



Quality of Life: Tinnitus and Psychopathological Symptoms

Luciana Geocze¹, Sujana S Chandrasekhar², Samantha Mucci³, Ektor Tsuneo Onishi⁴, Norma de Oliveira Penido⁴

ABSTRACT

Aim

Evaluate the presence of psychopathological symptoms and quality of life in patients with bothersome tinnitus and correlate it with tinnitus annoyance.

Study design

A cross-sectional study was performed. Setting: Ambulatory of Tinnitus - UNIFESP/EPM.

Subjects and methods

Group A included 40 patients with persistent and bothersome tinnitus and hearing loss; Group B had 26 patients with persistent and bothersome tinnitus without hearing loss; Group C (control group) had 26 individuals without either tinnitus or hearing loss. Each participant completed the BECK depression and anxiety scales, the Obsessions and Compulsions Inventory - Revised, the Tinnitus Handicap Inventory and Medical Outcomes Study Short Form-36.

Results

Psychopathological symptoms were more present in the patients than in controls ($p < 0.05$); 37.9% had depression, 47% anxiety and 40% obsessive-compulsive disorder. Positive associations between the degree of discomfort and depression, anxiety and the concurrence of more than one psychopathological symptoms were observed. The degree of tinnitus discomfort showed a strong correlation ($r > 0.40$) with anxiety and depression; physical, social and mental health quality of life domains and obsessive symptoms.

Conclusion

Depression, anxiety and OCD are related to tinnitus annoyance. These patients showed impairment in "social aspect", "emotional aspect" and "functional capacity". The presence of more than one psychopathological disorder was responsible for a worsening in the degree of tinnitus. The concomitance of anxiety and depression, depression and obsessive symptoms (OCD) or depression and lack of social interactions, were able to predict an increased discomfort of tinnitus in these patients.

Keywords

Tinnitus, Depression, Anxiety, OCD, Quality of Life

¹Hospital São Paulo University Hospital, Brazil

²Hofstra-Northwell Medical School, New York, NY, USA

³Psychiatry Department, Universidade Federal de São Paulo, Brazil

⁴Universidade Federal de São Paulo, Brazil

[†]Author for correspondence: Norma de Oliveira Penido, Department of Otorhinolaryngology and Head and Neck Surgery, Universidade Federal de São Paulo, Escola Paulista de Medicina, Rua Fabia, 610/ 112A, Vila Romana, São Paulo/SP, 05051-030, Brazil, email: nopenido@terra.com.br

Introduction

Tinnitus is a common symptom, defined as the perception of sound in the absence of external sound source. It is estimated that 15% to 20% of adults have experienced it, either temporarily or permanently [1]. Tinnitus discomfort is subjective, variable in its intensity and frequency, and can compromise the life of the patient globally, causing personal, professional, social and/or family prejudices [2]. Approximately 20% of tinnitus patients report significant discomfort, which negatively interferes in their lives and can lead, in extreme cases, to suicide [3,4]. According to the World Health Organization 278 million people have tinnitus [5]. Tinnitus is being approached as an “epidemic” as a result of the scientific evidence showing its progressive prevalence, rising from 15% to 25.3% in just 15 years [6]. This makes it a more common problem than asthma and Alzheimer’s disease [7].

Children are not ‘immune’ to tinnitus. Studies observed a prevalence of 37% among children [8], and a prevalence of tinnitus up to 36.8% among adolescents, which is assumed to be related to exposure to music loud and noisy environments [9]. The prevalence of tinnitus also increases with age, up to 70 years [10]. In Brazil, based on international epidemiological data, it is estimated that over 28 million individuals have tinnitus, making it a public health problem [11]. In the US, tinnitus affects 25 million individuals [12].

One of the difficulties in managing tinnitus is related to varied perception of it by affected individuals, from non-bothersome to severe and disabling. The perception of tinnitus is more related to psychopathological disorders and general aspects of health, than the audiological parameters such as frequency or intensity of the symptom [13,14].

The severity of tinnitus is associated with psychopathological disorders such as anxiety and depression [15]. Quality of life (QoL) is inversely proportional to the severity of tinnitus and its effect in some cases can be disabling [16]. Tinnitus patients with high degree of discomfort had obsessive thoughts and compulsive behaviors that harmed habituation to tinnitus [17].

Despite the fact that depression, anxiety and obsessive compulsive disorder (OCD) are psychopathological factors already related to tinnitus, there are no studies correlating these symptoms to each other and involving tinnitus

severity and its impact on the QoL of these patients. The clarification of these findings will contribute to the expansion of knowledge about the relationship between tinnitus and the mental health of patients and help to guide the clinical practice of health professionals, with the development of actions to reduce the negative impact on QoL of these patients.

The objective of this study was to evaluate the presence of psychopathological symptoms and QoL in patients with tinnitus and correlate them with the degree of discomfort.

Methods

A cross-sectional study was conducted in a sample divided into three groups: Group A (n=40) had patients with persistent and bothersome tinnitus and hearing loss, Group B (n=26) had patients with persistent and bothersome tinnitus without hearing loss, and Group C (n=26) had individuals without tinnitus and without hearing loss (controls). This study was approved by the Research Ethics Committee of the Federal University of São Paulo - São Paulo Hospital. CEP 1333/10.

■ Inclusion criteria

Both study groups (A and B) included patients with idiopathic, persistent and bothersome tinnitus, of both genders, between 20 and 70 years, who sought medical care due to tinnitus and were not using any psychotropic medication. Group A additionally included patients with hearing loss, but with enough thresholds in at least one ear to respond to the diagnostic research instruments; group B had patients with normal hearing thresholds. The control group (group C) had individuals who had no tinnitus, no hearing loss and were not using psychotropic medication. Group C was a matched group with respect to gender, age (+2 years or -2 years) and schooling.

■ Exclusion criteria

Excluded from this study were patients aged under 20 years and older than or equal to 70 years, those using psychotropic medication, the presence of acute or chronic infection of the ear, and patients with cognitive impairment that would prevent them from answering the test instruments.

■ Instruments

The Beck Depression Inventory (BDI) assesses depression severity. It is a structured instrument

consisting of 21 items. Presence of depression was determined by a score greater than 15. The Beck Anxiety Inventory (BAI) assesses anxiety. It consists of 21 items and describe common symptoms of anxiety conditions. Presence of anxiety was determined by scores greater than 12, as described for chronic diseases in the instrument manual.

The Obsessions and Compulsions Inventory - Revised (OCI-R) was developed in order to investigate several symptoms and estimate overall severity of OCD. It consists of 18 alternatives, presence of OCD was determined by scores greater than or equal to 21, as described in the instrument validation [18].

Medical Outcomes Study 36 - item short form health survey (MOS-SF-36) is a generic instrument for multidimensional assessment of QoL, allowing comparison with chronic diseases. It consists of 36 items grouped into eight domains: physical functioning, bodily pain, general health, vitality, social functioning, emotional and mental health [19].

The Tinnitus Handicap Inventory (THI) consists of 25 questions with a score ranging from zero to one hundred, and the higher the score, the greater the impact of tinnitus. The sum of the resulting points of the issues is categorized into five degrees of severity [20-22].

■ Procedures

The individuals in Groups A, B and C underwent formal hearing evaluation, psychological evaluation, where they were assessed for anxiety, depression, QoL and OCD. Informed consent was obtained and then the subjects completed a socio-demographic questionnaire, and the Tinnitus Handicap Inventory (THI).

■ Statistical analysis

Firstly, descriptive analyses of the overall sample and the groups were performed separately through the Explore procedure in IBM SPSS Statistics version 21 for MAC. The Mann-Whitney test was used to evaluate the variables without normal distribution and the Student's t-test was performed to analyze the variables with normal distribution. The test used to evaluate the normality of the samples was the Shapiro-Wilk test. Categorical variables were analyzed using contingency tables of categories according to the degree of tinnitus. The chi-square test was used to analyze the association between tinnitus grade and the presence of anxiety, depression and the

concurrency of more than one symptom, as well as the association of other qualitative variables as the association of gender and degree of discomfort in groups.

Correlation studies were conducted to evaluate the magnitude of the relationship between the variables, using the statistical test of Pearson r or Spearman. To check the aggregate interference of several variables on the dependent variable "Total THI" we used the statistical technique of Multiple Linear **Regression analysis**

The critical value used for statistical tests was 5%, so that the p value was considered significant when less than 0.05. Data analysis subsequently unified the two study groups into a single group of patients with tinnitus (A + B), as the only difference between them was found to be the presence or absence of hearing loss; they did not differ in any other parameter assessed.

Results

The study group consisted of 66 patients, aged between 20 and 70 years, with a mean age of 51 years (standard deviation of 11.9 years). 65% were female (N=43); 63% (N=42) of the sample was married or living in a stable relationship. 60.6% of patients had both tinnitus and hearing loss (N=40) and 39.4% (N=26) had tinnitus without hearing loss.

The control group consisted of 26 patients with a mean age of 43.1 years (standard deviation 9.8 years). 65.4% female and 65.4% were married or living in a stable union. These results are tabulated in **Table 1**.

The degree of tinnitus discomfort assessment in our sample by THI, found that 13.6% of the patients had a catastrophic degree of tinnitus, 24.2% had severe tinnitus, 22.7% had moderate tinnitus, 28.8% had mild tinnitus, and 10.6% had only light tinnitus. There was no difference between the degree of nuisance and gender of patients ($\chi^2=5.6$ $df=4$ $p>0.05$).

The comparison between average THI score in groups of patients with and without hearing loss showed no significant difference between groups A and B ($\chi^2=6$ $df=4$ $p>0.05$). The average degree of tinnitus was Grade 3. The THI results are shown in **Table 2**.

Depression was present in 37.9% of tinnitus patients (group A + B) and 15.4% in the control group. This difference was statistically significant ($p<0.05$). There was no significant difference

Table 1: Numerical and percentage distribution of sample characteristics between groups.

Sample		Group A	Group B	Group A+B	Group C
Sample N		40	26	66	26
Gender	Female % (N)	62,5% (25)	69,2% (18)	65,2% (43)	65,4% (17)
	Male % (N)	37,5% (15)	30,8% (8)	34,8% (23)	34,6% (9)
Age M ± SD		53,1 ± 10,7	48,9 ± 13,4	51 ± 11,9	43,5 ± 9,2
Marital Status	Married	67,5% (27)	57,7% (25)	63,6% (42)	73,1% (19)
	Single	32,5% (13)	42,3% (11)	36,4% (24)	26,9% (7)
Educational Level	Elementary school	40% (16)	34,7% (9)	37,8% (25)	35% (9)
	High school	47,5% (19)	15,3% (4)	34,8% (23)	35% (9)
	College	12,5% (5)	50%(13)	28,6% (18)	30% (8)

Table 2: Mean values and standard deviation of the total score of THI in relation to groups.

	Group	N	Mean	SD
THI Score	Group A	40	50	27,3
	Group B	26	42,7	22,2
	Group A+B	66	47,1	25,5
[t(90)=2,9 DP=8,5] p<0,05				

Table 3: Correlation between the variables and the degree of tinnitus annoyance.

Escola	Variáveis	r	P
	BAI	0,470*	*p<0,05
Beck Scales	BDI	0,567*	
	physical	-0,444*	
	pain	-0,323*	
MOS SF-36	vitality	-0,315*	
	social	-0,580*	
	emotional	-0,397*	
	mental health	-0,446*	
OCI-R	Obsessive symptoms	0,523*	

between the mean rank symptoms of depression and gender in the sample (female=13.67 and male=13.13).

Presence of anxiety in tinnitus patients was of 47% compared to 23% in the control group. This difference was statistically significant (p<0.05). There was no difference between the average symptoms of anxiety and gender in the sample.

Forty percent of the patients in the study group compared to only 3.8% of controls, had OCD. The presence of OCD between the groups and the average of symptoms was higher in patients with tinnitus than in controls in all areas and in the overall average and this difference was significant (p<0.05) in the fields: collecting, verifying, obsession, planning and overall score of the instrument.

Mean QoL scores were lower in all areas for the group of tinnitus patients when compared to controls. There were significant differences

between groups in regards to QoL in the physical domains of “functioning”, “general health” and “physical score” and in the mental health fields of “social aspect” and “emotional aspect “and” mental health score” (p<0.05).

Association between the criterion variable (THI) and the explanatory variables, anxiety and depression, was strong (R=0.63). The regression coefficient for depression was 1.25 (95% CI=0.58 to 1.92) for anxiety and 0.75 (95% CI=0.20 to 1.30). Association between the criterion variable (THI) and the explanatory variables depression and obsessive symptoms of OCD, was strong (R=0.70). The regression coefficient for depression was 1.23 (95% CI=0.65 to 1.81) and obsessive symptoms of OCD was 3.36 (95% CI=1.82 to 4.90). Association between the criterion variable (THI) and the explanatory variables depression and social aspects of QoL was strong (R=0.64). The regression coefficient for depression was 1.04 (95% CI=0.30 to 1.80) and social aspects of QoL was 1.25 (95% C=-0.62- -0.11) This data is shown in **Table 3**.

Depression and anxiety together accounted for 38% of the worsening of tinnitus discomfort; depression and obsessive symptoms accounted for 47% and depression and the Social Aspects QoL were responsible for a worsening of 39% in the tinnitus.

Discussion

Tinnitus impact on a patient’s mental health can be seen in contact with them in clinical practice, in anxious behavior in the consultations, depressive symptoms, hopelessness, somatic complaints, irritability and an impaired QoL globally. A better understanding of these aspects and their correlations contribute to better management of such patients in clinical practice and for a more accurate look at the psychological and psychopathological aspects experienced by them.

We observed a predominance of female patients with tinnitus; however, there is no consensus in the literature on the prevalence of tinnitus between genders. A possible explanation is that women have greater willingness to seek medical attention, which does not mean that the incidence of tinnitus is actually higher in women [4,23,24]. When comparing the annoyance of tinnitus, measured by THI, with the patients' genders, there was no statistically significant difference; these findings match other studies who also used the THI questionnaire [25,26] as well as the findings of Erlansson and Holgers [27].

The average age of our sample was 51 years. Several studies indicate its prevalence in the population above 45 years, but the forms of measurement used by them are different and there is no consensus between the results while agreeing that the risk of having tinnitus increases with age [28-30].

In order to verify the effect of psychopathological symptoms and QoL in tinnitus degree, at first, we chose to use three groups. We assessed separately the tinnitus groups with hearing loss and without hearing loss compared to a control group, since it was assumed that disturbance of the tinnitus could affect the two groups in different ways. After analyzing the data this hypothesis was not confirmed, demonstrating that the hearing loss did not interfere in tinnitus annoyance and nor the other variables. The discomfort of tinnitus outstripped the possible damage caused by hearing loss, whose presence did not interfere in the studied variables. Thus, we decided to unify the two groups of patients with tinnitus (A + B) for subsequent analysis.

There is controversy in the literature regarding these data. Yenigun et al. also found no differences between the groups with and without hearing loss in relation to the tinnitus [31]. Savastano evaluated the degree of nuisance THI in the presence and absence of hearing loss and noted that patients with hearing loss have a minor degree of annoyance than that paid in patients with normal hearing [32].

In our study depression was seen in 37.9% of patients with tinnitus and 15.4% of controls. The depression was moderately severe in 27.3% of cases and their presence was similar to those described in other studies [3,13,33]. Depression showed a strong correlation with the degree of tinnitus discomfort. It is important to note that tinnitus certainly has an impact on the life of the

patient and may, like other chronic diseases, lead to depression.

Anxiety disorders in Sao Paulo have a prevalence of approximately 28.1% [34]. This prevalence was similar in our control group (23.1%), but was higher in the group of patients with tinnitus (47%), and 36.3% of patients had moderate to severe anxiety. When compared to controls, the mean of patients' anxiety symptoms was significant and showed a strong correlation with the degree of tinnitus discomfort. The presence of anxiety in samples of outpatients with tinnitus which affected 22.8% to 25% of the sample, respectively [35,36]. In our sample the degree is almost twice that value; however, the Brazilian population also had higher anxiety levels than the world average, which must have been aggravated by the presence of such symptom.

Patients with tinnitus have an intermittent sound stressor, which may hinder their concentration, their communication, their understanding and their way to bond. A constant auditory stimulus can cause the body to function in an alert pattern, using tinnitus as a danger signal, activating a constant anxiogenic process. The coexistence of anxiety and depression in these patients is often present, especially in patients with a high degree of discomfort. High percentage (approximately 50%) of anxiety disorders is expected in patients with depressive disorders [13,15].

There are no studies assessing the presence of OCD in patients with tinnitus in Brazil, and ours is the first to review this correlation in our population. In our study, the presence of OCD was significant (40.9%) when compared to the general population (1%). The average of symptoms was higher in patients with tinnitus than controls in all areas and in the overall average and this difference was also significant.

The Obsessive Symptoms field of OCI-R was highly correlated with the degree of discomfort. The three items that make up this area are related to thought and the subject difficulty in controlling them. We can infer that the buzzing nuisance promotes the increasing intensity of self-referential thoughts due to its invasive nature and patients may have difficulty controlling them, maintaining the focus of attention constantly on the symptom, experiencing thus a vicious cycle and turning him/her into a hostage of tinnitus. Pinto emphasizes the importance of the influence of activation of auditory attention and silence in perception and bothersome tinnitus, reinforcing our hypothesis.

In our sample 69.7% of patients had anxiety, depression or OCD. Measures of association between psychopathological disorders were evaluated and performed, those who had a positive association with the degree of tinnitus were depressive and anxious, this means that the higher the degree of tinnitus discomfort, the worst is the patient's mental health. The concomitance of more than one disorder also showed a statistically significant difference in the discomfort degree, have more than one disorder, further exacerbates the annoyance of tinnitus. OCD, despite the prevalence of 40.9% in our sample, only had an impact on the degree of tinnitus when associated with anxiety and depression.

Regarding QoL, the average of their scores was lower in all areas for patients with tinnitus, when compared to controls. Physical, social and mental health areas showed stronger correlation with the degree of tinnitus than the other areas.

It was observed that the presence of anxiety and depression, depression and OCD symptoms and depression and worsening in the field of social interactions (QoL) are able to predict a worsening of tinnitus discomfort.

Therefore, greater attention to those aspects of mental health patients affected with tinnitus is needed and greater investment in social interactions of these individuals, promoting better health and better adherence to the proposed treatments. When tinnitus and psychopathological disorders coexist, both must be treated in order to achieve the best results possible.

Conclusions

Tinnitus remains a vexing problem for the patient and the healthcare provider. Our study shows a significant correlation between various psychopathological conditions and tinnitus severity. In particular, we elucidated the following. 1) Depression, anxiety and OCD are present in patients with tinnitus and are related to their discomfort. 2) Quality of life of these patients proved to be impaired in the fields "social aspect", "emotional aspect", "functioning" and "general health". 3) The presence of more than one psychopathological symptom was responsible for a worsening of tinnitus grade. 4) The concomitance of anxiety and depression, depression and obsessive symptoms (OCD) or depression and lack of social interactions (QOL)

were able to predict bothersome tinnitus. It is our hope that information such as this helps the healthcare provider direct the patient to the proper assessment and, if indicated, management of their psychopathology in order to ameliorate both that and the disturbing nature of their tinnitus.

Author Contributions

Luciana Geocze: Substantial contributions to the conception and design of the work and also acquisition, analysis, and interpretation of data for the work; drafting and revising the work, agreement to be accountable for all aspects of the work, final approval of the version to be published.

Sujana S. Chandrasekhar: Substantial contributions to the design of the work; revising the work; final approval of the version to be published; agreement to be accountable for all aspects of the work.

Samantha Mucci: Substantial contributions to the analysis and interpretation of data for the work; drafting the work; final approval of the version to be published; agreement to be accountable for all aspects of the work.

Ektor Tsuneo Onishi: Substantial contributions to final approval of the version to be published; agreement to be accountable for all aspects of the work.

Norma de Oliveira Penido: Substantial contributions to the conception and design of the work; drafting and revising the work; final approval of the version to be published; agreement to be accountable for all aspects of the work.

Disclosures

Competing interests: Sujana S. Chandrasekhar, shareholder and board member, Scientific Development and Research, Inc (Intranasal Surfactant Research); minor research funding from Sonitus Co.; consultant for Cochlear Americas and Med-El.

Sponsorships: Universidade Federal de São Paulo

Funding Source: CAPES – Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Coordination for the Improvement of Higher Level Personnel) –Federal Governmental Institution – Brazil.

References

1. Heller AJ. Classification and epidemiology of tinnitus. *Otolaryngol. Clin. North. Am* 36(2), 239-248 (2003).
2. Jastreboff PJ. Phantom auditory perception (tinnitus): mechanisms of generation and perception. *Neurosci. Res* 8(4), 221-254 (1990).
3. Lewis J, Stephens D, Huws D. Suicide in tinnitus. *J. Audiol. Med* 1(1), 30-37 (1992).
4. Coelho CCB, Sanchez TG, Bento RF. Tinnitus characteristics of patients attended in a tinnitus clinic. *Arq. Int. Otorrinolaringol* 8(3), 284-293 (2004).
5. WHO. World Health Organization (January 2010) (2016).
6. Sanchez TG. "Epidemics" of tinnitus in the 21st century: preparing our children and grandchildren. *Braz. J. Otorhinolaryngol* 80(1), 3-4 (2014).
7. Shargorodsky J, Curhan GC, Farwell WR. Prevalence and characteristics of tinnitus among US adults. *Am. J. Med* 123(8), 711-718 (2010).
8. Reynolds P, Gardner D, Lee R. Tinnitus and psychological morbidity: a cross-sectional study to investigate psychological morbidity in tinnitus patients and its relationship with severity of symptoms and illness perceptions. *Clin. Otolaryngol* 29(1), 628-634 (2004).
9. Bulbul SF, Muluk NB, Cakir EP, et al. Subjective tinnitus and hearing problems in adolescents. *Int. J. Pediatr. Otorhinolaryngol* 73(8), 1124-1131 (2009).
10. Baguley D, McFerran D, Hall D. Tinnitus. *Lancet* 9904(382), 1600-1607 (2013).
11. Sanchez TG, Knobel KA, Ferrari GMS, et al. Brazilian Tinnitus Support Group (GAPZ): Methodology, Preliminary Results and Future Proposals. *Arq. Otorrinolaringol* 6(4), 278-284 (2002).
12. Lin FR, Niparko JK, Ferrucci L. Hearing Loss Prevalence in the United States. *Arch. Intern. Med* 171(20), 1851-1852 (2011).
13. Zöger S, Svedlund J, Holgers KM. Relationship between tinnitus severity and psychiatric disorders. *Psychosomat* 47(4), 282-288 (2006).
14. Tunkel DE, Bauer CA, Sun GH, et al. Clinical practice guideline: tinnitus. *Otolaryngol. Head. Neck. Surg* 151(2), 1-40 (2014).
15. Cho GC, Jun HC, Song JJ, et al. Evaluation of Anxiety and Depressive Levels in Tinnitus Patients. *Korean. J. Audiol* 17(1), 83-89 (2013).
16. Nondahl DM, Cruickshanks KJ, Wiley T, et al. Prevalence and 5-year incidence of tinnitus among older adults: the epidemiology of hearing loss study. *J. Am. Acad. Audiol* 13(6), 323-331 (2002).
17. Folmer RL, Griest SE, Martin WH. Obsessive-compulsiveness in a population of tinnitus patients. *Int. Tinnitus. J* 14(2), 127-130 (2008).
18. Souza FP, Foa EB, Meyer E, et al. Obsessive-compulsive inventory and obsessive-compulsive inventory-revised scales: translation into brazilian portuguese and cross-cultural adaptation. *Rev. Bras. Psiquiatr* 30(1), 42-46 (2008).
19. Ciconelli RM, Ferraz MB, Santos W, et al. Translation into Portuguese and validation of the generic questionnaire of quality of life evaluation SF-36. *Rev. Bras. Reumatol* 39(3), 143-149 (1999).
20. McCombe A, Baguley D, Coles R, et al. Guidelines for the grading of tinnitus severity: the results of a working group commissioned by the British Association of Otolaryngologists. *Head. Neck. Surg* 26(5), 388-393 (2001).
21. Ferreira PEA, Cunha F, Onishi ET, et al. Tinnitus handicap inventory: cultural adaptation to Brazilian Portuguese. *Pro. Fono* 17(3), 303-310 (2005).
22. Schmidt LP, Teixeira VN, Dalligna C, et al. Brazilian Portuguese Language version of the "Tinnitus Handicap Inventory": validity and reproducibility. *Braz. J. Otorhinolaryngol* 72(6), 808-810 (2006).
23. Herráiz C, Hernández CJ, Plaza G, et al. Disability evaluation in patients with tinnitus. *Act. Otorrinolaringol* 52(6), 534-538 (2001).
24. Hobuss MD, Garcez VRC. Analysis and evaluation of subjective sensation of tinnitus compared with hearing loss. *Fono. Atual* 6(24), 18-27 (2003).
25. Pinto PCL, Sanchez TG, Tomita S. Evaluation of the severity of tinnitus and hearing loss, sex and age of the patient. *Bras. J. Otorhinolaryngol* 76(1), 18-24 (2010).
26. Mondelli MFCG, Rocha AB. Correlation between the audiologic findings and buzz disturbing. *Arq. int. otorrinolaringol* 15(2), 172-80 (2011).
27. Erlandsson SI, Holgers KM. The impact of perceived tinnitus severity on health-related quality of life with aspects of gender. *Noise. Health* 3(10), 39-51 (2001).
28. Axelsson A, Ringdahl A. Tinnitus a study of its prevalence and characteristics. *Br. J. Audiol* 23(1), 53-62 (1989).
29. Nondahl DM, Cruickshanks KJ, Wiley T, et al. Prevalence and 5-year incidence of tinnitus among older adults: the epidemiology of hearing loss study. *J. Am. Acad. Audiol* 13(6), 323-331 (2002).
30. Tams K, Hoffman H, Borchgrevink H, et al. Hearing loss induced by noise, ear infections, and head injuries: results from the Nord-Trøndelag Hearing Loss Study. *Int. J. Audiol* 42(2), 89-105 (2003).
31. Yenigün A, Doğan R, Aksoy F, et al. Assessment of tinnitus with tinnitus severity index, tinnitus handicap inventory and distortion product otoacoustic emissions in patients with normal hearing and hearing loss. *Kulak. Burun. Bogaz. Ihtis. Derg* 24(1), 11-16 (2014).
32. Savastano M. Tinnitus with or without hearing loss: are its characteristics different?. *Eur. Arch. Otorhinolaryngol* 265(11), 1295-1300 (2008).
33. Andersson G. Psychological aspects of tinnitus and the application of cognitive-behavioral therapy. *Clin. Psychol. Rev* 22(7), 977-990 (2002).
34. Viana MC, Andrade LH. Lifetime Prevalence, age and gender distribution and age-of-onset of psychiatric disorders in the São Paulo Metropolitan Area, Brazil: results from the São Paulo Megacity Mental Health Survey. *Rev. Bras. Psiquiatr* 34(3), 249-260 (2012).
35. Adoga AA, Adoga AS, Obindo JT. Tinnitus and the prevalence of comorbid psychological stress. *Nig. J. Med* 17(1), 95-97 (2008).
36. Andersson G, Svalastog OK, Kaldo V, et al. Future thinking in tinnitus patients. *J. Psychosom. Res* 63(2), 191-194 (2007).