







## An evaluation of the relationship between subjective tinnitus perception and COVID-19-related psychological factors

### *Subjektif tinnitus algısının COVID-19'a ilişkin psikolojik faktörler ile ilişkisinin değerlendirilmesi*

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### ABSTRACT

**Aim:** This study aimed to examine the relationship of tinnitus loudness, annoyance and handicap in tinnitus patients with the level of coronavirus-related anxiety, psychological distress, and fear. It was also aimed to evaluate the effects of insomnia severity and social and emotional loneliness perception on tinnitus in the pandemic period.

**Materials and Methods:** A total of 112 patients over the age of 18 who were followed up in two centers with the diagnosis of chronic subjective tinnitus were included in the study. During the pandemic, the data were collected using the following tools via Google Forms: Demographic Information Form, Visual Analogue Scale (VAS) for tinnitus loudness and annoyance, the Tinnitus Handicap Inventory (THI), Coronavirus Anxiety Scale (CAS), Fear of COVID Scale (FCVS-T), COVID-19 related Psychological Distress Scale (CORPD), Insomnia Severity Index (ISI), and Social and Emotional Loneliness Scale (SELSA-S).

**Results:** A weak positive correlation was found between CAS score and VAS for tinnitus loudness and annoyance, FCVS-T, ISI, Selsa-S total scores; between FCVS-T score and VAS for annoyance, CORPD, ISI scores; and, between CORPD and THI, ISI scores ( $p < 0.05$ ). There was a significant positive correlation between VAS and Selsa-S "social loneliness" sub-dimension scale, THI scores ( $p < 0.05$ ).

**Conclusion:** Psychological support should not be neglected in the management of tinnitus patients in the pandemic period, and tinnitus patients should be followed closely, since the increase in psychological factors and the perceived loneliness level and the severity of insomnia in the pandemic cause a worsening in the perception of tinnitus.

**Keywords:** Tinnitus, psychological factors, insomnia, loneliness, pandemic.

### ÖZ

**Amaç:** Bu çalışmanın amacı, pandemi sürecinde kronik subjektif tinnitus hastalarında tinnitus gürlüğü, tinnitusun yarattığı sıkıntı ve engellilik algısının koronavirüse ilişkin anksiyete, psikolojik sıkıntı ve korku düzeyi ile ilişkisini incelemek ve bu süreçte uykusuzluk şiddeti, sosyal ve duygusal yalnızlık algısı değişkenlerinin tinitusa etkisini değerlendirmektir.

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**Gereç ve Yöntem:** Kronik tinnitus tanısıyla İki merkezde takip edilen 18 yaş üstü toplam 112 hastaya pandemi sürecinde Google Forms aracılığıyla demografik bilgi formu, Vizüel Analog Skala (VAS) for tinnitus loudness and annoyance, Tinnitus Engellilik Envanteri (THI), Koronavirüs Anksiyete Ölçeği (CAS), Koronavirüs Korku Ölçeği (FCVS-T), COVID-19 Psikolojik Sıkıntı Ölçeği (CORPD), Uykusuzluk Şiddeti İndeksi (ISI) ve SELSA-S Sosyal ve Duygusal Yalnızlık Ölçeği uygulanmıştır.

**Bulgular:** CAS puanı ile "VAS for tinnitus loudness and annoyance", FCVS-T, ISI, Selsa-S toplam puanları arasında; FCVS-T puanı ile VAS for annoyance, CORPD ve ISI puanları arasında; CORPD puanı ile THI ve ISI puanları arasında pozitif yönde düşük düzeyde anlamlı korelasyon saptanmıştır ( $p<0,05$ ). VAS ile Selsa-S sosyal yalnızlık alt boyut ölçek ve THI puanları arasında pozitif yönde anlamlı ilişki vardır ( $p<0,05$ ).

**Sonuç:** Pandemide psikolojik faktörlerde ve algılanan yalnızlık düzeyi ile uykusuzluk şiddetindeki artış tinnitus algısında kötüleşme yarattığı için, bu süreçte hastaların yönetiminde psikolojik destek ihmal edilmemeli ve hastalar yakın takipte olmalıdır.

**Anahtar Sözcükler:** Tinnitus, psikolojik faktörler, insomnia, yalnızlık, pandemi.

## INTRODUCTION

Public health authorities have been obliged to take exceptional steps to prevent the spread of infection due to the COVID-19 pandemic (1). Many countries have imposed social distancing restrictions and encouraged individuals to stay at home as much as possible because of the person-to-person transmission of COVID-19 (2). With the social isolation imposed on people, the pandemic was expected to cause serious psychological tension and trigger various psychological problems (3). In Vindegaard and Benros's systematic review study, an increase in depression and anxiety levels and a decrease in psychological well-being were detected during the pandemic period, and data supporting this outcome was obtained (4).

Tinnitus, which is the perception of sound without a sound stimulus in the environment, is a very common condition in the society. Its prevalence was reported as 25.3% (5). The sense of sound in the ear or head that does not come from a sound source in the environment outside of the body, inside the body (such as vascular noises), or auditory hallucinations brought on by mental illness is known as subjective tinnitus (6). Sensory deprivation secondary to cortical reorganization and cochlear dysfunction is considered to be the most common causes of subjective tinnitus (7). When this condition lasts for at least six months, it is called chronic tinnitus. Tinnitus may also increase in relation to the physiological response of the individual to this perceived sound. Tinnitus was found to be associated with emotional distress, depressive symptoms, anxiety, and insomnia (8). There are few research investigating how the COVID-19

epidemic has affected people's subjective perceptions of tinnitus (2, 3, 9-12). In studies, changes in lifestyle such as social isolation, emotional states, insomnia, financial concerns during the pandemic period exacerbated the tinnitus complaint of people and caused these issues to be perceived as more disturbing.

The aim of our study was to examine the relationship between tinnitus loudness, annoyance and handicap in chronic subjective tinnitus patients during the pandemic period with the level of anxiety, psychological distress, and fear related to coronavirus, and to evaluate the effects of insomnia severity and social and emotional loneliness perception on tinnitus in this period.

## MATERIALS and METHODS

This study was carried out in the ENT clinics of two university hospitals between March and July 2021. Ethical approval was obtained for the study from the Medical Ethics Committee of Ege University (Decision Date: 18.02.2021, Decision No: 21-2.1T/32) and COVID-19 study approval was obtained from the Turkish Ministry of Health (Approval Date: 06.02.2021, Approval Code: 2021-02-02T20\_24\_39).

The sample size of this study was determined using power analysis. The sample size was computed as 111 with an effect size of 0.30, a margin of error of 0.05, a confidence level of 0.95, and a population representation of 0.95 using the G\*power 3.1 tool. As a result, a total of 112 participants from two centers took part in the study.

The clinical files of the patients who were followed up with the diagnosis of subjective

tinnitus in both clinics between February 2018 and February 2020 and who met the inclusion criteria were scanned and these patients were contacted by phone. All participants who volunteered were included in the study, which is a non-probability sampling method.

Individuals who were literate in Turkish and over the age of 18 and presented to these clinics for at least six months with the complaint of subjective tinnitus before the pandemic, had no problems with accessing the internet were included in the study. Patients with a history of middle ear pathology and/or previous ear surgery and chronic disease, diagnosed with psychiatric or neurological disease, and diagnosed with objective or new-onset tinnitus were excluded from the study.

The patients were informed about the study via telephone, and the informed consent form created in Google Forms and the link containing the questions were sent to those who volunteered to participate in the study via e-mail. After these patients gave consent to participate in the study via the link, they were able to answer demographic information, questions about the COVID-19 pandemic, and scale questions in three stages via the same link. Participants primarily answered socio-demographic questions such as age, gender, socio-economic level, occupation, as well as questions about chronic disease, hearing loss, and tinnitus complaints (hearing loss and hearing aid use status, tinnitus duration). In the second stage, the participants answered questions about the COVID-19 pandemic period (such as average sleep time at night for the last two weeks, its effect on the perception of tinnitus loudness and annoyance, COVID-19 diagnosis status, increase in tinnitus loudness after covid-19 diagnosis). In the third stage, the participants answered the scale questions.

The perception levels of tinnitus loudness and annoyance during the COVID-19 pandemic process were evaluated using the Visual Analogue Scale (VAS), scoring between 1 (no increase in tinnitus loudness, no increase in tinnitus annoyance) and 10 (excessive increase in tinnitus loudness, extreme tinnitus annoyance).

*Tinnitus Handicap Inventory (THI)*: Tinnitus Handicap Inventory is a 25-question questionnaire developed by Newman. It was translated into Turkish by Aksoy et al. and its validity and reliability study was conducted (13). It

evaluates the emotional, catastrophic, and functional effects of tinnitus and measures its effect on patients' daily functions. There are 25 items in the inventory consisting of three options as 'yes', 'no', and 'sometimes'. A 'Yes' answer is 4 points and a 'No' answer is 0 points. A maximum of 100 points can be obtained. A THI score ranging from 0 to 16 means "slight handicap", while a score between 18 and 36 indicates a "mild level of handicap". A score falling within the range of 38 to 56 suggests a "moderate level of handicap", whereas a score between 58 and 76 indicates a "severe level of handicap". Finally, a THI score ranging from 78 to 100 is classified as a "catastrophic level of handicap" (13).

*Coronavirus Anxiety Scale (CAS)*: It is a scale developed to assess anxiety related to the COVID-19 pandemic and adapted into Turkish by Evren et al (14). It consists of 5 items. Each item in the scale is scored from 0 to 4 based on experiences in the previous 2 weeks. A total score of 0-20 is taken from the scale, and the total score obtained shows the increase in dysfunctional anxiety associated with coronavirus. In Evren et al.'s study, the cutoff point was not assessed (14).

*Coronavirus Fear Scale (FCVS-T)*: It is a 5-point Likert-type scale, which was adapted into Turkish by Haktanır et al. (15) and consists of 7 items about fear of coronavirus. A total score of 7-35 is taken from the scale. As the total score obtained from the scale increases, the level of fear of coronavirus increases (15).

*COVID-19 Psychological Distress Scale (CORPD)*: It was adapted into Turkish by Ay et al (16). It evaluates psychological distress related to COVID-19 in twelve 5-point Likert type items (1-strongly disagree, 5-strongly agree). The score range is 12-60, and a high score means that there is a high level of psychological distress related to COVID-19 (16).

*Insomnia Severity Index (ISI)*: It is a scale that assesses the areas of difficulty falling asleep, difficulty staying asleep, difficulty waking up early in the morning, satisfaction with sleep patterns, disruptions to daily functionality, detectability of sleep-related disruptions, and stress level brought on by sleep issues in order to determine the severity of insomnia. It consists of 7 items in total. Boysan et al. conducted the Turkish validity and reliability study (17). A score of 0-7 on the scale indicates clinically insignificant insomnia; 8-14 indicates the lower threshold of insomnia; 15-

21 indicates clinical insomnia (moderate); and, 22-28 indicates clinical insomnia (severe) (17).

**Social and Emotional Loneliness Scale (SELSA-S):** It is a scale that evaluates the perceived loneliness in adults with emotional and social loneliness sub-dimensions (18). It consists of 15 items in total. A 7-point Likert-type scale with a range of 1 (strongly disagree) to 7 (strongly agree) determines the degree to which each statement on the scale is perceived by the person. The scale's lowest possible score is 15, and its greatest possible score is 105. There is no cutoff point for Akgul's study (18).

### Statistical Analysis

Data analysis was carried out with the SPSS (Statistical Program in Social Sciences) 25 program. The Kolmogorov-Smirnov test was used to determine if the study's data fit a normal distribution. For comparison tests, a significance

level (p) of 0.05 was chosen. With non-parametric test techniques, the analysis was carried out since the variables did not have a normal distribution ( $p > 0.05$ ). Due to the lack of a normalcy assumption, comparisons between independent pairs were done using the Mann Whitney U test. The Kruskal Wallis test was performed for comparisons in multiple independent groups. The study's variables did not have a normal distribution; thus Spearman's rank correlation coefficient was applied. The reliability analysis of the scales was determined using the Cronbach's coefficient.

### RESULTS

A total of 112 people, 58 women and 54 men, participated in this study. Demographic information about the participants is given in Table-1 in detail.

**Table-1.** Demographic variables.

Variable	Groups	Frequency	Percent
Gender	Female	58	51,8
	Male	54	48,2
Tinnitus Side	Right	25	22,3
	Left	33	29,5
	Bilateral	54	48,2
Hearing Loss	Yes	65	58,0
	No	47	42,0
Hearing Loss Side	Right	13	11,6
	Left	18	16,1
	Bilateral	34	30,4
	HL (-)	47	41,9
Hearing Loss Type	Sensorineural	65	58,0
	HL (-)	47	42,0
Hearing Aid Use	No	55	49,1
	Yes	10	8,9
	No HL	47	42,0
Total		112	100,0

**Table-2.** Descriptive statistics and reliability analyses regarding the scale scores.

Variable	Cronbach alfa	Mean $\pm$ sd	Min - Max
CAS	0,817	1,27 $\pm$ 2,55	0 - 13
FCVS-T	0,886	16,17 $\pm$ 6,16	7 - 34
CORPD	0,806	38,26 $\pm$ 12,75	12 - 110
THI	0,951	51,29 $\pm$ 27,43	4 - 96
ISI	0,958	9,11 $\pm$ 6,23	0 - 25
Selsa-S Social Loneliness		13,16 $\pm$ 7,06	5 - 35
Selsa-S Emotional Loneliness	0,713	9,86 $\pm$ 6,54	5 - 33
Selsa-S Total		38,84 $\pm$ 18,14	15 - 88

sd; standart deviation

**Table-3.** Comparison of variables for CAS, FCVS-T, CORPD, THI ve ISI Scores.

Variables	Groups	CAS		FCVS-T		CORPD		THI		ISI	
		Mean ± sd	M (Min - Max)	Mean ± sd	M (Min - Max)	Mean ± sd	M (Min - Max)	Mean ± sd	M (Min - Max)	Mean ± sd	M (Min - Max)
Gender	Female	1,43 ± 2,49	0(0-9)	17,71 ± 6,21	18(7-34)	40,22 ± 9,88	42(12-60)	52,81 ± 27,96	52(8-96)	9,19 ± 6,3	10(0-25)
	Male	1,09 ± 2,63	0(0-13)	14,52 ± 5,71	14(7-27)	36,15 ± 15,06	36(12-110)	49,67 ± 27,02	47(4-96)	9,02 ± 6,21	8,5(0-24)
	Test <sup>a</sup>	1364,000		1100,000		1180,000		1458,000		1531,000	
	p	0,144		0,006		0,024		0,529		0,838	
Tinnitus Side	Right	1,68 ± 2,5	0(0-9)	17,8 ± 6,76	19(7-27)	39,8 ± 11,94	42(12-60)	51,88 ± 28,25	52(8-96)	8,48 ± 5,92	9(0-22)
	Left	1,42 ± 2,61	0(0-8)	15,82 ± 6,85	14(7-34)	36,55 ± 12,24	35(12-59)	50,97 ± 28,43	46(8-96)	9,09 ± 6,7	8(0-25)
	Bilateral	0,98 ± 2,56	0(0-13)	15,63 ± 5,37	15,5(7-29)	38,59 ± 13,51	39,5(12-110)	51,22 ± 26,95	49(4-96)	9,41 ± 6,16	9(1-24)
	Test <sup>b</sup>	5,073		2,832		0,860		0,011		0,294	
	p	0,079		0,243		0,651		0,995		0,863	
Hearing Loss	Yes	1 ± 1,94	0(0-8)	15,74 ± 5,4	15(7-26)	38,17 ± 10,66	41(12-60)	54,32 ± 27,41	52(8-96)	8,83 ± 6,1	9(0-25)
	No	1,64 ± 3,2	0(0-13)	16,77 ± 7,1	16(7-34)	38,38 ± 15,31	37(16-110)	47,11 ± 27,18	46(4-96)	9,49 ± 6,45	9(0-24)
	Test <sup>a</sup>	1437,000		1400,500		1452,500		1297,500		1424,000	
	p	0,508		0,452		0,658		0,175		0,541	
HL Side	Right	1,31 ± 2,02	0(0-6)	16,69 ± 6,28	18(7-24)	38,92 ± 13,34	39(12-60)	52,85 ± 29,05	47(10-96)	7,23 ± 5,12	6(0-18)
	Left	0,94 ± 2,1	0(0-8)	15,89 ± 6,07	14(7-26)	39,33 ± 11,22	40(12-59)	49,89 ± 27,38	48(8-96)	9,78 ± 6,97	9,5(0-25)
	Bilateral	0,91 ± 1,88	0(0-6)	15,29 ± 4,76	14(7-26)	37,26 ± 9,43	41(12-48)	57,24 ± 27,28	61(14-96)	8,94 ± 6,01	9(1-24)
	Test <sup>b</sup>	0,882		0,973		0,187		0,644		1,103	
	p	0,643		0,615		0,911		0,725		0,576	
COVID-19 Diagnosis Status	No	1,2 ± 2,38	0(0-9)	16,01 ± 6,26	15(7-34)	38,05 ± 12,91	37(12-110)	48,54 ± 27,49	46(4-96)	8,76 ± 6,31	8(0-25)
	Yes	1,52 ± 3,14	0(0-13)	16,72 ± 5,89	18(7-25)	39 ± 12,41	42(12-60)	60,88 ± 25,47	64(6-96)	10,32 ± 5,89	11(1-24)
	Test <sup>a</sup>	1009,500		976,500		941,500		804,000		909,500	
	p	0,499		0,436		0,307		0,047		0,213	

sd; standart deviation, M; Median, Test<sup>a</sup>; test value of Mann Whitney, Test<sup>b</sup>; test value of Kruskal Wallis, \*p<0,05; there is a statistically significant difference between the groups.

The mean age of the participants was 46.45 years. Participants had tinnitus complaints for an average of 44.28 months, and 25 patients were diagnosed with COVID-19 an average of 7.68 months ago. 44% of the 25 patients diagnosed with COVID-19 answered 'yes' to the question of whether they experienced an increase in tinnitus loudness after diagnosis. The average sleep time of the participants at night for the previous two weeks was 6.57 hours. During the pandemic, the patients stated that the tinnitus loudness on VAS was 3.09 on average and tinnitus annoyance was 3.89 on average.

Descriptive statistics and reliability analyses regarding the scale scores in the study are in Table-2.

There was no statistically significant difference in the participants' CAS, FCVS-T, CORPD, THI, and ISI scores according to their tinnitus side, hearing loss, hearing loss side in those with hearing loss, and COVID-19 diagnosis status (p>0.05). Results from FCVS-T and CORPD revealed statistically significant gender differences (p<0.05) (Table-3).

The scale scores of the Selsa-S total and sub-dimensions in the participants did not differ statistically significantly according to gender, tinnitus side, hearing loss side in those with hearing loss, and COVID-19 diagnosis status (p>0.05). The scale scores of the Selsa-S total and sub-dimensions in the participants showed a statistically significant difference according to the state of hearing loss (p<0.05) (Table-4).

**Table 4.** Comparison of variables according to SELSA-S and sub-dimension scores

Variables	Groups	Social Loneliness		Emotional Loneliness		SELSA-S Total	
		Mean ± sd	M (Min - Max)	Mean ± sd	M (Min - Max)	Mean ± sd	M (Min - Max)
Gender	Female	13,14 ± 7,63	11(5-35)	9,03 ± 5,27	7(5-31)	38,81 ± 17,98	35(15-88)
	Male	13,19 ± 6,45	13(5-26)	10,74 ± 7,63	7,5(5-33)	38,87 ± 18,47	35,5(15-84)
	Test <sup>a</sup>	1521,000		1436,500		1565,000	
	p	0,793		0,437		0,995	
Tinnitus Side	Right	12,44 ± 6,32	11(5-24)	9,64 ± 4,74	9(5-23)	39,24 ± 16,12	41(15-71)
	Left	13,27 ± 7,71	10(5-34)	10,21 ± 7,71	7(5-31)	41,33 ± 19,45	35(15-88)
	Bilateral	13,43 ± 7,06	12(5-35)	9,74 ± 6,59	7(5-33)	37,13 ± 18,33	34,5(15-84)
	Test <sup>b</sup>	0,160		0,629		1,246	
	p	0,923		0,730		0,536	
Hearing Loss	Yes	14,45 ± 6,85	13(5-34)	11,66 ± 7,64	9(5-33)	42,86 ± 18,92	41(15-88)
	No	11,38 ± 7,02	9(5-35)	7,36 ± 3,34	6(5-18)	33,28 ± 15,54	30(15-71)
	Test <sup>a</sup>	<b>1062,500</b>		<b>1011,000</b>		<b>1061,000</b>	
	p	<b>0,006*</b>		<b>0,002*</b>		<b>0,006*</b>	
HL Side	Right	11,92 ± 5,94	11(5-23)	10,08 ± 5,63	9(5-23)	36,62 ± 15,51	41(16-69)
	Left	14 ± 7,81	10,5(5-30)	9,72 ± 6,97	6,5(5-31)	41,67 ± 18,97	35(19-88)
	Bilateral	15,65 ± 6,53	16,5(5-34)	13,29 ± 8,42	11(5-33)	45,88 ± 19,89	47,5(15-84)
	Test <sup>b</sup>	2,977		2,964		2,060	
	p	0,226		0,227		0,357	
COVID-19 Diagnosis Status	No	13,2 ± 7	11(5-35)	9,99 ± 6,71	7(5-33)	38,84 ± 17,69	36(15-88)
	Yes	13,04 ± 7,4	11(5-26)	9,4 ± 6,04	7(5-29)	38,84 ± 20,01	34(15-75)
	Test <sup>a</sup>	1048,500		1050,000		1065,500	
	p	0,785		0,787		0,878	

sd; standart deviation, M; Median, Test<sup>a</sup>; test value of Mann Whitney, Test<sup>b</sup>; test value of Kruskal Wallis, \*p<0,05; there is a statistically significant difference between the groups.

**Table-5.** Examining the relationships between scale scores and demographic variables

Variables	CAS	FCVS-T	CORPD	THI	ISI	Social Loneliness	Emotional Loneliness	Selsa-S Total	
Age	r	<b>-0,239</b>	0,121	0,124	-0,018	-0,079	-0,033	0,074	0,006
	p	<b>0,011*</b>	0,202	0,192	0,850	0,409	0,732	0,438	0,953
Tinnitus Duration (Month)	r	-0,136	-0,078	-0,054	-0,134	-0,093	0,029	0,109	0,019
	p	0,154	0,411	0,572	0,159	0,332	0,758	0,252	0,841
CAS	r		<b>0,348</b>	0,168	0,146	<b>0,215</b>	0,144	<b>0,263</b>	<b>0,297</b>
	p		<b>0,001*</b>	0,077	0,124	<b>0,023*</b>	0,131	<b>0,005*</b>	<b>0,038*</b>
FCVS-T	r			<b>0,337</b>	0,128	<b>0,208</b>	0,153	0,041	0,065
	p			<b>0,001*</b>	0,178	<b>0,028*</b>	0,107	0,671	0,499
CORPD	r				<b>0,210</b>	<b>0,201</b>	-0,104	-0,162	-0,114
	p				<b>0,026*</b>	<b>0,034*</b>	0,274	0,088	0,231
THI	r					<b>0,384</b>	0,178	0,074	0,098
	p					<b>0,001*</b>	0,060	0,437	0,304
ISI	r						<b>0,296</b>	0,089	<b>0,296</b>
	p						<b>0,038*</b>	0,352	<b>0,039*</b>

r; spearman correlation coefficient, \*p<0,05; there is a statistically significant relationship between the groups

**Table-6.** Examining the relationship between VAS and demographic variables

Variables	r/p	VAS Loudness	VAS Annoyance
Age	r	-0,155	-0,097
	p	0,103	0,308
Tinnitus Duration (Month)	r	0,100	-0,031
	p	0,294	0,747
CAS	r	<b>0,295</b>	<b>0,312</b>
	p	<b>0,002*</b>	<b>0,001*</b>
FCVS-T	r	0,171	<b>0,240</b>
	p	0,072	<b>0,011*</b>
CORPD	r	0,172	<b>0,235</b>
	p	0,070	<b>0,013*</b>
THI	r	<b>0,415</b>	<b>0,548</b>
	p	<b>&lt;0,001*</b>	<b>&lt;0,001*</b>
ISI	r	<b>0,246</b>	<b>0,288</b>
	p	<b>0,009</b>	<b>0,002*</b>
Selsa- S Social Loneliness	r	<b>0,234</b>	<b>0,236</b>
	p	<b>0,013*</b>	<b>0,012*</b>
Selsa-S Emotional Loneliness	r	-0,018	-0,009
	p	0,851	0,927
Selsa-S Total	r	0,107	0,146
	p	0,261	0,125
VAS Loudness	r		<b>0,791</b>
	p		<b>&lt;0,001*</b>

r; spearman correlation coefficient, \*p<0,05; there is a statistically significant relationship between the groups

The results regarding the correlation between age, tinnitus duration, and scale scores are in (Table-5). There was a weak negative significant correlation between the age variable and the CAS score (p<0.05). There was a weak significant positive correlation between CAS score and FCVS-T, ISI, Selsa-S total, and Emotional Loneliness sub-dimension scores; between the FCVS-T score and the CORPD and ISI scores; between the CORPD score and the THI and ISI scores; between the THI and the ISI scores; and between ISI scores, Selsa-S total, and Social loneliness sub-dimension scale scores (p<0.05) (Table-5).

There was a weak positive correlation between VAS for tinnitus loudness and CAS, ISI, and social loneliness scores; and, there was a statistically significant moderate positive correlation between VAS for tinnitus loudness and THI scores (p<0.05). There was a weak positive correlation between the VAS for tinnitus annoyance and the CAS, FCVS-T, CORPD, ISI, and Selsa-S social loneliness subscale scores; a moderately significant positive correlation between the VAS for tinnitus annoyance and THI scores; and a statistically significant positive high correlation between the VAS for tinnitus

annoyance and the VAS for tinnitus loudness (p<0.05) (Table-6).

## DISCUSSION

In this study, the relationship of tinnitus loudness, annoyance and handicap with the level of anxiety, psychological distress, and fear related to the pandemic was examined; and the correlation of the severity of insomnia and perceived loneliness level of the patients with these variables was also examined in a total of 112 chronic subjective tinnitus patients followed in two clinics.

In our study, the increase in the perception of tinnitus loudness and tinnitus annoyance during the pandemic period was evaluated with VAS scoring. Participants yielded an average of 3.09 points out of 10 regarding the increase in the perception of tinnitus loudness during the pandemic and an average of 3.89 points regarding the increase in the perception of being disturbed by tinnitus. The mean THI score was 51.29. According to this result, the patients had a moderate level of disability perception. Although the increase in VAS scores was not apparent, a moderate positive correlation was obtained with

THI scores. In addition, a high level of positive correlation was found between VAS loudness and annoyance scores. Accordingly, it can be said that tinnitus increases the perception of disability in daily life and psychosocial functions, as the level of discomfort from tinnitus and the perception of tinnitus loudness increase during the pandemic period. The study by Beukes et al. concluded that lifestyle changes imposed by the pandemic were one of the factors that worsened tinnitus in one-third of respondents. Since most of the participants lived in a town or city, they stated that the pandemic was a quieter experience than they were used to, and this may be a factor that changed the tinnitus experience and made the tinnitus perception more prominent (2). In the study of Anzivivo et al., a moderate level of tinnitus disability perception was found in more than half of the patients (62.5%) similar to our study (19). They suggested that during home isolation (lockdowns), the lack of background noise may have made tinnitus more noticeable. They also emphasized that susceptibility to anxiety and stress during the pandemic may be included as other potential risk factors regarding worsening tinnitus. In the study of Fioretti et al., it was stated that 77.5% of the patients had increased tinnitus complaints due to stress (10).

In our study, 25 participants stated that they were diagnosed with COVID-19. The participants diagnosed with COVID-19 were asked if they experienced an increase in tinnitus loudness following their diagnosis. 44% of 25 participants diagnosed with COVID-19 described an increase in tinnitus loudness after diagnosis. In studies in the literature, it has been reported that tinnitus exacerbates after COVID-19 infection in 24.3% to 40% of people with tinnitus (2, 12, 20). These results can be considered compatible with the findings of our study. In our study, the factors related to the increase in perceived tinnitus loudness after COVID-19 infection may have been stemmed from the exposure to viral infection and stress factors. Damages in the peripheral auditory system due to viral infections can occur by directly affecting structures such as the Organ of Corti, stria vascularis, or spiral ganglion, or by activating the patient's immune system against the virus (21). Along with viral infections, physical, mental, and metabolic stress factors can also affect the inner ear by affecting the immune system, causing the release of cytokines and reactive oxygen radicals (22).

In the study of Schlee et al., a significant relationship was found between "pandemic stress questions" which are related to feelings of grief, disappointment, irritability and stress and the tinnitus scales; as the scores obtained from the questions increased, the scores obtained from the tinnitus scales also increased (3). According to Aydođan et al., tinnitus patients' stressed, worried, and pessimistic moods were linked to higher THI and VAS (tinnitus loudness and tinnitus annoyance level) scores (9). They suggested that a stressful, anxious, and pessimistic mood during the pandemic may trigger tinnitus. In our study, similar to the literature, a significant increase was found in the level of tinnitus disability as the level of psychological distress related to COVID-19 increased. In addition, the increase in the level of VAS tinnitus annoyance during the pandemic was associated with the increase in psychological distress related to the pandemic. In addition, a weak positive significant correlation was found in our study between VAS for tinnitus loudness, tinnitus annoyance and the level of dysfunctional anxiety associated with coronavirus. Xia et al. found that the increase in THI scores after the pandemic lockdown was partially related to the increase in anxiety scores (11). In addition, it was determined that providing only educational counseling to tinnitus patients in this period caused an increase in the level of anxiety, and therefore, it made it difficult to manage tinnitus as the feeling of anxiety increased tinnitus. Therefore, they emphasized that if stress is not managed well in the pandemic, it can significantly increase the severity of tinnitus and the level of associated anxiety. Both this study and our findings are important in confirming the causal role of anxiety on tinnitus during the pandemic period. Beukes et al. reported that 32% of the participants found tinnitus to be more disturbing due to fears and limitations related to COVID-19 (2). In our study, however, no significant relationship was found between the level of fear of coronavirus and tinnitus variables. On the other hand, as the level of fear increased, anxiety and psychological distress related to the coronavirus increased. Beukes et al. emphasized that the increase in anxiety and frustration due to various reasons such as having problems in relationships due to lockdown, issues related to food supply, and the anxiety related to catching the virus also increased the level of discomfort with tinnitus, and also that the anxiety of catching



the virus can trigger fear avoidance behavior (2). Therefore, it is inevitable that the increase in the levels of fear, anxiety, and psychological distress related to the pandemic is related to each other in our study.

In our study, no relationship was found between tinnitus duration and psychological factors. This result shows that tinnitus loudness, annoyance, and handicap may increase with worsening in psychological factors associated with the pandemic, independent of the duration of chronic tinnitus.

In the literature, the effects of psychological factors on tinnitus during the pandemic period have been interpreted by comparing them with general psychological scales and the scores obtained in the pre-pandemic period (2, 3, 9-11). In our study, scales that directly evaluate the psychological factors related to the COVID-19 period were used. In this sense, although our study showed a significant and partial relationship between psychological factors and tinnitus variables in the pandemic, adding the group with newly on-set tinnitus complaints in the pandemic could have helped us to understand this relationship and the effect of the pandemic process more clearly.

In the study of Beukes et al., the majority of patients with tinnitus reported lower sleep quality, more sleep problems, more frequent night waking, and less rest, which were significantly associated with worsening tinnitus (2). In the literature, it is reported that most of the individuals who experience tinnitus often experience sleep disturbance, concentration difficulties or psychiatric disorders, especially depression and anxiety (23). In our study, the mean ISI score of the participants was 9.11, which corresponds to mild insomnia. In our study, a weak positive significant correlation was found between the scores of psychological factors related to COVID-19, tinnitus handicap level, VAS tinnitus loudness, VAS tinnitus annoyance, and insomnia severity level. Accordingly, as the fear of the pandemic, anxiety, psychological distress factors, and tinnitus handicap, loudness and annoyance level increase, insomnia-related problems such as difficulty in sleeping, maintaining sleep, and sleep satisfaction also increase partially. It was suggested that focusing on the treatment of sleep disorders may also be beneficial in reducing the anxiety of patients, since not treating tinnitus symptoms or not

responding to psychosomatic problems in a timely manner may lead to a vicious cycle of tinnitus-sleep disorders-anxiety (24).

In our study, a significant correlation was found between VAS for tinnitus loudness and VAS for tinnitus annoyance scores and social loneliness subscale scores of the Selsa-S scale. Social loneliness is called a type of loneliness that occurs when a person lacks a social network (18). Beukes et al. found that more than half of the participants with tinnitus felt lonely during the pandemic process, and those who reported it this way were perceived as more disturbing. As explained by one of the participants in their study, "spending a lot of time alone has made me more aware of tinnitus", they stated that their experience of loneliness may have increased during the pandemic due to the lockdown measures implemented at that time (2). Our study is in line with that of Beukes et al (2). Especially during the pandemic period, it is possible to see a significant increase in the level of social loneliness in our findings, rather than emotional loneliness scores due to lockdown and social isolation in Turkey. In addition, as the level of dysfunctional anxiety associated with coronavirus increased in our study, there was a significant and low increase in SELSA-S total and emotional loneliness subscale scores. In the literature, social distance and isolation have been found to result in more negative psychological effects. Beukes et al. emphasized that despite the participants' desire for social interaction, the observance of social distancing and isolation rules may cause the participants to have less social interaction and feel lonelier, and thus, tinnitus may have worsened (2). In our study, as the severity of insomnia increased, SELSA-S total and social loneliness subscale scores also increased. Studies in the literature have determined that increased anxiety, depression, and perceived loneliness are important causes of poor sleep quality in the pandemic (25). Researchers have hypothesized that there are various factors effective in this outcome. Accordingly, it is that insomnia disrupts daytime functioning and therefore may affect individuals' motivation and/or their ability to relate to others and form meaningful social connections. Also, individuals with insomnia may show an increased response to possible daily stressors that can increase responses to interpersonal conflicts or reduce their resources to deal with interpersonal needs. People may experience a greater need for

social support as a result of this (26). Last but not the least, the proportion of participants with hearing loss in our study was 58%. The scores obtained from the Selsa-S total and social and emotional loneliness subscales of the participants with hearing loss were found to be higher than the participants without hearing loss. Similarly, in the study of Littlejohn et al., a significant correlation was observed between the greater hearing difficulties reported by individuals over the age of 70 and the increase in depression, loneliness, and cognitive dysfunction reported by individuals in the pandemic (27). They suggested the reason for this as the increasing levels of loneliness brought about by mandatory social distancing. These results show us that social isolation during the pandemic may have an effect on increasing the perceived emotional and social loneliness level in adults with hearing loss. In our study, no significant difference was found in all other scales in terms of hearing loss. This shows us that regardless of hearing loss, patients with tinnitus may be affected by psychological factors related to the pandemic process.

Tinnitus was substantially more unpleasant for women and young people under 50 during the pandemic, according to Beukes et al. (2). Fioretti et al., on the other hand, found that the depression and anxiety scores of female patients with tinnitus increased (10). This has been suggested to be related to more significant lifestyle changes made during the epidemic, such as changes in work for these groups and an increase in childcare and household duties (2). Similarly, in our study, women had significantly higher scores on psychological factors related to COVID-19. Concerns about COVID-19 have also been found to increase as age decreases.

#### **Limitations**

Our study has some limitations. The first of these is the lack of a chance to compare changes related to tinnitus, loneliness perception, insomnia, and psychological factors before and after the pandemic. In addition, groups with newly

on-set tinnitus complaints during the pandemic or due to COVID-19 infection were not included in the study. Another limitation is demographic information on hearing loss based on the results of objective and subjective evaluations made in two clinics before the pandemic. The degree of hearing loss in the pandemic and the perception of tinnitus frequency and loudness of the patients could not be determined objectively and face to face. Due to the closure and social isolation measures in the pandemic, intensive measures were taken in clinics in Turkey, and the number of patients presenting themselves to clinics has decreased. Therefore, patients were reached by telephone. After determining whether they met the inclusion criteria or not as a result of patient file analysis and telephone interviews, they were able to answer the questions via the internet link. Another limitation is that the participants, especially those who had problems with accessing the Internet, were not included in our study. Last limitation is that there was no control group including participants who have not any health problems. Therefore, it was not possible to compare psychological factors related to covid-19 between control and experimental groups.

#### **CONCLUSION**

It was found in the present study that the increase in the psychological factors related to the coronavirus was associated with an increase in the perception of tinnitus loudness, annoyance, and handicap. It was also found that the severity of insomnia and perceived loneliness were the factors that worsened this situation. Although the restrictions have been relaxed in Turkey as well as the rest of the world, these factors that increase the perception of tinnitus should be taken into consideration in the clinical follow-up and treatment of tinnitus patients. In this process, psychological support should not be neglected in the management of patients and patients should be followed closely.

**Conflicts of interest:** Authors declared no conflict of interest.

#### **References**

1. Shrivastava SR, Shrivastava PS. COVID-19 and impairment of mental health: public health perspective. *Afr Health Sci.* 2021;21(4):1527-32.
2. Beukes EW, Baguley DM, Jacquemin L, et al. Changes in Tinnitus Experiences During the COVID-19 Pandemic. *Front Public Health.* 2020; 8:592878.
3. Schlee W, Hølleland S, Bulla J, et al. The Effect of Environmental Stressors on Tinnitus: A Prospective Longitudinal Study on the Impact of the COVID-19 Pandemic. *J Clin Med.* 2020;9(9):2756.

4. Vindegaard N, Benros ME. COVID-19 pandemic and mental health consequences: Systematic review of the current evidence. *Brain Behav Immun*. 2020; 89:531-42.
5. Bhatt JM, Bhattacharyya N, Lin HW. Relationships between tinnitus and the prevalence of anxiety and depression. *Laryngoscope*. 2017;127(2):466-9.
6. Baguley D, McFerran D, Hall D. Tinnitus. *Lancet*. 2013;382(9904):1600-7.
7. Shore SE, Roberts LE, Langguth B. Maladaptive plasticity in tinnitus--triggers, mechanisms and treatment. *Nat Rev Neurol*. 2016;12(3):150-60.
8. Henry JA. "Measurement" of Tinnitus. *Otol Neurotol*. 2016;37(8): e276-e285.
9. Aydođan Z, Çınar Satekin M, Ocak E, Tokgoz Yılmaz S. Effects of the coronavirus disease 2019 pandemic on subjective tinnitus perception. *J Laryngol Otol*. 2022;136(5):410-3.
10. Fioretti A, Natalini E, Triggianese G, et al. Impact of the COVID-19 Lockdown on Patients with Chronic Tinnitus-Preliminary Results. *Audiol Res*. 2022;12(3):327-36.
11. Xia L, He G, Feng Y, et al. COVID-19 associated anxiety enhances tinnitus. *PLoS One* Published online Feb 5, 2021. doi:10.1371/journal.pone.0246328
12. Erinc M, Mutlu A, Celik S, Kalciođlu MT, Szczepek AJ. Long-Term Effects of COVID-19 and the Pandemic on Tinnitus Patients. *Front Neurol*. 2022;13:921173.
13. Aksoy S, Firat Y, Alpar R. The Tinnitus Handicap Inventory: a study of validity and reliability. *Int Tinnitus J*. 2007;13(2):94-98.
14. Evren C, Evren B, Dalbudak E, Topcu M, Kutlu N. Measuring anxiety related to COVID-19: A Turkish validation study of the Coronavirus Anxiety Scale. *Death Stud*. 2022;46(5):1052-8.
15. Haktanir A, Seki T, Dilmaç B. Adaptation and evaluation of Turkish version of the fear of COVID-19 Scale. *Death Stud*. 2022;46(3):719-27.
16. Ay T, Oruç D, Özdođru AA. Adaptation and evaluation of COVID-19 related Psychological Distress Scale Turkish form. *Death Stud*. 2022;46(3):560-8.
17. Boysan, M., Güleç, M., Beşirođlu, L., & Kalafat, T., (2010). Psychometric properties of the insomnia severity index in Turkish sample. *Alpha Psychiatry* 2010; 11: 248-52.
18. Akgül, H. Adapting Social and Emotional Loneliness Scale(Selsa-S) to Turkish Culture: Relevance and Reliability. *Yalova Sosyal Bilimler Dergisi* 2020; 10(21): 54-69.
19. Anzivino R, Sciancalepore PI, Petrone P, D'Elia A, Petrone D, Quaranta N. Tinnitus revival during COVID-19 lockdown: how to deal with it? *Eur Arch Otorhinolaryngol*. 2021;278(1):295-6.
20. Figueiredo RR, Penido NO, de Azevedo AA, et al. Tinnitus emerging in the context of a COVID-19 infection seems not to differ in its characteristics from tinnitus unrelated to COVID-19. *Front Neurol*. 2022;13:974179.
21. Abramovich S, Prasher DK. Electrocochleography and brain-stem potentials in Ramsay Hunt syndrome. *Arch Otolaryngol Head Neck Surg*. 1986;112(9):925-8.
22. Merchant SN, Durand ML, Adams JC. Sudden deafness: is it viral?. *ORL J Otorhinolaryngol Relat Spec*. 2008;70(1):52-62.
23. Gu H, Kong W, Yin H, Zheng Y. Prevalence of sleep impairment in patients with tinnitus: a systematic review and single-arm meta-analysis. *Eur Arch Otorhinolaryngol*. 2022;279(5):2211-21.
24. Wang S, Cha X, Li F, et al. Associations between sleep disorders and anxiety in patients with tinnitus: A cross-sectional study. *Front Psychol*. 2022;13:963148.
25. Bakul F, Heanoy EZ. Impact of COVID-19 anxiety on loneliness and sleep quality of students and professionals in Bangladesh. *Acta Psychol (Amst)*. 2022;230:103759.
26. Hom MA, Hames JL, Bodell LP, et al. Investigating insomnia as a cross-sectional and longitudinal predictor of loneliness: Findings from six samples. *Psychiatry Res*. 2017;253:116-28.
27. Littlejohn J, Venneri A, Marsden A, Plack CJ. Self-reported hearing difficulties are associated with loneliness, depression and cognitive dysfunction during the COVID-19 pandemic. *Int J Audiol*. 2022;61(2):97-101.