

The Relationship between Oral Health and Sleep Quality in Community-Dwelling Older Adults

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ABSTRACT

Introduction: The assessment of the sleep status of older adults and its relationship to oral health can help determine their well-being and quality of life. In accordance with this purpose, we aimed to evaluate the relationship between oral health and sleep quality in community-dwelling older adults in an urban area. **Materials and Methods:** The data of this study were taken from the Kayseri Elderly Health Study. The study group was administered a questionnaire form and the Pittsburgh Sleep Quality Index. A specialist dentist examined the oral health conditions (dentures use; caries; deficient, filled, natural teeth numbers; periodontal health) using the Community Periodontal Index and the Oral Health Impact Profile-14 (OHIP-14-TR). **Results:** One hundred forty (38.1%) of the study group were female, and 227 (61.9%) were male. When evaluated in terms of oral hygiene, there was a statistically significant difference between those with good sleep quality and poor sleep quality in terms of mechanical interventions such as using toothpaste and an inter-dental brush, and also, OHIP-14-TR was significant. In the binary logistic regression analysis, OHIP-14-TR was found to be a significant risk factor, reflecting only the subjective interpretation of the older adults in terms of oral health-related quality of life (odds ratio: 1.069, 95.0% confidence interval: 1.043–1.096). **Conclusion:** This is the first epidemiologic study to examine the relationship between oral health status and sleep quality, in which many oral health indicators are evaluated together in Turkish community-dwelling older adults. OHIP-14-TR may be a useful tool to employ in sleep disorder clinics for older people.

KEYWORDS: *Community-dwelling, older adults, oral health, Pittsburgh Sleep Quality Index, sleep quality*

INTRODUCTION

Irrespective of an individual’s age, regular sleep is important for mental and physical health. However, in old age, due to chronic diseases and pain, as well as neurological and psychiatric disorders, the elderly experience frequent interruption of night sleep, which negatively affects their general health status and quality of life. It is inevitable, therefore, for a person who does not get quality sleep to have a wide variety of oral, systemic, and cognitive health problems.^[1-3]

With aging, some changes occur in sleep patterns. Long and deep sleep is replaced by lighter, shorter, and interrupted sleep. Although the time spent in

bed increases, the time spent asleep decreases, so the efficiency of sleep decreases.^[4]

In addition to medical problems with advanced age, an increase in periodontal diseases, gingival recession, tooth loss, tooth wear, and impaired sleep quality are more likely because oral health is an integral component of general health.^[5] This chronic process impairs the quality

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of life of older adults who are already frail and places a serious burden on the functioning of the health system.^[3,6-8] Primary care physicians are ideal service providers in screening and follow-up in geriatric health. Previous reports indicated that there was a negative interaction between oral health status and sleep quality.^[2,5,6,9,10] Accordingly, in both dental consultations and primary care screening procedures, evaluation of sleep quality and dental health status should be handled together. Therefore, primary care physicians who monitor older adults may have a positive effect on their quality of life by giving oral healthcare recommendations and referring patients for dental consultations if needed. A large proportion of studies about older adult sleep disorders and oral health status are related with “sleep apnea”.^[2,9] However, studies about sleep quality and oral health status are limited, which is why we designed this study.

The assessment of the sleep status of older adults and its relationship to oral health can help determine their well-being and quality of life. For this purpose, the present study aims to evaluate the quality of sleep in community-dwelling older adults in an urban area and determines the relationship between sleep quality and oral health.

MATERIALS AND METHODS

The research data were procured from the Kayseri Elderly Health Study (KEHES) dataset, some of which have also been employed in other studies.^[11] Ethical approval for the study was obtained from the Ethics Board of Erciyes University (2013/441), and regulatory approval was granted by the Turkish Institution of Public Health.

This cross-sectional population-based study included 960 older adults aged 60 years or older living in the community. The study was conducted on older people who were randomly selected from a list created by their family physicians and invited to 21 Family Health Centers (FHCs) in Kayseri and/or older adults who were admitted to these FHCs for various reasons between August and December 2013. The selection of FHCs was made according to the socio-economic characteristics of the older adults living in the region and the rate of receiving health care. According to Turkish Statistical Institute's (TUIK) 2011 data, the population aged 65 years or above in Kayseri was 86,924^[12] (88% lived in urban areas) and it was aimed to reach 1/100 of this population (869 people). Each family physician registered an average of 3600 patients, about 10% of whom were older adults.

For the study, each family physician invited two older adult patients from both sexes and across age

groups (60–69, 70–79, and ≥ 80 years) to the FHC by phone. Written informed consent was obtained from the patients. Furthermore, the following questionnaires were administered: a form to capture participants' socio-demographic characteristics; a questionnaire regarding the use of toothbrushes, toothpaste, inter-dental brushes, floss, mouthwash, the status and frequency of going to the dentist, and the frequency of brushing teeth; and the Pittsburgh Sleep Quality Index (PSQI) scale. The questionnaires were completed through face-to-face interviews conducted by six interviewers—lecturers and research assistants who were trained in the subject.

Those aged ≥ 60 years and who had been living in Kayseri for at least 5 years were included in the study. The following set of people were excluded from the study: those who refused to participate in the study, those who had advanced physical and mental disability (i.e., malignancy, severe hearing loss, severe vision loss, and/or severe communication problems), and those with missing data in the questionnaire forms or scales. Mental disability and cognitive impairment were assessed using the Geriatric Depression Scale and Mini-Mental State Examination. Considering that alterations in cognitive and mental status may have a significant effect on oral health, community-dwelling older adults with high depressive scores or a low mental status were also excluded from the study population.

Aging is a physiologic process and can be defined as a decrease in adaptation to environmental factors in terms of biologic and psycho-social aspects. Although physical and mental losses begin to become apparent in late adulthood, prominent functions can be maintained within a relatively certain period of time. Although this limit is generally accepted as 65 years of age, it is taken as 60 years in some instances by some authors or institutions.^[13]

Oral health examination was performed by a specialist dentist. Gingival health, caries, tooth fillings, missing teeth, oral health profiles, use of prosthesis, and oral hygiene habits in the patients were evaluated and recorded using different methods as described below.

Oral Health Impact Profile-14-TR (OHIP-14-TR): Subjective oral health-related quality of life was evaluated using this scale, which has been validated for the Turkish population. The scale consists of 14 questions that examine seven dimensions (functional limitations; physical pain; psychological discomfort; physical, psychological, and social disability; and handicap) of individual perception with two questions for each dimension. Questions are given a score of 0–4. It is scored with the lowest 0 and the highest 56. High

scores are considered as impaired oral health-related quality of life.^[14]

Community Periodontal Index (CPI): Gingival health was evaluated using this scale, as recommended by the World Health Organization. A score of 0 is associated with healthy gingiva, while a higher CPI score implies impaired gingival health. CPI scores are evaluated as 1: gingival bleeding, 2: calculus and bleeding, 3: shallow periodontal pockets (pockets 4–5 mm), and 4: deep periodontal pockets (≥ 6 mm). A CPI score of 1 can improve with individual oral hygiene, scores 2 and 3 can improve with the help of a dentist, and a score of 4, which is the most severe, can only be improved with periodontal surgery.^[15] The types of prosthesis used in the participants were classified as none, fixed dentures, and removable dentures.

Pittsburgh Sleep Quality Index (PSQI): This scale evaluates sleep quality with questions asked in seven main topics, including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficacy, sleep disorders, use of sleep medication, and daytime dysfunction within the last month.^[16] These seven sub-scales measure different domains, and they are scored of 0–3 separately for each domain. A total of five points or above is considered as poor sleep quality. This index is also valid in Turkish.^[17]

Geriatric Depression Scale (GDS) was used for screening depressive mood. The scale was developed by Yesavage *et al.* in 1983, which consists of 30 items.^[18] The GDS was used for screening depressive mood. In the Turkish version the GDS, score 14 is accepted as the cut-off point for the Turkish older adults.^[19,20]

Mini-Mental State Examination (MMSE) was used to assess cognitive impairment. It was developed by Folstein and McHugh in 1975.^[21] The Turkish study about the validity and reliability of the MMSE was published in 2002.^[22] The maximum score of the test is 30 points. Cognitive impairment was defined as 24/30 in the illiterate and 25/30 in the literate for Turkish older adults.^[23]

Statistical analysis

The R 2.14.0 (www.r-project.org) program was used to evaluate the data. In descriptive statistical analysis, frequency and percentage distributions are given for categorical variables and mean and standard deviation values are presented for continuous variables. The Chi-square test was used in comparative analysis between oral health parameters and the PSQI. Binary logistic regression analysis was performed to identify the risk factors of poor sleep quality among oral health parameters that were considered to affect sleep quality. Spearman

correlation analysis was used in the comparisons of qualitative variables. In all comparisons, $P < 0.05$ was considered as significant. Confidence intervals of Spearman correlation coefficients were calculated using the bootstrap method. The number of bootstrap samples was set as 1000.

RESULTS

A total of 960 older adults were reached for the study. A total of 367 older individuals who met the inclusion criteria, completed the scales, and underwent oral health examinations were included in the study. Of those

Table 1: Comparison of sleep quality and oral health parameters in community-dwelling older adults

Variables	PSQI <4.99 n (%)	PSQI ≥ 5 n (%)	P
Categorical variables*			
Use of toothbrush	88 (75.2)	108 (76.6)	0.79
≤ 1	29 (24.8)	33 (23.4)	
> 1			
Use of toothpaste	45 (52.9)	96 (44.0)	0.04
Yes	16 (18.8)	122 (56.0)	
No			
To be examined by the dentist	84 (98.8)	217 (99.5)	0.21
Yes	1 (1.2)	1 (0.5)	
No			
Use of mouthwash	21 (24.7)	45 (20.6)	0.21
Yes	63 (75.3)	173 (79.4)	
No			
Use of interdental brush	9 (6.4)	2 (1.2)	0.03
Yes	131 (93.6)	160 (98.8)	
No			
Use of dental floss	21 (14.6)	23 (14.6)	0.78
Yes	123 (85.4)	135 (85.4)	
No			
The number of permanent teeth			
Toothless	26 (30.6)	88 (40.4)	0.50
1–19 teeth	59 (69.4)	130 (59.6)	
The presence of decayed teeth			0.58
Yes	35 (41.2)	142 (65.1)	
No	50 (58.8)	76 (34.9)	
Use of dental prosthesis	12 (14.1)	40 (18.5)	0.90
No	9 (10.6)	19 (8.8)	
Fixed denture	64 (75.3)	157 (72.7)	
Removable denture			
Periodontal status (CPI)	32 (37.6)	89 (40.8)	
Healthy	53 (62.4)	129 (59.2)	0.59
Unhealthy			
Continuous variables*			
OHIP-14-TR	7.1 (7.7)	12.7 (11.8)	0.005

Comparisons were done by χ^2 for categorical variables and t -test for continuous variables. Significant P -values are given in bold. *For each variable, missing values were omitted.

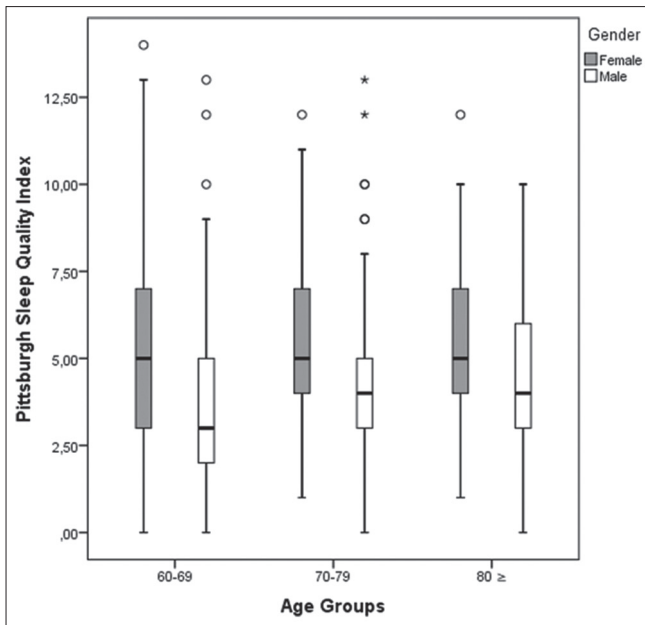


Figure 1: Comparison of PSQI score between female and male older adults for each age group

included, 140 (38.1%) were female and 227 (61.9%) were male. The participants' age ranged from 60 to 82 years, with a mean of 71.6 ± 5.7 years. The average age of the females was 71.1 ± 5.4 years, and the average age of males was 72.1 ± 5.8 years.

According to the PSQI, sleep quality was found to be impaired in more than half of the older adults (51.9%) (a PSQI score of 5 or above). Regarding the distribution of age groups, it was observed that the rates of poor sleep quality increased with age (48.4% between 60 and 64 years old, 53.1% between 65 and 74 years old, 59.3% between 75 and 84 years old, and 62.3% over 85 years old). Moreover, sleep quality was found to be more than 1.5 times poorer in females than in males [shown in Figure 1].

When evaluated in terms of oral hygiene, there was no significant difference between those with good and poor sleep quality in terms of frequency of brushing teeth, the frequency of going to dentists for examinations, and using mouthwash and floss, but there was a statistically significant difference between them regarding toothpaste and inter-dental brush use.

When evaluated in terms of oral health indicators, OHIP-14-TR scores were higher in patients with poor sleep quality. Increased scores reflect the subjective interpretation of older adults regarding the deterioration in their oral-dental health-related quality of life. A statistically significant relationship was found between poor sleep quality and high OHIP-14-TR scores [Table 1].

When the study group was evaluated in terms of the number of native teeth, it was seen that the

Table 2: Binary logistic regression analyses to determine risk factors in the older adult with poor sleep quality (PSQI ≥ 5)

Variables	OR	95.0% CI
Use of toothpaste		
Yes	1	0.457-1.117
No	0.71	
Use of interdental brush		
Yes	1	0.004-1.135
No	0.06	
OHIP-14-TR	1	1.043-1.096
	1.06	

OR=Odds ratio, CI=Confidence interval

Table 3: The correlations between total and subscale scores of PSQI and OHIP-14-TR and CPI

Variables	Correlations	
	OHIP-14-TR (95.0% CI)	CPI (95.0% CI)
PSQI Total score	0.355* (0.273-0.438)	-0.028 ((-0.127)-0.076)
PSQI Subscales		
Subjective sleep quality	0.259** (0.178-0.336)	-0.064* ((-0.157)-0.031)
Sleep latency	0.239** (0.157-0.321)	-0.052 ((-0.149)-0.041)
Sleep duration	0.013 ((-0.072)-0.103)	0.022 ((-0.068)-0.111)
Habitual sleep efficiency	-0.039 ((-0.077)-0.034)	-0.050 ((-0.094)-0.048)
Sleep disturbances	0.303** (0.222-0.389)	-0.007 ((-0.098)-0.084)
Use of sleeping medication	0.115* (0.031-0.188)	-0.075 ((-0.174)-0.023)
Daytime dysfunction	0.197** (0.111-0.287)	-0.052 ((-0.150)-0.047)

* $P < 0.05$ ** $P < 0.001$ CI=Confidence interval

vast majority of the older adults had no native teeth (38.9%), and only a few had more than 10 native teeth (8.2%). Among those with no native teeth, poor sleep quality was about 10% higher. When the effect of the number of native teeth and missing teeth on sleep quality was evaluated, there was no statistically significant difference between them and sleep quality [Table 1].

In the periodontal evaluation, CPI scores regarding diseased gingiva were similar between older adults with poor sleep quality and those with good sleep quality. In one-quarter of the older adults with poor sleep quality, the CPI scores were found to be compatible with advanced gingival disease. Although the periodontal status scores were higher in favor of diseased gingiva, this was not statistically significant in terms of sleep quality [Table 1].

The rate of older adults with no native teeth was 10% higher in older adults with poor sleep quality than

in those with good sleep quality. More than 80% of older adults with no native teeth were using fixed or removable dentures [Table 1].

In the binary logistic regression analysis conducted to evaluate the relationship between oral hygiene habits and oral health markers and sleep quality, OHIP-14-TR was found to be the most significant risk factor in terms of sleep quality (OR, 1.069, 95.0% CI: 1.043–1.096) [Table 2]. Additionally, we calculated the correlations between PSQI total, PSQI sub-scale, and oral health scores (OHIP-14-TR and CPI). The highest correlation was observed between the total PSQI scores. Among the sub-scales of the PSQI, the strongest correlations, albeit at a low level, were with the PSQI total score and subjective sleep quality, sleep latency, sleep disturbances, and daytime dysfunction [Table 3].

DISCUSSION

In this study, outcomes from older adults were compared with oral health status and sleep quality. The PSQI score cut-off of ≥ 5 was used to determine sleep disturbance. Not using an inter-dental toothbrush, not using a toothpaste, and having a high OHIP-14-TR score were determined as important parameters that negatively affected sleep quality.

Aging is defined as a permanent loss in vital functions and a decrease in the ability to adapt to environmental factors.^[24] The target for successful aging is age-related minimal loss of function in physiologic functions of sleep and circadian rhythm.^[25,26] Changes in the tissues surrounding the oral cavity due to aging disrupt sleep quality, leading to daytime sleepiness and decreased daytime performance. Examinations of older people by primary healthcare providers, geriatricians, and dentists with this perspective are of primary importance for maintaining sleep and quality of life because poor sleep quality will further reduce the daytime capacity of older adults. Early detection of systemic health-related negative conditions such as disturbances of oral health and sleep disturbances is important for correcting poor sleep and reducing associated co-morbidities.^[2,4] Early detection of systemic health-related adverse conditions through sleep clinics and dentistry consultations and oral health and sleep disorders in the older population will be important for improving poor sleep and reducing associated co-morbidities. The rapidly increasing older population and the increase in the expected life span further increase the importance of this issue.

Although sleep changes that occur with aging are noteworthy at all times, studies have focused mostly on general sleep disturbance; associated socio-demographic, hormonal, and endocrine effects; obstructive sleep

apnea; and prosthesis use.^[5,6,10] Systemic diseases and poorly made dentures, which affect the mouth tissues in older adults, often result in chewing disorders, causing older adults to consume soft foods. This can lead to bacterial plaque buildup and impairment of oral hygiene and health over time.^[5,10] Although these oral health problems are seen as threatening factors for sleep in older adults,^[2,6,9] in the Turkish population, there are no studies evaluating the relationship between sleep quality and such a large number of oral health indicators in active older adults.

The dependent variable in this study was a PSQI score ≥ 5 . The major measures used to assess the quality of oral health were OHIP-14-TR and CPI (quality of general oral health and assessment of the gingival health state, respectively). The demographics of community-dwelling older adults were also assessed in relation to sleep quality. The most prominent demographic characteristics interfering with sleep quality were advanced age and male sex. Since the average age of the sample was young-old adults, it may not be possible to comment on the old-old adults. It appears that more than half of the elderly had a disorder even in early adulthood based on the rate of the PSQI scores ≥ 5 . These findings are similar to those of other studies.^[9,10]

Significant interactions between sleep quality and oral health status (in the Chi-square analyses) were carried over to the logistic regression analyses. The oral healthcare interventions with significant interactions with low sleep quality were the use of toothpaste and inter-dental brushes. All the other oral healthcare interventions (i.e., use of a toothbrush, flossing, using mouthwash, examinations by a dentist, the number of existing natural teeth, and the use of dental prosthesis) had no interaction with poor sleep quality.

It is a fact that individuals with good oral health have less dental caries. A study published in 2018 showed that older adults with fewer than 10 teeth have higher risks for short and long sleep periods.^[27] In another study population, lack of sleep was associated with a high prevalence of periodontitis.^[28] Although the positive effects of mechanical oral health interventions on oral hygiene cannot be denied, it was found in our study that only the use of toothpaste and inter-dental brushes had statistically significant effects on sleep quality. The use of toothpaste and inter-dental brushes in oral care procedures shows that effective oral care is performed in terms of showing that this intervention positively affects oral health and sleep quality.^[29,30]

The interaction of the PSQI sub-scales and oral health status was also controlled via a correlation analysis. The highest correlation between poor sleep quality

and oral health status was with the PSQI total score and sub-scores of decreased subjective sleep quality, increased sleep latency, increased frequency of sleep disorders, and daytime sleep quality-related dysfunctions. Sleep is a complex phenomenon, and it is often difficult to objectively define and measure sleep quality. The precise elements that result in quality sleep can vary across individuals.^[16,31] Therefore, information about the relationship between oral health and the various PSQI sub-scales can help facilitate the management of sleep disorders. Thus, we conclude that in each dental consultation, the assessment of sleep quality may significantly contribute to the improved sleep health of older adults.

Although objective evaluation methods, which include multiple scales and dentist examinations, have been developed for the evaluation of oral health, the most important factor affecting sleep quality in our study was determined to be OHIP-14-TR. OHIP-14-TR is distinct from other questionnaires as the measure evaluates the oral health of older adults based on their own perception and by presenting its effect on the quality of life. This shows that even if the general assessment of oral hygiene and health has been objective, the most important component is the perception of the older adults themselves. This perception will positively affect the quality of sleep (and life) by providing older adults the opportunity to maintain their daily life activities and the ability to socialize.^[32]

This study has several strengths, including a large representative sample size, being the first epidemiological study to examine the relationship between oral health status and sleep quality in community-dwelling older adults in Turkey, and implementation of a full-mouth clinical periodontal examination protocol. Our study however has some limitations. The study mostly reflects the oral health and sleep relationship of young-old adults who may come to FHC. It does not provide information about the condition of the old-old adults. The cross-sectional design of our study is another limitation. Longitudinal cohort studies are required to confirm the findings of the current analysis and to explore potential causation.

Determining sleep quality and oral health status in community-dwelling older adults may contribute older adults' health care. Detecting the related factors of sleep quality may provide useful information to prevent and slow the progression of sleep disorders. Additional information about the relationship between the oral health and sleep quality can be used in our clinical practice for older adults' health. These points are important for dental consultations for older adults

presenting to sleep disorder clinics and for advising older adults at dental clinics about the potential risk of sleep disorders.

In conclusion, OHIP-14-TR may be a useful tool to employ in sleep disorder clinics for older people. Thus, we recommend dental consultations for older people admitted to sleep disorder clinics and recommend providing advice to older adults in dental clinics about the risk of possible sleep disorders.

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Conflicts of interest

There are no conflicts of interest.

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