Personality and sleep evaluation of patients with tinnitus in Japan

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Keywords: tinnitus, severity, personality, NEO Five-Factor Inventory, sleep disorder

Posted Date: May 22nd, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-30270/v1>

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Version of Record: A version of this preprint was published at Psychiatric Quarterly on July 1st, 2020. See the published version at <https://doi.org/10.1007/s11126-020-09794-7>.

Abstract

Background

In Japan, there have been no examinations of tinnitus with respect to personality traits, and only a few studies have investigated sleep disorders in tinnitus. Understanding the association of these with one another can aid in selecting and developing effective treatment options for patients with tinnitus. This study aimed to clarify the relationship between tinnitus severity, personality, and sleeping disorders, in patients with chronic tinnitus in Japan.

Methods

We retrospectively evaluated the personality factors of 56 patients presenting with tinnitus using the NEO Five-Factor Inventory (NEO-FFI), which examines five personality characteristics, including Neuroticism, Extroversion, Openness, Agreeableness, and Conscientiousness. We also evaluated tinnitus severity using the Tinnitus Handicap Inventory, sleep disorders using the Pittsburgh Sleep Quality Index (PSQI), depression using the Self-Rating Depression Scale, and anxiety using the State Trait Anxiety Inventory.

Results

There was a positive correlation between Neuroticism and tinnitus severity ($r = 0.548$, $P < 0.001$). Sleep disorders were observed in 73.2% of patients; however, there was no correlation between the PSQI score and tinnitus severity or between PSQI score and scores of the five NEO-FFI items.

Conclusions

Understanding the relationship between personality and tinnitus severity could lead to better management of tinnitus. Sleep disorders are frequently experienced by patients with chronic tinnitus, regardless of tinnitus severity or personality.

Background

Tinnitus, which is the sensation of hearing ringing, buzzing, or other sounds in the absence of any external noise, is a common syndrome. Epidemiologic studies have revealed that tinnitus is experienced by 10–15% of the adult population in different countries [1, 2]. It has been reported that for about 20% of those with chronic tinnitus, their tinnitus is bothersome and clinical intervention is required [3–5]. In Japan, the prevalence of tinnitus has been reported to be 18.6% among Japanese people aged 65 years or older [6].

There are many possible options for tinnitus treatment, such as sound therapy (using hearing aids and/or sound generators), counseling sessions, relaxation techniques, medications such as antidepressants and sedatives, and psychotherapy such as cognitive behavioral therapy [7–10]. In those cases, treatment focuses on a patient's chief complaint, but responses to treatments vary widely from patient to patient. Previous studies have suggested that treatment uncertainty can be explained by individual factors. For example, depression and anxiety are known to exacerbate tinnitus symptoms [11–16]. However, determining the absence/presence of depression and anxiety alone is insufficient to determine adequate treatment, and other factors should be evaluated to achieve better tinnitus management outcomes. Dehkordi et al. investigated the relationship between personality traits and tinnitus and reported that tinnitus could be associated with personality characteristics [17]. Personality composition can be described as individual profiles of characteristic patterns of thought, emotion, and behavior. Several models have been developed to characterize and quantify different personality traits, such as the five-factor model. Previous studies have used the NEO Five-Factor Inventory (NEO-FFI) to evaluate the relationship between tinnitus and personality [18, 19]. The NEO-FFI measures five domains of personality, those being Openness, Conscientiousness,

Agreeableness, Neuroticism, and Extraversion. In Germany, Jorge et al. reported that neuroticism, extraversion, and agreeableness were associated with tinnitus distress. Reports that alexithymia was associated with tinnitus severity also demonstrates the relationship between personality and tinnitus [20]. Another report that personality traits can predict the results of Internet-based cognitive behavioral therapy for chronic tinnitus suggests that personality traits can affect tinnitus treatment outcomes [21]. However in Japan, no previous study has investigated tinnitus with respect to personality traits. Given the differences in racial and cultural backgrounds between Japan and Germany, it is possible that different results could be obtained with respect to the relationship between personality and tinnitus in Japan.

Additionally, a recent report indicated that sleep is related to tinnitus. Several studies have reported on the association between tinnitus and sleep disorders in the West and in Asian countries other than Japan [22–24]. In Japan, however, there is only one study by Wakabayashi et al. that found that sleep disorders in tinnitus patients improved after tinnitus treatment [25]. Understanding the prevalence of sleep disorders in tinnitus can help determine whether this is an avenue for therapeutic intervention as well.

We investigated Japanese patients with chronic tinnitus and evaluated the relationship between tinnitus and personality, as well as between tinnitus and sleeping disorders. Furthermore, we aimed to determine whether the findings of any such relationship could be utilized to determine a suitable treatment method for each patient.

Methods

Participants

We administered a series of questionnaires to 100 consecutive patients who presented with chief complaints of tinnitus at the department of Otolaryngology, Keio University Hospital, in 2009. Excluded from this study were any participants with a disease that required surgery. Of the 73 patients that responded to the survey, 17 dropped out because they did not complete the surveys or their tinnitus was in the acute phase (tinnitus < 3 months). Thus, we included 56 cases with chronic tinnitus (tinnitus that had lasted for more than three months) in this study. We investigated tinnitus severity, personality, depression, anxiety, and sleep disorder severity.

Consent and ethics approval

This retrospective study was approved by the ethics committee at the Keio University School of Medicine (JPRN-UMIN000008901). Procedures that involved collecting information from patient medical records were carried out in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans (<http://www.wma.net/en/30publications/10policies/b3/index.html>).

Details of this clinical research study were displayed in a consultation room, and informed oral consent was obtained from all participants. We informed participants about, or made public, information concerning the research, including the purpose of collecting and using the information. Participants were informed that they at any time could refuse participation or request that their data be removed. This information was also documented in each patients' medical chart. All participants consented that their data could also be used for future studies. Data were anonymized at the time of collection.

Questionnaires

We investigated personality using the NEO-FFI. The NEO-FFI is used worldwide as a personality survey. The 60-item questionnaire examines the following five personality traits: Neuroticism, Extroversion, Openness, Agreeableness, and Conscientiousness [26]. There are 12 questions in each of five categories, and each category is evaluated on six levels. The NEO-FFI takes approximately 10 minutes to complete.

We investigated tinnitus severity using the Japanese version of the Tinnitus Handicap Inventory (THI) [27]. The THI consists of 25 questions, and each question is scored as 0, 2, or 4. These scores are then summed, and the total score ranges from 0

to 100, whereby a higher THI score indicates a greater handicap resulting from tinnitus [28].

Depression was assessed using the Self-Rating Depression Scale (SDS). The SDS consists of 20 questions, and each question is scored as 1, 2, 3, or 4. The total SDS score ranges from 20 to 80, whereby a higher SDS score indicates more severe depressive symptoms [29].

Anxiety was assessed using the State Trait Anxiety Inventory (STAI). The STAI assesses both state (STAI-s) and trait (STAI-t) anxiety using two separate 20-item subscales. The total scores range from 20 to 80 for each subscale, with higher scores indicating greater anxiety. The total scores are further divided into grades 1–5 according to severity, with 5 being the most severe [30].

Sleep disorder severity was assessed using the Pittsburgh Sleep Quality Index (PSQI). The PSQI is one of the most widely used standardized measures to assess subjective sleep quality. The test evaluates seven domains of sleep, namely, subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. There are 7 items rated on a 4-point scale of 0–3 points, with an overall score of 0–21. The higher the individual's overall score, the poorer the quality of sleep. A score of > 6 is suggestive of the presence of sleep disturbance [31, 32].

Statistical analysis

A correlation analysis was performed that included NEO-FFI, THI, SDS, STAI, and PSQI scores. The linear regression correlations were determined using Pearson's correlation coefficient. Statistical analyses were performed using SPSS version 23 (IBM, New York, NY, USA). The significance level was set at $p < 0.05$.

Results

Of the 56 patients included in the study, 34 were men and 22 were women (age range, 22–80 years; mean age, 59.1 years). Among these, presbycusis was present in 18 cases, sensorineural hearing loss in 11 cases, sudden deafness in 7 cases, and non-hearing loss tinnitus in 7 cases. The duration of tinnitus ranged from 0.3 to 36 years (Table 1). The average score and standard deviation of each questionnaire are shown in Table 2. We tested correlations between variables using Pearson's correlation coefficient.

Table 1
Participant characteristics

Background characteristics		
Age in years, range (mean)	22–80 (57.0)	
Sex	male: 34; female: 22	
Underlying disease	Presbycusis	18
	Sensorineural hearing loss	11
	Sudden deafness	7
	Non-hearing loss	7
	Low tone deafness	4
	After traffic trauma	4
	Chronic otitis media	2
	Psychogenic deafness	1
	Vestibular schwannoma	1
	Meniere's disease	1
Duration in months, range (median)	4–462 (18)	

Table 2
Average scores and standard deviations of study questionnaires

Scores		
	Average	SD
THI	55.3	27.0
Neuroticism	3.3	1.1
Extraversion	2.7	1.0
Openness	3.0	1.0
Agreeableness	3.2	1.2
Conscientiousness	3.1	1.0
SDS	44.4	10.5
STAI-t (grade)	3.9	1.1
STAI-s (grade)	4.0	1.0
PSQI	9.4	4.6
Abbreviations: THI, Tinnitus Handicap Inventory; SDS, Self-Rating Depression Scale, STAI-t, State Trait Anxiety Inventory-trait; STAI-s, State Trait Anxiety Inventory-state; PSQI, Pittsburgh Sleep Quality Index; SD, standard deviation		

The THI score was positively correlated with the Neuroticism score ($r = 0.548$, $P < 0.001$), SDS score ($r = 0.539$, $P < 0.001$), STAI-t score ($r = 0.513$, $P < 0.001$), and STAI-s score ($r = 0.454$, $P < 0.001$). There were no significant correlations between the THI score and the score of any of the other personality traits: Extroversion ($r = -0.051$, $P = 0.709$), Openness ($r = -0.107$, $P = 0.433$), Agreeableness ($r = -0.019$, $P = 0.889$), Conscientiousness ($r = -0.024$, $P = 0.862$). Additionally, there were positive correlations between the Neuroticism score and the SDS score ($r = 0.512$, $P < 0.001$), STAI-t score ($r = 0.678$, $P < 0.001$), and STAI-s score ($r = 0.678$, $P < 0.001$).

= 0.637, $P < 0.001$). There were also positive correlations between the SDS and STAI-t scores ($r = 0.591$, $P < 0.001$), SDS and STAI-s scores ($r = 0.635$, $P < 0.001$), and STAI-t and STAI-s scores ($r = 0.800$, $P < 0.001$). Sleep disturbances were observed in 41/56 cases (73.2%). However, there was no correlation between the PSQI score and THI ($r = -0.143$, $P = 0.294$), or between the PSQI score and the five items of the NEO-FFI (Table 3).

Table 3
Correlations between questionnaires

	THI	N	E	O	A	C	SDS	STAI-t	STAI-s	PSQI
THI		0.548	-0.051	-0.107	-0.019	-0.024	0.539	0.513	0.454	-0.143
		(0.000)	(0.709)	(0.433)	(0.889)	(0.862)	(0.000)	(0.000)	(0.000)	(0.294)
Neuroticism (N)			-0.247	0.079	-0.229	-0.267*	0.512	0.678	0.637	-0.231
			(0.066)	(0.563)	(0.089)	(0.047)	(0.000)	(0.000)	(0.000)	(0.086)
Extraversion (E)				0.068	0.178	0.187	-0.215	-0.251	-0.210	-0.125
				(0.620)	(0.189)	(0.168)	(0.111)	(0.062)	(0.120)	(0.360)
Openness (O)					-0.121	0.090	-0.156	0.017	-0.018	-0.219
					(0.373)	(0.508)	(0.251)	(0.898)	(0.895)	(0.104)
Agreeableness (A)						0.089	-0.064	-0.168	-0.194	-0.025
						(0.516)	(0.640)	(0.216)	(0.152)	(0.856)
Conscientiousness (C)							-0.039	-0.063	-0.087	0.101
							(0.775)	(0.646)	(0.525)	(0.458)
SDS								0.591	0.635	-0.167
								(0.000)	(0.000)	(0.219)
STAI-t									0.800	0.027
									(0.000)	(0.846)
STAI-s										-0.010
										(0.943)
PSQI										
Note: Significant correlations are shown in bold, p values are in parentheses.										
Abbreviations: THI, Tinnitus Handicap Inventory; SDS, Self-Rating Depression Scale, STAI-t, State Trait Anxiety Inventory-trait; STAI-s, State Trait Anxiety Inventory-state; PSQI, Pittsburgh Sleep Quality Index										

Discussion

In this study, we found a positive correlation between tinnitus severity and the personality trait of neuroticism, indicating that more severe tinnitus was associated with higher neuroticism. Tinnitus severity was also positively correlated with depression and both trait and state anxiety. Currently, research in the field of personality psychology that has used the NEO-FFI has helped progress our understanding of personality changes. Personality changes resulting from psychotherapy (cognitive behavioral therapy, collective psychotherapy, and autonomous training) for neurotic tendencies, in addition to Tinnitus

Retraining Therapy (TRT) and tinnitus drug therapies, could reduce the psychological impact of tinnitus and lead to new techniques in psychotherapy for chronic tinnitus.

A similar study of 72 patients with tinnitus in Germany found a positive correlation between the Neuroticism NEO-FFI score and the Beck depression inventory score, but no correlation between Neuroticism and THI scores [18]. The authors also found a negative correlation between Agreeableness and THI scores. Because of the difference in the pattern of association between the THI score and personality traits found in that study compared to the current study, we hypothesized that the types of psychotherapy that might be effective may also vary from region to region.

Depression and anxiety evaluation has been reported to be an important component of tinnitus treatment [11–16]. Additionally, treatments that combine TRT with drug therapies (such as with anxiolytic and antidepressant drugs) are considered effective in some cases [33]. Our findings of the positive correlation between both the SDS and STAI scores with the THI score corroborate that this treatment would be an effective treatment for Japanese patients. Many studies have shown that people with higher neurotic tendencies tend to develop anxiety disorders or depression; this could explain why we observed a positive correlation between Neuroticism and the SDS and STAI scores in this study. These results are consistent with those of previous reports [34, 35]. Patients with tinnitus have also been reported to be more prone to an episode of major depression, and to often have an obsessive personality [36].

In this study, sleep disorders were found in 73.2% of patients; however, there was no correlation between the PSQI score and THI score, or between the PSQI score and the five items of the NEO-FFI. This indicates that patients with chronic tinnitus have frequent sleep disturbances, regardless of tinnitus severity or their personality traits. Sleep disorders can be highly stressful and are known to adversely affect the autonomic nervous system [30, 37]. Autonomic nervous system disorders can in turn exacerbate tinnitus, and aggressive treatment for sleep disorders in patients with chronic tinnitus may improve autonomic nervous system balance and improve tinnitus. This has not yet been considered in this study and should be investigated further.

Conclusions

Our results indicate that tinnitus severity could be reduced by inducing changes in personality via psychotherapy for neurotic tendencies, in addition to TRT and drug therapy for patients with chronic tinnitus. Sleep disorders occur frequently in patients with chronic tinnitus, regardless of tinnitus severity or personality.

Abbreviations

PSQI Pittsburgh Sleep Quality Index

SDS Self-Rating Depression Scale

STAI State Trait Anxiety Inventory

THI Tinnitus Handicap Inventory

TRT Tinnitus Retraining Therapy

Declarations

Ethics approval and consent to participate

This retrospective study was approved by the ethics committee at the Keio University School of Medicine (JPRN-UMIN000008901). Procedures that involved collecting information from patient medical records were carried out in

accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans (<http://www.wma.net/en/30publications/10policies/b3/index.html>).

Consent for publication

Not applicable

Availability of data and materials

All data generated or analyzed during this study are included in this published article.

Competing interests

The authors declare that they have no competing interests.

Funding

This study did not receive any grant support.

Authors' contributions

All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by Yozo Inagaki, Noriomi Suzuki, and Naoki Oishi. The first draft of the manuscript was written by Yozo Inagaki and Noriomi Suzuki, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Acknowledgements

Not applicable.

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