



Premiere Publications from The Triological Society

Read all three of our prestigious publications, each offering high-quality content to keep you informed with the latest developments in the field.

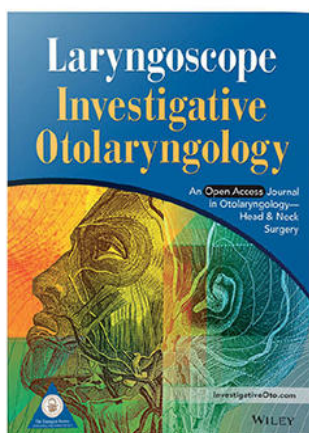


THE Laryngoscope FOUNDED IN 1896

Editor-in-Chief: Samuel H. Selesnick, MD, FACS

The leading source for information
in head and neck disorders.

Laryngoscope.com

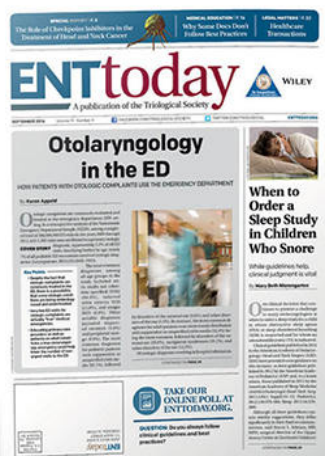


Laryngoscope Investigative Otolaryngology Open Access

Editor-in-Chief: D. Bradley Welling, MD, PhD, FACS

Rapid dissemination of the science and practice
of otolaryngology-head and neck surgery.

InvestigativeOto.com



ENTtoday A publication of the Triological Society

Editor-in-Chief: Alexander Chiu, MD

Must-have timely information that Otolaryngologist-head and neck surgeons can use in daily practice.

Enttoday.org

WILEY

Seasonal Affective Disorder in Patients With Chronic Tinnitus

Young H. Kim, MD, PhD

Objectives/Hypothesis: To investigate the point prevalence of SAD, degrees of anxiety/depression/sleep disturbance, and characteristics of tinnitus in patients with chronic tinnitus.

Study Design: Cross-sectional survey study.

Methods: From December 2012 to February 2014, 100 patients with chronic persistent or intermittent tinnitus (>3 months) were enrolled. Audiograms, tinnitograms, and Visual Analogue Scales (VAS) were used to assess tinnitus. Tinnitus Handicap Inventory (THI) assessment and questionnaires about anxiety/depression/sleep disturbance/SAD were administered.

Results: The male:female ratio was 48:52, and the mean age was 55.0 years. The numbers of patients with suspected SAD and subsyndromal SAD (S-SAD) were nine (9.0%) and 11 (11.0%), respectively. Winter was the most uncomfortable season. Nine patients had a catastrophic THI score >76 (11.1% in the SAD group, 27.3% in the S-SAD group, and 6.3% in the control group), suggesting a significant correlation between SAD/S-SAD and THI ($P=.042$). Audiogram, tinnitogram, VAS assessment, and sleep disturbance testing revealed no significant differences among the three groups. Anxiety tests yielded more abnormal findings in the SAD group than in the control group (State Anxiety Inventory score: 33.3% vs. 3.3%, respectively, $P=.012$; Trait Anxiety Inventory score: 22.2% vs. 1.3%, respectively, $P=.002$). Depression test scores were significantly higher in the SAD/S-SAD groups than in the control group (35.0% vs. 21.3%, respectively; $P=.005$).

Conclusions: Suspected SAD and/or S-SAD in chronic tinnitus patients were correlated with THI, anxiety, and depression. Understanding SAD in tinnitus patients may be important to manage these patients effectively.

Key Words: Seasonal affective disorder, tinnitus.

Level of Evidence: 4

Laryngoscope, 126:447–451, 2016

INTRODUCTION

Seasonality can represent a source of stress that individuals encounter in their living environment. Some people exhibit periodic depressive symptoms, particularly in areas of high or low latitude during the winter or summer.¹ Seasonal affective disorder (SAD) is a form of depression presenting in regions with wide temperature differences at a particular time of year or during a particular season.² SAD typically occurs between the autumn and winter seasons and enters remission during the spring or summer.³ The development of SAD is associated with the reduction of daylight according to seasonal change, and its remission starts as daylight increases.⁴ Therefore, SAD is known to respond well to bright-light (photo) therapy.^{2,5} Patients with SAD can exhibit various

symptoms such as depression, fatigue, hypersomnia, hyperphagia, carbohydrate craving, weight gain, and loss of libido.¹

Tinnitus is known to be frequently accompanied by emotionally affected disorders such as depression or anxiety.⁶ Patients with tinnitus commonly demonstrate annoyance, concentration problems, depression, anxiety, irritability, sleep disturbances, and intense worrying.⁷ However, their exact relationship to tinnitus remains debatable.⁸

In the present study, an analysis of medical records using results of questionnaires and audiological tests was performed to identify the correlation between SAD and chronic tinnitus. The objective of the present study was to investigate the point prevalence of SAD, degrees of anxiety/depression/sleep disturbance, and characteristics of tinnitus in patients with chronic tinnitus.

MATERIALS AND METHODS

Among the patients who visited the Seoul National University Boramae Medical Center due to tinnitus from December 2012 to February 2014, those with chronic persistent or intermittent tinnitus (>3 months) were enrolled in the present study. Exclusion criteria were pulsatile tinnitus, tinnitus due to temporal bone trauma or ear surgery, a history of tinnitus treatment more than 3 months previously, a history of neuropsychological disease or depression, past abuse of alcohol or drugs, cognitive dysfunction (due to a brain lesion or surgery), and severe illness that would complicate regular follow-up and treatment. Of 116 responders to the questionnaires, 16 with incomplete answers were excluded. Thus, the study enrolled

From the Department of Otorhinolaryngology–Head and Neck Surgery, Seoul Metropolitan Government, Seoul National University, Boramae Medical Center, Seoul, South Korea.

Editor's Note: This Manuscript was accepted for publication May 20, 2015.

Presented at the 8th International Tinnitus Research Initiative Meeting, Auckland, New Zealand, March 10–13, 2014.

This study was supported by a clinical research grant provided by Seoul National University Boramae Medical Center.

The author has no other funding, financial relationships, or conflicts of interest to disclose.

Send correspondence to Young Ho Kim, MD, Department of Otolaryngology–Head and Neck Surgery, Seoul Metropolitan Government, Seoul National University, Boramae Medical Center, 39, Boramae-Gil, Dongjak-Gu, Seoul 156–707, Korea, South Korea.
E-mail: yhkiment@gmail.com

DOI: 10.1002/lary.25446

TABLE I.
Demographics of Enrolled Subjects (n = 100).

Parameter	
Age, yr	
Mean	55.0 ± 13.4
Range	19–78
Sex, no.	
Male	48
Female	52

100 patients, aged 19 to 78 years (mean age 55.0 ± 13.4 years). The study group consisted of 48 males and 52 females. The demographics of enrolled patients are summarized in Table I. This study was approved by the institutional review board at Seoul National University College of Medicine, Boramae Medical Center (permit no. 16-2012-48).

Audiogram, tinnitogram, Visual Analogue Scale (VAS) assessment for tinnitus, Tinnitus Handicap Inventory (THI) assessment, and questionnaires for anxiety (State/Trait Anxiety Inventory [SAI/TAI])/depression (Beck Depression Inventory [BDI])/sleep disturbance (Pittsburgh Sleep Questionnaire Inventory [PSQI])/SAD (Seasonal Pattern Assessment Questionnaire [SPAQ]) were administered for all 100 enrolled patients. The questionnaire comprised 111 questions, including VAS and conventional THI questions, for individuals with tinnitus (Table II). Additionally, all patients were asked to choose the most preferred and uncomfortable seasons among the four seasons.

When hearing loss >40 dB on average pure-tone audiogram was recorded, the correlation between hearing loss and SAD was statistically analyzed. Tinnitograms performed to investigate acoustic characteristics of tinnitus in patients with tinnitus consist of pitch matching, loudness matching, minimum masking level, and residual inhibition tests.

Tinnitograms for the pitch and loudness of tinnitus were used in this study. VAS consists of assessments about awareness, annoyance, loudness, and effect on life, with a scale from 0 (none) to 10 (very serious). Among them, VAS for the annoyance from 0 (no annoyance) to 10 (very serious annoyance) was used in this study. Intensity levels >75 dB on tinnitogram and annoyance scores >7 on VAS assessment were considered severe. THI was defined as severe when scores were from 58 to 100 and as catastrophic when scores were >76. SAI and TAI were considered severe when scores were >62 and >64, respectively. BDI and PSQI were determined as abnormal when scores were >16 and >8.5, respectively. According to results of the SPAQ, tinnitus patients were divided into three groups—SAD group, subsyndromal SAD (S-SAD) group, and non-SAD group. SAD was defined as a global seasonality score (GSS) >11 and VAS for seasonality >2; S-SAD was defined as GSS 9 to 10 and VAS for seasonality >2 or GSS >11 and VAS for seasonality <1. Correlations between SAD/S-SAD and the results of the other questionnaires were investigated.

Statistical analysis was performed using SPSS software (version 18.0; SPSS Inc., Chicago, IL). The data from the audiogram, tinnitogram, VAS, THI, SAI/TAI, BDI, and PSQI were compared among the SAD, S-SAD, and non-SAD groups that were classified according to results obtained from the SPAQ questionnaires. χ^2 tests were performed to compare the clinical characteristics of each group. Additionally, nonparametric analysis, the Mann-Whitney test, or Fischer exact test were used for comparisons among the SAD and S-SAD groups. A *P* value <.05 was considered statistically significant.

RESULTS

Among the 100 patients, the numbers of patients with suggested SAD and S-SAD were nine (9.0%) and 11 (11.0%), respectively. The male:female ratios in the SAD and S-SAD groups were 4:5 and 3:8, respectively. Winter (54.1%, 53/98 responders) was the most uncomfortable season for most patients, followed by summer (41.8%, 41/98 responders). The most preferred season was spring (45.9%, 45/98 responders) followed by autumn (44.9%, 44/98 responders). Audiogram, tinnitogram, and VAS results revealed no significant differences among the SAD group, S-SAD group, and control (non-SAD/S-SAD) group (*P* = .375, *P* = .329, and *P* = .257, respectively). Nine patients had catastrophic THI scores >76, and the proportion was 1/9 (11.1%) in the SAD group, 3/11 (27.3%) in the S-SAD group, and 5/80 (6.3%) in the control (non-SAD/S-SAD) group, suggesting a significant correlation between SAD/S-SAD and THI (SAD/S-SAD vs. control, *P* = .042; Fig. 1a). Among 18 patients with a severe THI score >58, the proportion was 3/9 (33.3%) in the SAD group, 4/11 (36.4%) in the S-SAD group, and 11/80 (13.8%) in the control (non-SAD/S-SAD) group, suggesting a significant correlation between SAD/S-SAD and THI (SAD/S-SAD vs. control, *P* = .048; Fig. 1b). Severe SAI scores in the SAD group (3/9, 33.3%) revealed a significant difference compared with those in the control group (3/91, 3.3%) (*P* = .012), and severe TAI scores in the SAD group (2/9, 22.2% in SAD) also revealed a significant difference compared with those in the control group (1/80, 1.3%) (*P* = .002; Fig. 2a,b). Abnormal BDI scores in the SAD/S-SAD group (7/20, 35.0%) were significantly higher than those in the non-SAD group (17/80, 21.3%) (*P* = .05; Fig. 3). PSQI scores did not differ significantly among the three groups (*P* = .122).

DISCUSSION

Although it is not life threatening, tinnitus is still an annoying disease that has a persistent influence on a person's life. Most people with tinnitus hear frustrating comments concerning their results or prognosis of their disease from people around them or physicians. Additionally, the huge economic burden of tinnitus is another cross-societal health issue, with the social cost of tinnitus estimated at more than £6.8 billion as reported in a

TABLE II.
Questionnaires Used in This Study.

Questionnaire Items	No. of Questions
Visual Analogue Scale for Tinnitus	4
Tinnitus Handicap Inventory	25
State Anxiety Inventory	20
Trait Anxiety Inventory	20
Beck Depression Inventory	21
Pittsburgh Sleep Questionnaire Inventory	15
Seasonal Pattern Assessment Questionnaire	6
Total questions	111

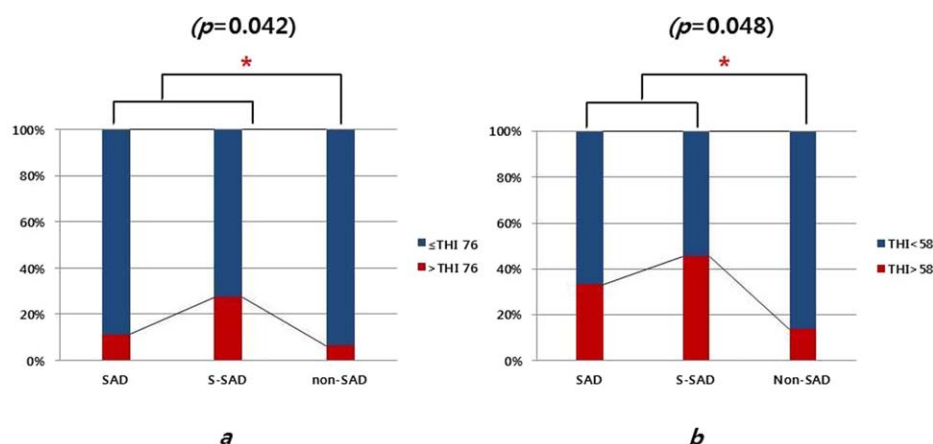


Fig. 1. Comparison of Tinnitus Handicap Inventory (THI) scores among the three groups. (a) Of the nine patients who scored as catastrophic THI >76 , the proportions were 1/9 (11.1%) in the seasonal affective disorder (SAD) group, 3/11 (27.3%) in the subsyndromal SAD (S-SAD) group, and 5/80 (6.3%) in the control (non-SAD/S-SAD) group (SAD/S-SAD vs. control, $P=.042$; Fischer exact test). (b) Of the 18 patients who scored as severe THI >58 , the proportions were 3/9 (33.3%) in the SAD group, 4/11 (36.4%) in the S-SAD group, and 11/80 (13.8%) in the control (non-SAD/S-SAD) group (SAD/S-SAD vs. control, $P=.048$; Fischer exact test). [Color figure can be viewed in the online issue, which is available at www.laryngoscope.com.]

study conducted in the Netherlands.⁹ Various and intensive research regarding the etiopathogenesis and treatment of tinnitus is ongoing, but to date, the exact underlying cause remains elusive. The relationship between tinnitus and emotional components in the limbic system within the brain has been reported consistently.^{6,10,11} Clinically, a relatively large percentage of tinnitus patients complain of aggravated tinnitus during episodes of mental problems, including serious emotional disturbance or psychological disorders.^{12–14} Therefore, it may be important to investigate external factors (i.e., zeitgebers [outside rhythms influencing endogenous cycles]) or internal (circadian phase) factors that trigger or aggravate tinnitus to effectively manage the disease.

Mood changes according to seasonal variation is a phenomenon that occurs in the general population.^{15–18} SAD, at its extreme, has an incidence of 4% to 10% in the general population, with a higher incidence in women.^{15,19–22} The incidence of SAD and S-SAD together has been estimated at 11% to 21%, a range that includes the 20% point prevalence reported in the present study.¹ The male:female ratios of SAD and SAD/S-SAD in the present study were 4:5 and 7:13, respectively; however,

some studies have reported male:female ratios of SAD from 1:2 to 2:3.^{23,24} Additionally, a previous study suggested that SAD has a genetic tendency, with genetic findings documented for 29% of the variance in seasonality in the study of seasonality and SAD in 3,331 twins.²⁵

When tinnitus patients have chronobiological problems or disorders such as shift work maladaptation, jet lag, a habit of keeping late hours, or SAD, they may be treated by circadian rhythm adjustment. Melatonin, a marker for biological rhythms and a circadian phase-shifting agent that is synthesized and secreted from the pineal gland and many other organs and tissues, has also been introduced as a therapeutic regimen of tinnitus.^{26–31} Therefore, studies regarding the biological relationship between tinnitus and SAD may be important for the investigation of circadian phase derangement as the pathogenesis of tinnitus. Additionally, sleep is an important factor to consider in SAD. Hypersomnia is known to accompany SAD; however, some authors have reported that patients with SAD are more likely to have hypersomnia, as well as a coexistence of hypersomnia and insomnia as scored on PSQI.³² In the present study, no significant sleep disturbances were observed among

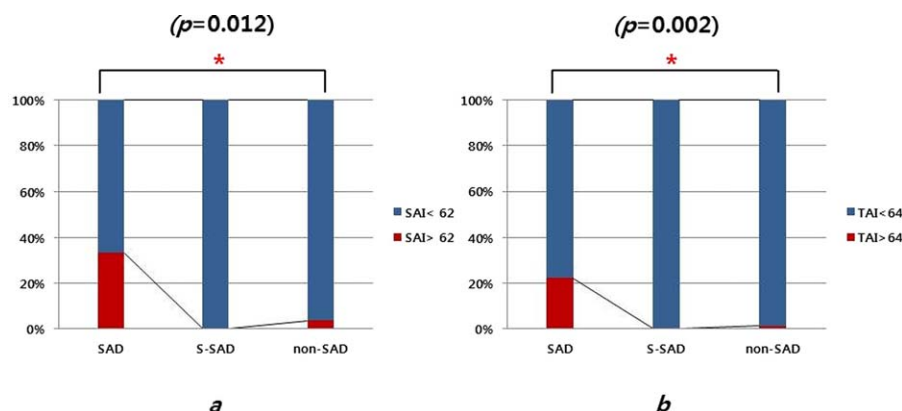


Fig. 2. Comparison of State Anxiety Inventory (SAI) and Trait Anxiety Inventory (TAI) scores among the three groups. (a) Severe SAI scores were higher in the seasonal affective disorder (SAD) group (3/9, 33.3%) than in the control group (3/91, 3.3%) ($P=.012$; Fischer exact test). (b) Severe TAI scores were also higher in the SAD group (2/9, 22.2%) than in the control group (1/80, 1.3%) ($P=.002$; Fischer exact test). [Color figure can be viewed in the online issue, which is available at www.laryngoscope.com.]

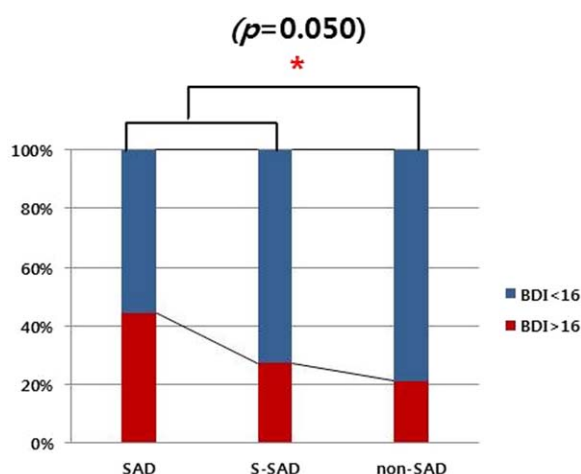


Fig. 3. Comparison of Beck Depression Inventory (BDI) scores among the three groups. Abnormal BDI scores were significantly higher in the seasonal affective disorder (SAD)/subsyndromal SAD (S-SAD) group (7/20, 35.0%) than in the non-SAD group (17/80, 21.3%) ($P = .05$; χ^2 test). [Color figure can be viewed in the online issue, which is available at www.laryngoscope.com.]

the SAD, S-SAD, and control groups. Although this study used PSQI to evaluate sleep disturbance, other instruments may be needed for more specific investigations.

In the present study, the most uncomfortable season was winter (54.1%); however, summer (41.8%) was also uncomfortable for many. Similarly, regarding the most preferred season, scores were similar for spring (45.9%) and autumn (44.9%). Of the 100 patients enrolled in the present study, the responses of 98 patients did not show a concentrated season distribution for the most uncomfortable or preferred season. Because we excluded patients with a history of neuropsychological disease or depression during the screening step, very few patients were likely to have had serious problems related to psychological disorders such as depression or anxiety, which may be important when interpreting our results. Also, because these questions were not included in the SPAQ, tinnitus patients were not asked to choose a symptomatic season for SAD. However, in the present study, many patients who were asked to complete the SPAQ seemed confused about the choice of winter or summer as the most uncomfortable season. As a result of the very hot and humid summer weather in this country, many people may feel more physically exhausted during the summer season and underestimate emotional stress during cold winter weather. However, of the 20 patients who may have had SAD or S-SAD, the most uncomfortable season was winter (12 patients), followed by summer (seven patients), and then autumn (one patient). Additionally, the male:female ratios for each season were 4:8, 3:4, and 0:1, respectively, indicating a predominance of women only during the winter. Furthermore, the results of this study revealed that suspected SAD or S-SAD in some tinnitus patients may have important implications as follows. First, seasonality may be a consideration in the diagnosis and management of tinnitus. Specifically, patients with psychological disorders such as anxiety or depression

should be investigated in terms of how seasonality may affect the possibility of SAD. Second, new methods may be necessary for the treatment and management of tinnitus accompanied with SAD because SAD is highly responsive to treatment using phototherapy and/or melatonin, which is the main therapeutic regimen of SAD. Therefore, better-designed studies will be required in the future to evaluate the effects of phototherapy and/or melatonin in cases of tinnitus with SAD.

To the best of the author's knowledge, no study to date has focused on the comorbidity or relevance between tinnitus and SAD. The point prevalence of SAD in the present study is similar to the incidence of SAD in the general population, possibly indicating that SAD distribution regardless of the presence of tinnitus and SAD in tinnitus patients is not rare. One of the limitations of this study is the small sample size. Another limitation may be a lack of a complementary testing tool such as the Structured Interview Guide for the Hamilton Depression Rating-Seasonal Affective Disorder (SIGH-SAD) for the diagnosis of SAD. SIGH-SAD is known to distinguish between SAD and S-SAD.¹ Finally, this study did not investigate the relevance between SAD and hearing loss according to degrees and types of hearing loss, although the correlation between them was not statistically significant. Therefore, future studies with a more suitable sample size and definitive diagnosis of SAD will clarify the correlations between tinnitus and SAD more clearly.

CONCLUSION

The findings of the present study suggest that SAD or S-SAD in chronic tinnitus patients may be correlated with THI, anxiety, and depression. Understanding the relationship between SAD and tinnitus may be important in effective management of tinnitus patients.

Acknowledgments

The author would like to thank Dr. Kim SY for assistance with the statistical analyses.

BIBLIOGRAPHY

1. Miller AL. Epidemiology, etiology, and natural treatment of seasonal affective disorder. *Altern Med Rev* 2005;10:5–13.
2. Rosenthal NE, Sack DA, Gillin JC, et al. Seasonal affective disorder. A description of the syndrome and preliminary findings with light therapy. *Arch Gen Psychiatry* 1984;41:72–80.
3. Dalglish T, Rosen K, Marks M. Rhythm and blues: the theory and treatment of seasonal affective disorder. *Br J Clin Psychol* 1996;35(pt 2):163–182.
4. Young MA, Meaden PM, Fogg LF, Cherin EA, Eastman CI. Which environmental variables are related to the onset of seasonal affective disorder? *J Abnorm Psychol* 1997;106:554–562.
5. Kasper S, Rogers SL, Yancey A, Schulz PM, Skwerer RG, Rosenthal NE. Phototherapy in individuals with and without subsyndromal seasonal affective disorder. *Arch Gen Psychiatry* 1989;46:837–844.
6. McKenna L, Hallam RS, Hinchcliffe R. The prevalence of psychological disturbance in neurology outpatients. *Clin Otolaryngol Allied Sci* 1991;16:452–456.
7. Scott B, Lindberg P. Psychological profile and somatic complaints between help-seeking and non-help-seeking tinnitus subjects. *Psychosomatics* 2000;41:347–352.
8. Langguth B, Landgrebe M, Kleinjung T, Sand GP, Hajak G. Tinnitus and depression. *World J Biol Psychiatry* 2011;12:489–500.
9. Maes IH, Cima RF, Vlaeyen JW, Anteunis LJ, Joore MA. Tinnitus: a cost study. *Ear Hear* 2013;34:508–514.
10. Jastreboff PJ. Phantom auditory perception (tinnitus): mechanisms of generation and perception. *Neurosci Res* 1990;8:221–254.

11. Möller AR. Pathophysiology of tinnitus. *Otolaryngol Clin North Am* 2003; 36:249–266.
12. Halford JB, Anderson SD. Anxiety and depression in tinnitus sufferers. *J Psychosom Res* 1991;35:383–390.
13. Zöger S, Svedlund J, Holgers KM. Relationship between tinnitus severity and psychiatric disorders. *Psychosomatics* 2006;47:282–288.
14. Belli S, Belli H, Bahcebasi T, Ozcetin A, Alpay E, Ertem U. Assessment of psychopathological aspects and psychiatric comorbidities in patients affected by tinnitus. *Eur Arch Otorhinolaryngol* 2008;265:279–285.
15. Rosen LN, Targum SD, Terman M, et al. Prevalence of seasonal affective disorder at four latitudes. *Psychiatry Res* 1990;31:131–144.
16. Hardin TA, Wehr TA, Brewerton T, et al. Evaluation of seasonality in six clinical populations and two normal populations. *J Psychiatr Res* 1991; 25:75–87.
17. Rosen LN, Rosenthal NE. Seasonal variations in mood and behavior in the general population: a factor-analytic approach. *Psychiatry Res* 1991;38: 271–283.
18. Hegde AL, Woodson H. Prevalence of seasonal changes in mood and behavior during the winter months in central Texas. *Psychiatry Res* 1996;62:265–271.
19. Kasper S, Wehr TA, Bartko JJ, Gaist PA, Rosenthal NE. Epidemiological findings of seasonal changes in mood and behavior. A telephone survey of Montgomery County, Maryland. *Arch Gen Psychiatry* 1989;46: 823–833.
20. Eagles JM, Mercer G, Boshier AJ, Jamieson F. Seasonal affective disorder among psychiatric nurses in Aberdeen. *J Affect Disord* 1996;37:129–135.
21. Axelsson J, Stefánsson JG, Magnússon A, Sigvaldason H, Karlsson MM. Seasonal affective disorders: relevance of Icelandic and Icelandic-Canadian evidence to etiologic hypotheses. *Can J Psychiatry* 2002;47:153–158.
22. Blazer DG, Kessler RC, Swartz MS. Epidemiology of recurrent major and minor depression with a seasonal pattern. The National Comorbidity Survey. *Br J Psychiatry* 1998;172:164–167.
23. Rosen L, Knudson KH, Fancher P. Prevalence of seasonal affective disorder among U.S. Army soldiers in Alaska. *Mil Med* 2002;167: 581–584.
24. Booker JM, Hellekson CJ. Prevalence of seasonal affective disorder in Alaska. *Am J Psychiatry* 1992;149:1176–1182.
25. Madden PA, Heath AC, Rosenthal NE, Martin NG. Seasonal changes in mood and behavior. The role of genetic factors. *Arch Gen Psychiatry* 1996;53:47–55.
26. Lewy AJ. Clinical applications of melatonin in circadian disorders. *Dialogues Clin Neurosci* 2003;5:399–413.
27. Srinivasan V, Spence DW, Trakht I, Pandi-Perumal SR, Cardinali DP, Maestroni GJ. Immunomodulation by melatonin: its significance for seasonally occurring diseases. *Neuroimmunomodulation* 2008;15: 93–101.
28. Merrick L, Youssef D, Tanner M, Peiris AN. Does melatonin have therapeutic use in tinnitus? *South Med J* 2014;107:362–366.
29. Hurtuk A, Dome C, Holloman CH, et al. Melatonin: can it stop the ringing? *Ann Otol Rhinol Laryngol* 2011;120:433–440.
30. Megwalu UC, Finnell JE, Piccirillo JF. The effects of melatonin on tinnitus and sleep. *Otolaryngol Head Neck Surg* 2006;134:210–213.
31. Rosenberg SI, Silverstein H, Rowan PT, Olds MJ. Effect of melatonin on tinnitus. *Laryngoscope* 1998;108:305–310.
32. Roecklein KA, Carney CE, Wong PM, Steiner JL, Hasler BP, Franzen PL. The role of beliefs and attitudes about sleep in seasonal and nonseasonal mood disorder, and nondepressed controls. *J Affect Disord* 2013;150:466–473.