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## Survey to Assess the Impact of the COVID-19 Pandemic on Tinnitus Perception

### COVID-19 Pandemisinin Tinnitus Algısı Üzerindeki Etkisinin Değerlendirilmesi

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#### ABSTRACT

**Objective:** This study aimed to evaluate the effect of coronavirus disease-2019 (COVID-19) on the perception of tinnitus in the population.

**Methods:** A web-based Google survey was performed between May and April 2020, and 1895 volunteers answered questions mainly related to demographic data, daily lifestyle during the pandemic, aural problems, and the presence of tinnitus. Participants with tinnitus were further evaluated using a visual analog scale (VAS) and Tinnitus Handicap Inventory (THI).

**Results:** Of 1895 participants, 184 (9.4%) had tinnitus. Of 184 participants with tinnitus, 64.7% had tinnitus onset before the pandemic, whereas 35.3% had tinnitus onset after the pandemic. There was no significant difference between the parameters of the participants who had no tinnitus and those who had tinnitus onset before and after the pandemic ( $p>0.05$ ). There was no significant difference between the THI results of the participants with tinnitus onset before and after the pandemic ( $p>0.05$ ). The VAS scores of the participants with tinnitus onset after the pandemic were higher than those of the participants with tinnitus onset before the pandemic ( $p<0.05$ ). The participants who had a tinnitus onset before the pandemic described alterations in their tinnitus perception as increased, decreased and unchanged tinnitus perception in 28.8%, 13.4% and 57.8%, respectively.

**Conclusion:** Because of this study, we observed that the COVID-19 pandemic did not increase tinnitus and tinnitus-related problems. However, because of the life-threatening risks that come with the pandemic, people may not consider the effects of tinnitus as a primary problem.

**Keywords:** COVID-19, perception, SARS-CoV-2, survey, tinnitus

#### ÖZ

**Amaç:** Bu çalışma ile toplumda koronavirüs hastalığı-2019'un (COVID-19) tinnitus algısına etkisinin değerlendirilmesi amaçlanmıştır.

**Yöntemler:** Mayıs ve Nisan 2020 arasında web tabanlı bir Google anketi yapıldı ve 1895 gönüllü, temel olarak demografik veriler, pandemi sırasında günlük yaşam tarzı ve kulak sorunları ile kulak çınlaması varlığı ile ilgili soruları yanıtladı. Kulak çınlaması olan katılımcılar visual analog skala (VAS) ve Tinnitus Handikap Envanteri (THI) ile ayrıca değerlendirildi.

**Bulgular:** Bin sekiz yüz doksan beş katılımcının 184'ünde (%9,4) tinnitus vardı. Tinnituslu 184 katılımcının %64,7'sinde tinnitus pandemiden önce, %35,3'ünde ise pandemiden sonra tinnitus başlamıştır. Kulak çınlaması olmayan ve pandemi öncesi ve sonrasında tinnitus başlayan katılımcıların parametreleri arasında anlamlı fark bulunmadı ( $p>0,05$ ). Pandemi öncesi ve sonrası tinnitus başlangıcı olan katılımcıların THI sonuçları arasında anlamlı fark bulunmadı ( $p>0,05$ ). Pandemi sonrası tinnitus başlayan katılımcıların VAS skorları, tinnitus pandemi sonrası başlayanlara göre daha yüksekti ( $p<0,05$ ). Pandemi öncesi tinnitus başlangıcı olan katılımcılar tinnitus algısındaki değişiklikleri sırasıyla %28,8, %13,4 ve %57,8 oranında artmış, azalmış ve değişmemiş tinnitus algısı olarak tanımlandılar.

**Sonuç:** Bu çalışma sonucunda COVID-19 pandemisinin kulak çınlaması ve kulak çınlamasına bağlı problemlerde artışa yol açmadığını gözlemledik. Ancak pandemi ile birlikte gelen hayatı tehdit eden riskler nedeniyle insanlar kulak çınlamasının etkilerini birincil sorun olarak görmeyebilirler.

**Anahtar Sözcükler:** COVID-19, algı, SARS-CoV-2, anket, tinnitus

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## INTRODUCTION

Tinnitus can be defined as the conscious perception of an auditory sensation in the absence of acoustic stimuli, with a prevalence of 8-15% in adults (1). Tinnitus can be associated with various conditions such as hearing impairment, noise exposure, ototoxicity, and head and neck trauma (2-4). Emotional factors and stress play a role in tinnitus (5,6). Symptoms such as frustration, annoyance, irritability, anxiety, depression, hyperacusis, insomnia, and concentration difficulties are also associated with the perception of tinnitus (7-9).

An increased prevalence of psychological distress in the population was reported during epidemic quarantine (10-13). Mask use is another phenomenon that enters our life during this period. Mask use reduces the air quality down because of the pressure on the nose and increase of the carbon dioxide in ventilated air. Both social shortages and mask use have negative effects on human psychology, which may cause anxiety and depression related to tinnitus etiology.

Coronavirus disease-2019 (COVID-19) dependent tinnitus cases and increased tinnitus perception were also defined in previous studies (14-18). Tinnitus severity increased by 40%, remained unchanged by 54%, and decreased by 6% because of the effects of social distinction and loneliness experience on tinnitus perception during the pandemic (10). It is possible that different populations may react differently to pandemic conditions (19). Several health questionnaires are available to assess the effects of tinnitus. The Tinnitus Handicap Inventory (THI) is the one that is mostly used worldwide. It has been translated into Turkish by (20). The validity and reliability of the study have been confirmed (Cronbach's alpha coefficient 0.88) (20).

In this study, we created a survey form to assess the effects of COVID-19-related pandemic lifestyle changes on tinnitus perception. In addition, we aimed to compare the discomfort levels of patients with tinnitus onset before and during the COVID-19 pandemic.

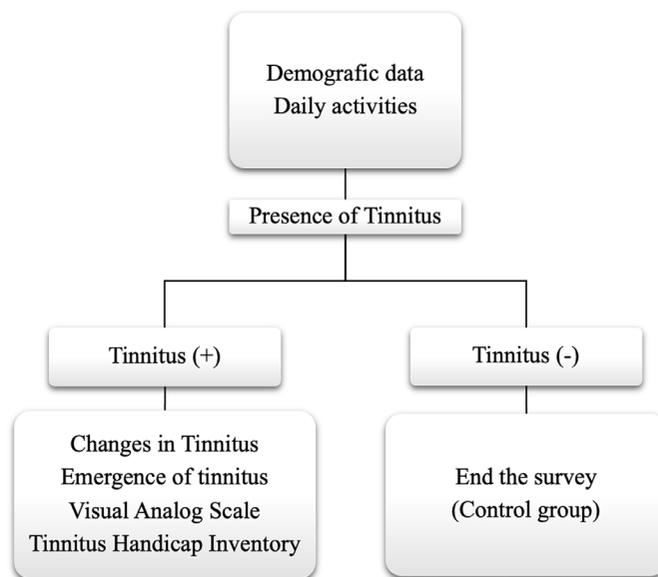
## MATERIALS AND METHODS

To evaluate tinnitus perception and pandemic-related changes in the population, the study was designed as a descriptive cross-sectional model. A Web-based Google Survey was conducted between April and May 2020 after obtaining ethical approval from İstanbul Medipol University (approval number: 525, date: 25.06.2020). Data from 1,337 female and 558 male patients with tinnitus were assessed. The patients were 18-70 years of age. All volunteers read and approved the informed consent before starting the survey. A total of 1895 volunteers were accepted to answer questions that were mainly related to demographic data, daily lifestyle during the pandemic, aural problems, and the presence of tinnitus.

The "Google Survey" application was used to obtain the survey data, and the answers of the participants were recorded. Answering the questions took a total of 5-7 minutes.

The flow chart is shown in Table 1. In the first part of the survey, which consists of three main parts, the daily life activities of the participants during the pandemic period and the presence of tinnitus were questioned. Participants with tinnitus completed the second and third parts of the questionnaire. For the participants without

**Table 1.** Survey flow chart



tinnitus, the questionnaire ended in the first part. The participants who had tinnitus were further evaluated with a second part of the survey, which included questions related to changes in tinnitus severity or the emergence of tinnitus since the beginning of the pandemic and a visual analog scale (VAS). Six main problem areas (discomfort level before and during pandemic, sleep disturbance, concentration problems, general comfort and hearing problems) for the patients evaluated with VAS. All the VAS questions were evaluated as 0 points means no and 10 points means very severe.

The third part of the questionnaire included the THI. Participants with tinnitus were also asked to complete the THI, which included 25 questions with a score range of 0 to 100. Accordingly, reactions to tinnitus were graded as slight (grade 1), mild (grade 2), moderate (grade 3), severe (grade 4), and catastrophic (grade 5) when the THI scores ranged between (0 to 16), (18 to 36), (38 to 56), (58 to 76) and (78 to 100), respectively (20).

### Statistical Analysis

The Statistical Package for Social Sciences version 23.0 was used for quantitative analysis. Descriptive data were evaluated. Chi-square and Spearman correlation coefficient tests were used to assess correlations. Paired samples t-test was used to compare the VAS scores between "tinnitus onset before" and "tinnitus onset after" in the evaluation of the tinnitus discomfort effect of the participants.

## RESULTS

Of 1895 participants, 184 (9.4%) had tinnitus complaints. Of 184 participants with tinnitus, 64.7% had tinnitus onset before the pandemic, whereas 35.3% had tinnitus onset after the pandemic. There was no significant difference between the demographic, lifestyle, and mask usage parameters of the participants who had no tinnitus and those who had tinnitus onset before and after the pandemic ( $p > 0.05$ ) (Table 2). There was no significant difference between the THI results of the participants with tinnitus onset

**Table 2.** Survey responses of participants with and without tinnitus

Questions	Parameters	Non-tinnitus (%)	Tinnitus onset before the pandemic (%)	Tinnitus onset after the pandemic (%)	p
Age (years)	18 to 30	45.5	45.2	45.9	>0.05
	30 to 50	54.5	54.8	54.1	
Gender	Man	47.2	48.7	44.3	
	Woman	57.8	51.3	55.7	
How many days did you go out in the last 2 months?	<10	27.3	21.7	37.7	
	10 to 20	26.7	29.6	21.3	
	21 to 30	13.6	16.5	8.2	
	>30	32.4	32.2	32.8	
How many hours do you go out a day?	0 to 2	40.3	34.8	50.8	
	2 to 4	17.6	20.9	11.5	
	4 to 6	42.0	44.3	37.7	
	>6	-	-	-	
Do you have a known disease?	COVID-19	0.6	-	1.6	
	Other	12.5	12.2	13.1	
	None	51.7	47.8	59.0	
	Cardiac	2.3	1.7	3.3	
	Otologic	17.0	20.9	9.8	
	Neurologic	2.3	3.5	-	
	Endocrine	13.6	13.9	13.1	
How many hours did you wear a mask per day in the last 2 months?	<1 h	24.4	22.6	27.9	
	1 to 4 h	36.4	36.5	36.1	
	4 to 8 h	17.0	18.3	14.8	
	>8 h	19.9	20.0	19.7	
What type of mask do you wear?	Surgical	69.9	71.3	67.2	
	Other (cloths etc.)	25.0	21.7	31.1	
	N95	5.1	7.0	1.6	
Do you have nasal congestion?	No	59.7	55.7	67.2	
	Bilateral	12.5	13.9	9.8	
	Unilateral	27.8	30.5	23	
Do you have allergic rhinitis?	Yes	35.8	40.0	27.9	
	No	64.2	60.0	72.1	
Do you have a hearing loss?	Bilateral	10.8	8.7	14.8	
	No	69.3	71.3	65.6	
	Unilateral	19.9	20	19.6	
Do you experience pain or discharge in your ear?	Bilateral	8.5	7.8	9.8	
	No	82.4	86.1	75.4	
	Unilateral	9.1	6.1	14.8	

before and after the pandemic ( $p>0.05$ ) (Table 3).

Participants with post-pandemic tinnitus had higher VAS scores than those with pre-pandemic tinnitus ( $p<0.05$ ) (Figure 1). The participants who had a tinnitus onset before the pandemic described alterations in their tinnitus perception as increased, decreased and unchanged tinnitus perception in 28.8%, 13.4% and 57.8%, respectively (Figure 2). The tinnitus characteristics of the participants who complained of

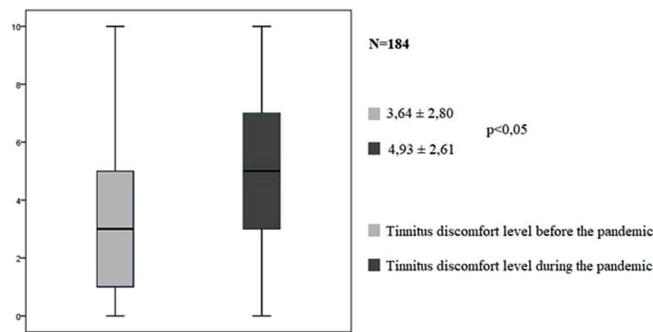
tinnitus in the last 2 months are shown in Figure 3.

## DISCUSSION

Tinnitus was reported in 9.4% of the population in our study, and tinnitus onset occurred after the pandemic in one-third of them. These rates seem within acceptable ranges since tinnitus can affect up to 30% of the adult population (21). Psychosocial stress

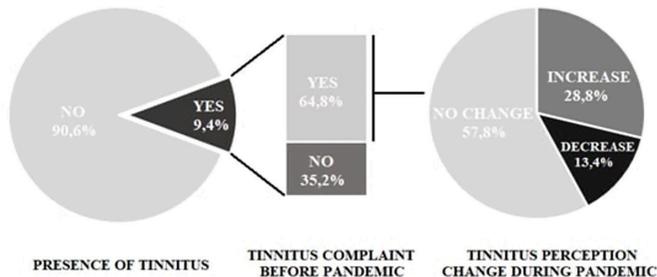
**Table 3.** Tinnitus Handicap Inventory results of participants with tinnitus onset before and after the pandemic

Grade	Tinnitus onset before the pandemic, n (%)	Tinnitus onset after the pandemic, n (%)	p
1	4 (3.3)	1 (1.5)	>0.05
2	16 (13.5)	10 (15.3)	
3	78 (65.5)	41 (63)	
4	7 (5.9)	3 (4.6)	
5	14 (11.8)	10 (15.3)	
Total	119 (100)	65 (100)	

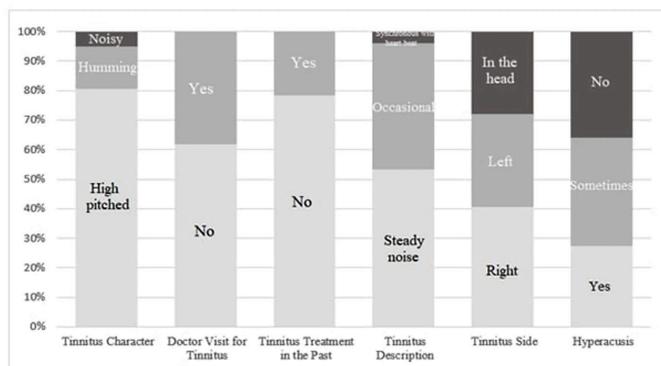


**Figure 1.** Total VAS scores of participants with tinnitus onset before and after the pandemic.

VAS: Visual analog scale.



**Figure 2.** Tinnitus perception change in people with tinnitus onset after pandemic.



**Figure 3.** General features related to tinnitus.

can trigger tinnitus according to epidemiological studies (22,23). We believe that although the initial period of the pandemic was a stressful state, it was associated with the occurrence of tinnitus. Our study covers a 2-month period after the pandemic life conditions begin. Further studies should evaluate the long-term effects of the pandemic on the onset of tinnitus.

Personality, different coping abilities, cognitive characteristics, and stress may affect tinnitus perception (24,25). There is a linear correlation between tinnitus and the duration and magnitude of stress (23). According to a national study in the UK, tinnitus is moderately and severely annoying in 2.8% and 1.6% of people and severely affects daily life in 0.5% of people (26). In studies, it was observed that there was a significant difference between VAS and THI scores before and during the pandemic, and it was determined that the 2019 coronavirus disease pandemic negatively affected tinnitus perceptions and quality of life (27). These results were also supported by other studies performed in different countries (28-30). Hence, psychological stress increased in the population during quarantine could increase the perception of tinnitus severity (7-10,16). An increase in the THI scores of the participants was also reported during the pandemic (31). It was reported that tinnitus severity was mostly unchanged in 54% or decreased in 6% of the people during the pandemic (10).

The primary purpose of this study was to investigate the effect of stress on the perception of tinnitus, which occurs because of the isolation of people during the COVID-19 pandemic. Despite this, it has been shown that COVID-19 disease can cause tinnitus perception depending on the effect it has on the central nervous system and auditory mechanisms (32,33). In our study, some of the participants may have had a perception of tinnitus after these effects; however, due to the lack of PCR results of these patients, the patients could not be fully evaluated in this respect. Patients in this group need to be evaluated in more detail.

A small proportion of the participants in the study had unilateral or bilateral earaches. Earache and discharge are often associated with external auditory canal and middle ear pathologies. These pathologies also can cause tinnitus. Especially during the pandemic period, the rate of unilateral ear discharge increases up to 14.8% in patients with tinnitus. These patients should be evaluated in terms of external ear canal and middle ear pathologies.

**Study Limitations**

However, there is no such opportunity within the scope of the study, and this appears to be a limitation of the study. According to the results of this study, the THI scores of the participants with tinnitus onset before and after the pandemic were similar, although an increase in VAS scores was encountered. Accordingly, it is plausible to say that although people could have experienced increased tinnitus discomfort during the pandemic, that discomfort may have been neglected because of the presence of a life-threatening condition, COVID-19.

**CONCLUSION**

As a result of this study, we observed that the short-term effects of the changes that come with the sudden change in the daily life conditions of the people affected by the COVID-19 pandemic do not lead to an increase in tinnitus or problems related to tinnitus.

Because of the life-threatening risks that come with the pandemic, people may not see the effects of tinnitus as a primary problem. This study covers a short-term effect that needs to be supported by studies that will show the long-term consequences.

### Ethics

**Ethics Committee Approval:** Approval was granted by the Ethics Committee of İstanbul Medipol University (approval number: 525, date: 25.06.2020).

**Informed Consent:** All volunteers read and approved the informed consent before starting the survey.

### Authorship Contributions

Concept: O.Y., H.D., Y.A.B., Design: O.Y., H.D., Y.A.B., Data Collection or Processing: O.Y., H.Y., B.Ö.M., D.B., Analysis or Interpretation: O.Y., H.Y., B.Ö.M., D.B., S.E., Y.A.B., Literature Search: O.Y., H.Y., B.Ö.M., D.B., H.D., Y.A.B., Writing: O.Y., H.Y., B.Ö.M., D.B., S.E., Y.A.B.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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