



Evaluation of sleep quality in patients with tinnitus

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Abstract

Aim: Tinnitus occurs when a sound is detected in the ear in the absence of external auditory stimuli. It can impact daily activities, leading to issues with concentration, emotional distress, and sleep disturbances. The objective of this study is to examine the state of sleep quality in patients with tinnitus.

Materials and Methods: A total of 81 patients (42 females, 39 males) who presented to the clinic within the past six months and had experienced subjective tinnitus for at least six months were included in the study. The Tinnitus Handicap Index (THI), Pittsburgh Sleep Quality Index (PSQI), and Insomnia Severity Index (ISI) questionnaires were utilized.

Results: There was a moderate statistically correlation between THI and both PSQI ($r=0.411$; $p<0.001$) and ISI ($r=0.436$; $p=0.003$). Higher THI scores were associated with higher PSQI and ISI scores.

Conclusion: Assessing sleep quality is essential in the management of tinnitus, as it plays a role in managing tinnitus and improving the quality of life of those affected.



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Introduction

Tinnitus occurs when, in the absence of external auditory stimuli, a sound is detected in the ear. Individuals with tinnitus often report hearing nonspecific sounds such as ringing, buzzing, clicking, vibrations, and various other noises [1]. Objective tinnitus is less common and may be caused by vascular and muscular factors. Subjective tinnitus is observed more frequently. While no cause can be found in some cases of subjective tinnitus, it may be caused by metabolic disorders, otological, neurological, and psychogenic problems [2]. Subjective tinnitus is characterized as subjective because only the patient hears the sounds [3]. Tinnitus lasting longer than 3 months is defined as chronic [4]. The Tinnitus Handicap Index (THI) is crucial for assessing the severity of tinnitus and its effects on daily activities [5]. Tinnitus is often linked to symptoms like difficulty concentrating, emotional distress, and sleep disturbances, all of which contribute to a reduced quality of life for those affected [6]. It is possible that this situation may have an adverse effect on the individual's daily activities and general condition. The prevalence of insomnia in tinnitus patients ranges from 28.1% to 76% according to the literature [7]. Sleep quality is commonly

assessed through the application of the Pittsburgh Sleep Quality Index (PSQI) [8]. For patients experiencing poor sleep quality, the severity of insomnia can be assessed using the Insomnia Severity Index (ISI) questionnaire and its impact on the patient [9]. The presence of tinnitus can exacerbate sleep disturbances, and sleep disturbances can also contribute to the worsening of tinnitus. It is therefore crucial to examine the relationship between sleep disorders and tinnitus in order to plan effective treatments.

The objective of this study is to examine the state of sleep quality in patients with tinnitus.

Materials and Methods

Upon receiving approval from the local ethics committee (University of Health Sciences Kanuni Training and Research Hospital Clinical Research Ethics Committee, Decision number: 2021/107), lasting longer than 6 months of subjektif tinnitus patients visiting the Otorhinolaryngology Clinic within the last 6 months were included in the study. The patients were evaluated using the THI questionnaire, PSQI questionnaire and ISI questionnaire. Patients with objective tinnitus, under 18 years of age, pregnant, with unstable metabolic disease, unstable psychiatric disease, body mass index over 35 kg/m², sleep apnea syndrome or chronic otitis media were excluded from the study. The Turkish validated THI was employed to

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ascertain the severity of tinnitus. The questionnaire comprises 25 questions in Turkish, each of which is scored on a scale of 0 to 100. Responses are scored as "4," "2," and "0" for "yes," "sometimes," and "no," respectively. The impact of tinnitus on an individual's life was quantified by calculating a score out of 100. The results were classified according to the following score ranges: The severity of tinnitus-related impairment was classified as follows: Slight 0-16 score, mild 18-36 score, moderate 38-56 score, severe 58-76 score and catastrophic 78-100 score [10].

In order to assess sleep quality, a validated PSQI (Pittsburgh Sleep Quality Index) was employed in the Turkish context. The scale comprises 24 questions, including four Likert-type items. Nineteen self-report questions are answered by the patient, while five questions answered by a friend in the room or someone who witnessed her sleep are used, are not used in scoring. The scale evaluates seven sub-dimensions in the scored section: The subject is sleep regulation and its disorders, the use of combustible sleeping pills and disruption during daytime and work time, as well as distribution time, total sleep time, and individual sleep quality. The responses to each question are scored on a scale of 0 to 3. The total PSQI score is derived from the sum of the scores obtained from the seven components, with a possible range of values 0 to 21. Individuals scoring five or less are categorized as having "good" sleep quality, while those scoring higher than five are considered to have "poor" sleep quality [11].

The Turkish adaptation of the ISI (Insomnia Severity Index), conducted by Boysan et al., consists of seven Likert-type questions with four possible responses each. It assesses aspects such as difficulty falling asleep, staying asleep, and waking up too early, satisfaction with sleep, daytime impairment, and distress caused by sleep difficulties. Scores for each question range from 0 to 4. The total ISI score ranges from 0 to 28, categorizing insomnia severity as follows: The absence of clinically persistent insomnia is indicated by a score of 0 to 7, while subthreshold insomnia is indicated by a score of 8 to 14. Moderate insomnia is indicated by a score of 15 to 21, while severe insomnia is indicated by a score of 22 to 28 [12].

Statistical analysis

The data analysis for this research study was performed with the aid of the statistical software package SPSS 25.0. Descriptive analyses included reporting means with standard deviation values and medians with minimum-maximum values. The relationship between categorical variables were assessed using the chi-square test. Since the data did not conform to normal distribution, the Mann-Whitney U test and Kruskal Wallis H test were used to compare the measurement values between groups. The Spearman correlation test was utilized to examine correlations between variables. Statistical significance was determined at a p-value below 0.05.

Results

The study was completed with 81 participants, 42 women (51.9%) and 39 men (48.1%). The participants' ages ranged from a minimum of 20 to a maximum of 84 years,

with an average age of 55.2 ± 15.5 . There were 36 (44.4%) participants with PSQI below 5. THI was between 0-16 in 25.9% (n=21), between 18-36 in 17.3% (n=14), between 38-56 in 28.4% (n=23), between 58-76 in 13.6% (n=11) and between 78-100 in 14.8% (n=12) of the participants. When the ISI was analysed, there were 12 (26.7%) participants with no clinically significant insomnia, 18 (40.0%) with insomnia subthreshold, 12 (26.7%) with moderate severity insomnia and 3 (6.7%) with severe insomnia (Table 1).

Table 1. Distribution of characteristics of the participants.

		Number(n)	Percent (%)
Gender	Female	42	51.9
	Male	39	48.1
Tinnitus Handicap Index	0-16	21	25.9
	18-36	14	17.3
	38-56	23	28.4
	58-76	11	13.6
	78-100	12	14.8
Pittsburgh Sleep Quality Index	≤5	36	44.4
	>5	45	55.6
Insomnia Severity Index (n=45)	0-7	12	26.7
	8-14	18	40.0
	15-21	12	26.7
	22-28	3	6.7
		Mean±SD	Medium (min-max)
	Age	55.2 ±15.5	57 (20-84)

No statistically significant relationship was found between gender and age variables and THI, PSQI, and ISI ($p > 0.05$) (Tables 2-3). When evaluating the correlation between the indices, a moderately statistically significant positive correlation was observed between THI and both PSQI ($r = 0.411$; $p < 0.001$) and ISI ($r = 0.436$; $p = 0.003$). As THI scores increased, both PSQI and ISI scores also increased (Table 4).

Discussion

The aim of our study is to investigate the state of sleep quality in patients with tinnitus. Our data indicate a significant correlation between tinnitus severity and sleep quality. Our results demonstrate that higher THI scores correlate significantly with poorer sleep quality as indicated by elevated PSQI scores. When we evaluated the severity of insomnia in patients with poor sleep quality, we found that insomnia severity increased as tinnitus severity increased. A review of the quality of life in individuals with chronic subjective tinnitus indicates a negative correlation between the severity of tinnitus and quality of life [13]. Considering the significant physical and psychological impairment experienced by tinnitus patients and the direct and indirect costs to the healthcare system, tinnitus is an important public health problem [14]. According to our findings, sleep disturbances should be assessed when evaluating patients with tinnitus and treatment should be

Table 2. The relationship between gender and THI, PSQI, ISI.

		Gender				Statistical analysis (p value)*
		Female		Male		
		Number (n)	Percent (%)	Number (n)	Percent (%)	
Tinnitus Handicap Index	0-16	14	33.3	7	17.9	0.058
	18-36	9	21.4	5	12.8	
	38-56	8	19.0	15	38.5	
	58-76	3	7.1	8	20.5	
	78-100	8	19.0	4	10.3	
Pittsburgh Sleep Quality Index	≤5	19	45.2	17	43.6	0.881
	>5	23	54.8	22	56.4	
Insomnia Severity Index (n=45)	0-7	7	30.4	5	22.7	0.886
	8-14	9	39.1	9	40.9	
	15-21	6	26.1	6	27.3	
	22-28	1	4.3	2	9.1	

* Chi-square test. THI: Tinnitus handicap index, PSQI: Pittsburgh Sleep Quality Index, ISI: Insomnia Severity Index.

Table 3. The relationship between age and THI, PSQI, ISI.

		Age		Statistical analysis (p value)*
		Median (IQR)	95% CI (Lower-Upper)	
Tinnitus Handicap Index	0-16	57 (51-62)	53-62	0.073 ^a
	18-36	51 (43-66)	43-66	
	38-56	50 (39-60)	41-60	
	58-76	66 (53-76)	53-76	
	78-100	67 (46.5-74.5)	43-75	
Pittsburgh Sleep Quality Index	≤5	54 (43.5-64)	51-60	0.408 ^b
	>5	59 (43-70)	50-64	
Insomnia Severity Index (n=45)	0-7	57 (49-61.5)	48-62	0.927 ^a
	8-14	59.5 (40-72)	43-70	
	15-21	56.5 (41.5-71)	41-72	
	22-28	64 (50-68)	50-68	

IQR:Interquartile Range, ^aKruskal Wallis H test, ^bMann Whitney U test. THI: Tinnitus handicap index, PSQI: Pittsburgh Sleep Quality Index, ISI: Insomnia Severity Index.

Table 4. Correlation relationship between THI and PSQI, ISI.

	Tinnitus Handicap Index	
Pittsburgh Sleep Quality Index	r	0.411
	p	<0.001
Insomnia Severity Index	r	0.436
	p	0.003

Spearman korelasyon testi. THI: Tinnitus handicap index, PSQI: Pittsburgh Sleep Quality Index, ISI: Insomnia Severity Index.

planned accordingly. We believe that this approach will both improve patients' quality of life and reduce the cost of treating tinnitus. Teixeira et al. demonstrated that patients with tinnitus often experience poor sleep quality and insufficient sleep depth [15]. I A study by Asplund indicated a higher prevalence of sleep disturbances among patients with tinnitus [16].

Sleep disturbances may exacerbate tinnitus and trigger intolerance by influencing the autonomic nervous system and activating the limbic and sympathetic systems, thereby creating a stress factor [17,18]. This mechanism explains that the relationship between insomnia and tinnitus can be bidirectional, meaning they may trigger each other. Eysel-Gosepath et al.'s study demonstrated that treating sleep disturbances was beneficial for tinnitus [19].

Sleep disturbances at night cause daytime sleepiness. Tinnitus intolerance has been shown to be more prominent in patients with both sleep disturbances and tinnitus [19]. In the study by Folmer et al., patients with tinnitus were compared between those without sleep disorders and those with sleep disorders, tinnitus symptoms were worse in patients with sleep disorders [20]. Li et al. found that daytime sleepiness and tinnitus severity increased in patients experiencing poor sleep quality [2]. While sleep complaints are prevalent among patients with tinnitus, the evaluation of these patients in terms of sleep disorders may be over-

looked during treatment planning. Studies in the literature evaluating the effects of melatonin and antidepressants have shown that these drugs have been shown to improve insomnia symptoms and alleviate tinnitus severity [21,22]. A review and meta-analysis examining the effect melatonin treatment for tinnitus demonstrated that melatonin treatment contributed to an improvement in tinnitus severity [23]. It is an expected finding that treatment for sleep disorders will improve the severity of tinnitus. Therefore, tinnitus patients should be evaluated in detail in terms of sleep disorders and treated accordingly. Maintaining sleep hygiene, using soothing sounds while falling asleep, and establishing a regular bedtime routine are very important in alleviating tinnitus complaints. Individual behavioral therapy can also be used in patients with sleep disorders and may help change patients' responses to tinnitus symptoms [24]. Tinnitus patients experiencing improved sleep quality will contribute to the improvement of activities of daily living.

Limitations of our study include hearing loss not assessed, its cross-sectional design and the potential impact of disease duration is not known since the duration of tinnitus was not taken into consideration. Further clarification of the relationship between sleep and tinnitus is warranted by planning prospective studies on this subject. In addition, subjective questionnaires were used to evaluate tinnitus and sleep. Objective methods should be used in future studies to obtain clearer results. Future research should explore how tinnitus and sleep disturbances affect the autonomic nervous system and neurotransmitter oscillations, informing the development of treatment strategies.

Conclusion

Our study shows that sleep quality is impaired in patients with chronic subjective tinnitus and that the severity of insomnia increases with the severity of tinnitus. This highlights the importance of investigating sleep disorders in the management of tinnitus in order to improve patients' quality of life. We therefore emphasise the need for a multidisciplinary approach involving psychiatrists, psychologists, neurologists and ENT specialists in treatment planning.

Ethical approval

Ethical approval was obtained for this study from the Clinical Research Ethics Committee of the University of Health Sciences Kanuni Training and Research Hospital (Decision no: 2021/107).

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