as mean and standard deviation (mean  $\pm$  SD) for normally distributed variables and as median and minimum – maximum values for nonnormally distributed variables. Categorical variables were expressed in number and percentage (%). The Mann-Whitney U test and the t-test were conducted in the intergroup comparisons, and the chi-square test was performed for the categorical variables. The MMSE total score was dichotomized as  $\geq 24$  and  $< 24$ , and the logistic regression was carried out to determine the independent factors affecting on the cognitive functions. In Model 1, the logistic regression was carried out without any corrections to determine the effect of insomnia on cognitive functions. In Model 2, a correction was applied to the variables of age and education status additionally to Model 1. Sex variable was not included into Model 2 since there was multicollinearity between sex and insomnia. The p value  $< 0.05$  was considered statistically significant in the interpretation of the analyses.

## FINDINGS

The average age of the participants was  $71.5 \pm 5.4$  and 311 (47.7%) of the patients were female. 355 (54.4%) of the patients were living with their spouses, 105 (16.1%) were living alone, 47 (7.2%) with their spouses and children, 61 (9.4%) with their children, 32 (4.9%) with their relative and 52 (8%) were living in a retirement home. The number of illiterate patients was 122 (18.7%), while the number of the patients describing insomnia was 254 (39%). 568 (87.1%) participants obtained 24 and higher points in the MMSE. The clinical and sociodemographic characteristics are presented in detail in Table 1.

The results of the logistic regression analysis, conducted to determine the independent factors affecting the cognitive functions, are presented in Table 2. In Model 1, in which the effect of insomnia alone on cognitive functions, it was found that insomnia increased the deterioration in cognitive functions by 1.6 (95% Confidence Interval; 1.1 -2.5,  $p$ : 0.04). When corrections were made for age and education status in Model 2, insomnia increased the deterioration in cognitive functions by 1.4 (95% Confidence Interval; 1.2 - 2.8,  $p$ : 0.05), and not having any education by 5.1 (95% Confidence Interval; 3.7 -15.9,  $p$  < 0.001).

## DISCUSSION

In this study, in which the relationship between cognitive function and sleep was examined in individuals at the age of 65 and above without dementia and depression, it is found that insomnia increases the deterioration in cognitive functions by 1.4 independently from age and education status. The results of the study also indicate a negative correlation between education status and cognitive function. When the noncontrollable risk factors that cause decline in cognitive functions, such as genetic background and aging, it is of great importance to maintain cognitive functionality and prevent dementia development in elderly individuals to meliorate controllable risk factors such as insomnia, which are related to the decline in cognitive functions.

In the Maastricht Aging Study (MAAS), which aimed at determining whether subjective sleep complaints (i.e. falling asleep difficulty, waking up too early, restless sleep or sleep disorder) predict cognitive decline for three years, it is found that subjective sleep complaints have a negative correlation with cognitive performance, and waking up too early has the strongest correlation with the decline in cognitive functions (9).

The role of sleep in learning, memory and other cognitive functions are frequently studied in young adults (10-12). The present information indicate that sleep facilitates synaptic plasticity, supports procedural learning processes and is important for processing emotional memories (13-14). In a study, conducted with 88 healthy postmenopausal women, it is shown that low sleep quality is correlated with a decline in cognitive test performance and concentration difficulty (15).

The relationship between insomnia and cognitive functions in elders can be argued to be dependent on the changes in the brain due to aging. Sleep and memory are widely affected by general aging processes such as gray and white matter atrophy, synaptic degeneration, decreased blood flow and neurochemical changes (16). Thus, age related changes in brain regions such as the hippocampus that have a role in the procession of memories, the most important cognitive function, affect the quality of memory consolidation during sleep in elders (17). Another potential mechanism for insomnia and cognitive decline is the possibility of insomnia resulting in fatigue and reduced attention during the day. This reduced attention can decrease the performance in tasks requiring attention (18). Another outcome of day long reduced attention is the lowered exposure to cognitively challenging situations, which help preserving the cognitive functions. For instance, fatigue can cause degradation of interest in reading, hobbies, social participation, physical activities and other relations of the individual with their environment (19).

There are some limitations to our study. Due to its cross-sectional and observational design, the causal relationship between insomnia and cognitive functions cannot be asserted clearly. The assessment of insomnia with the statements of the participant, instead of objective measurements, comprises another significant limitation. In addition, the exclusion of individuals with existing diagnoses of dementia and depression prevents the results of the study to be generalized to all elderly individuals.

Our findings indicate that poor sleep quality contributes in cognitive delay in elders and thus renders elderly individuals declaring insomnia more susceptible to the decline in cognitive functions. Therefore, screening, assessing and treating insomnia symptoms in elderly patients are important for healthcare professionals.

The findings of this study suggests that treating insomnia in elders would have beneficial effects in ameliorating the cognitive functions in these patients. Thus, attention should be paid to chronic insomnia in elderly people. Treatment of insomnia in elders not only improves the quality of night's sleep but also preserve cognitive function and thus improve the general quality of life.

**Table 1.** Sociodemographic and clinical characteristics of the participants.

Age	71.5 ± 5.4
Sex	
Female	311 (47.7%)
Male	341 (52.3%)
Marital status	
Married	
Bachelor	
Widow	
People they live together	
Alone	105 (16.1%)
With spouse	355 (54.4%)
With spouse and children	47 (7.2%)
With children	61 (9.4%)
With relatives	32 (4.9%)
Retirement home	52 (8%)
Education status	
Did not receive education	530 (81.3%)
Educated	122 (18.7%)
MMSE	
≥24 points	568 (87.1%)
<24 points	84 (12.9%)
Katz ADL	0 (0-8)
Lawton-Brody IADL	15 (2-17)
Hypertension	464 (71.2%)
Diabetes Mellitus	170 (26.1%)
Coronary Artery Disease	199 (30.5%)
Chronic Obstructive Lung Disease	60 (9.2%)
insomnia	
Present	254 (39%)
Absent	398 (61%)

**Table 2.** The Logistic Regression Analysis of the Factors Affecting Cognitive Functions.

	MEAN (95% CI)	<i>p</i> value	MEAN (95% CI)	<i>p</i> value
	Model 1		Model 2	
insomnia				
Present	Reference		Reference	
Absent	1.6 (1.1 – 2.5)	0.04	1.4 (1.2 – 2.8)	0.05
Age	-	-	1.01 (0.9 – 1.07)	0.48
Education status				
Did not receive education	-		Reference	
Educated	-	-	5.1 (3.7 – 15.9)	<0.001

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