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The applicability of the Tinnitus and Hearing Survey (THS) in the differentiation of tinnitus and hearing complaints

Aplicabilidade do Tinnitus and Hearing Survey (THS) na diferenciação de queixas auditivas

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Keywords

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Hearing
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ABSTRACT

Purpose: To verify the applicability of the Tinnitus and Hearing Survey (THS) to measure the different complaints of tinnitus, hearing loss and sound tolerance. **Methods:** THS was performed, composed of 4 questions about tinnitus, 4 about hearing loss and one about sound tolerance. Previously, all participants performed a battery of audiological diagnostic tests and were then divided into 4 groups: Bilateral normal audiometry with mean up to 25dB, with and without tinnitus complaint (Groups 1 and 3); diagnosis of mild to moderate neural sensory hearing loss (26dB to 60dB), no previous use of individual hearing aids, complaining of chronic tinnitus (≥6 months) and individuals without tinnitus complaints (Groups 2 and 4); and age ≥18 years old. **Results:** Seventy subjects were included in the present study. Regarding the analysis of the total between the groups by the Kruskal-Wallis test, significant differences were found in the sections about tinnitus and hearing loss, but there was no significance in the section regarding sound tolerance. Regarding the questions in Section A of the THS, only Groups 3 and 4 scored the highest. Regarding the questions related to Section B about hearing loss, the groups without hearing loss (Groups 1 and 3) scored the lowest. In relation to the question of the THS in Section C, Group 3 scored the highest. **Conclusions:** The THS questionnaire proved to be a useful, quick and simple tool to assist the audiologist in the understanding and differentiation of the audiologic complaints.

Descritores

Adulto
Audição
Estudos Transversais
Perda Auditiva
Zumbido

RESUMO

Objetivo: verificar a aplicabilidade do THS em mensurar e diferenciar as queixas de zumbido, perda auditiva e tolerância ao som. **Método:** Foi aplicado o questionário THS, composto por 4 questões sobre zumbido, 4 sobre perda auditiva e 1 sobre tolerância ao som. Previamente, todos os participantes realizaram uma bateria de exames de diagnóstico audiológico e foram divididos em grupos: audição normal bilateral com média até 25dB, com e sem queixa de zumbido (Grupos 1 e 3); diagnóstico de perda auditiva sensório neural de grau leve a moderado (26dB a 60dB), sem uso prévio de aparelho de amplificação sonora Individual (AASI), com queixa de zumbido crônico (≥6 meses) e também indivíduos sem queixa de zumbido (Grupos 2 e 4); idade igual ou superior a 18 anos. **Resultados:** Foram incluídos no presente estudo 70 indivíduos. Em relação a análise do total entre os grupos pelo teste Kruskal-Wallis foram encontradas diferenças significativas nas seções sobre zumbido e perda auditiva, mas não houve significância da seção sobre tolerância ao som. Em relação às questões sobre zumbido apenas os grupos 3 e 4 pontuaram. Quanto às questões referentes à perda auditiva, os grupos sem perda (grupos 1 e 3) foram os que menos pontuaram. Em relação a questão do THS sobre tolerância ao som, o grupo 3 foi o que mais pontuou. **Conclusão:** o questionário THS se mostrou como uma possível ferramenta para auxiliar na compreensão e diferenciação das queixas auditivas.

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INTRODUCTION

Hearing loss can cause psychosocial impairments and negative consequences for the individual. The difficulty caused by it over the years makes it a factor of social withdrawal and occupational activities, generating changes in the interpersonal relationships of this population[1,2].

There are several factors and symptoms related to hearing loss, such as high blood pressure, diabetes mellitus and vestibular problems. In relation to hearing complaints, tinnitus has been frequently reported as an auditory perception noticed only by the affected individual which can cause concentration problems, difficulty sleeping, irritation, social withdrawal and emotional upheaval[3-6].

The relationship between hearing loss and tinnitus has already been widely cited[7,8]. Chronic tinnitus is often accompanied by hearing impairment and generally, moderate-level sensorineural hearing loss is present in association with this symptom, widely affecting communication and the lives of these individuals[9].

Still associated with complaints of tinnitus, there is a reduced tolerance to sound. Sound tolerance problems are more likely to occur in individuals affected by tinnitus, and the use of a biopsychosocial conceptualization of tinnitus and other behavioral medicine conditions could be useful to understand and treat such problems[10].

Based on the literature on tinnitus, it is possible to estimate the prevalence of low sound tolerance in the general population. In the study conducted by the Emory Tinnitus and Hyperacusis Center in Atlanta, 60% of patients examined for tinnitus had low sound tolerance, however, this problem has only recently attracted attention[11,12].

The degree of discomfort caused by tinnitus is related to the discomfort caused by hearing loss, which may justify the erroneous attribution of hearing difficulties for tinnitus by patients who present the symptom, which makes it essential to separate the problems caused by tinnitus from the problems caused by hearing loss so that the targeting of treatment is more specific, providing greater effectiveness of the intervention[13,14].

Current self-report questionnaires about tinnitus predict that hearing complaints are related to the symptom itself, often assigning questions about the impact of tinnitus on activities of daily living, work and social issues, making it even more difficult to determine which hearing complaint really bothers the patient, and sometimes the individual attributes the difficulty of hearing only to the symptom. There is a population that presents only tinnitus without hearing loss. For these, the intervention differs, emphasizing the importance of differentiating complaints since some interventions for tinnitus do not take hearing loss into account. Thus, when hearing complaints are clarified and defined, it is possible to study more efficient intervention strategies that really meet the needs of patients[13].

Even today, there is great difficulty in measuring and differentiating the symptoms of tinnitus from hearing complaints, both by the patient, who often cannot report what most bothers him, and by the therapist, since there is no full consensus in the literature regarding an assessment tool.

Thus, the Tinnitus and Hearing Survey (THS) was developed with a proposal to identify how much of the patient's complaint is related to hearing problems and how much is directly related to tinnitus., This questionnaire can also facilitate clarification of the directions to identify tolerance problems and identify the best treatment for each patient[13]. THS is divided into three small A, B, Cs with questions related specifically to tinnitus, hearing loss and sound tolerance being attributed to each one, enabling a quick assessment of the effects of hearing loss separate from the effects caused by tinnitus[15,16]. Thus, the objective of the present study was to verify the applicability of the THS in measuring and differentiating complaints of tinnitus, hearing loss and sound tolerance.

METHOD

An observational, cross-sectional study was carried out at the Audiology and Speech Therapy Center at the Bauru School of Dentistry (FOB), Universidade de São Paulo (USP), under the approval of the Research Ethics Committee (REC) CAAE: 59804216.1.0000.5417 .

All selected participants signed the Free and Informed Consent Form (FIC) and underwent a previous evaluation in which the following exams were performed: Tonal Liminar Audiometry, Logoaudiometry and Acoustic Immitance Measures.

In total, 70 people were selected at random according to the eligibility criteria, with and without complaints of tinnitus and of both sexes for voluntary participation in the present study. The sample was divided into four groups: 20 individuals without hearing loss and without tinnitus (Group 1); 14 individuals with hearing loss and without tinnitus (Group 2); 14 individuals without hearing loss and with tinnitus (Group 3); 22 individuals with hearing loss and tinnitus (Group 4).

Inclusion criteria:

- Normal bilateral audiometry with an average established by the International Organization for Standardization (ISO) of 500, 1000, 2000, and 4000Hz up to 25dB and without tinnitus complaint (Group 1);
- Diagnosis of mild to moderate neural sensorineural hearing loss with an ISO average of 26dB to 60dB, without previous use of an individual hearing aid (hearing aid) and without tinnitus (Group 2);
- Normal bilateral audiometry with an ISO average of up to 25dB and complaining of continuous tinnitus for a minimum period of 6 months (Group 3);
- Diagnosis of mild to moderate neural sensorineural hearing loss with an ISO average of 26dB to 60dB, without previous use of hearing aids and with complaints of continuous tinnitus for a minimum period of 6 months (Group 4);
- Individuals who did not have limitations in attending the clinic and answering the questionnaire;
- Be 18 years old or older.

Exclusion Criteria:

- Severe or profound neural sensorineural hearing loss with an ISO average equal to or greater than 61 dB;
- Previous use of hearing aids;
- Present sporadic tinnitus;
- Previous performance of some type of tinnitus intervention.

For the initial evaluations referring to the audiological diagnosis, a pure tone audiometry was performed with the Warble Tone stimulus and application of the descending method in the frequencies of 250Hz, 500Hz, 1000Hz, 2000Hz, 3000Hz, 4000Hz, 6000Hz and 8000Hz to classify the patient's hearing acuity from the average frequencies of 500Hz, 1000Hz, 2000Hz and 4000Hz. Hearing loss was considered to be any result above the average of 26 dBHL.

Logoaudiometry was performed with the objective of measuring the patient's ability to detect and recognize speech through the analysis of the Speech Recognition Percentage Index (SRPI), where we add 40dB to the average of 500Hz, 1000Hz, 2000Hz and 4000Hz for each patient's ear and we asked them to repeat 25 monosyllabic words.

Acoustic immittance measurements were performed in order to rule out possible changes in the external / middle ear, as well as retrocochlear changes in the research members[17].

Subsequently to the evaluations, an interviewer, knowledgeable about the questions that comprise the THS, applied the adapted questionnaire to all the research participants[6].

The THS is divided into three sections, the first being Section A which corresponds to four questions only about tinnitus (difficulty concentrating, relaxing and also difficulties related to sleep), which are not related to hearing loss. Section B was composed of four questions related only to hearing loss (difficulty in understanding speech in noise, group conversations and low-intensity voices). Section C was composed of a question about sound tolerance which is not related to the difficulties resulting from tinnitus or hearing loss[18]. As a result, patients could assign the following marks for each question: 0 (no, it is not a problem), 1 (yes, it is a small problem), 2 (yes, it is a moderate problem), 3 (yes, it is a problem) big problem) or 4 (yes, it's a very big problem) (Annex 1).

At the end of the test, the total of each column must be added followed by the general total of the section, with the session with the highest score the one to which the complaint is most evident.

Right after completing the THS, patients can understand more clearly that the problems listed in Section A of the questionnaire are related to tinnitus management. The problems reported in Section B are related to specific interventions for hearing loss and the difficulties presented in the application of Section C of the questionnaire are related to problems of sound intolerance[19].

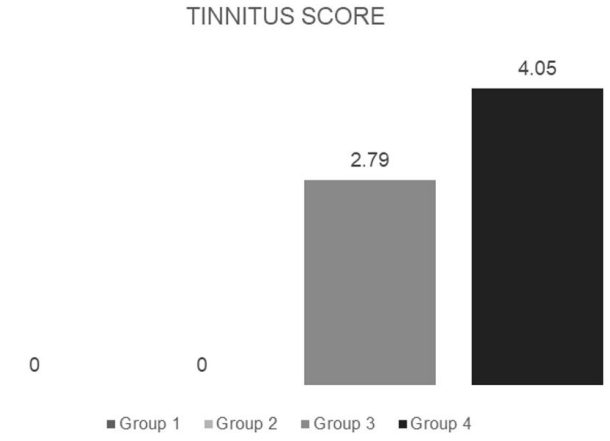
Data were recorded in Microsoft Office Excel from the distribution of patients between groups, tabulated and described according to the descriptive statistical analysis (mean and standard deviation) and the Kruskal-Wallis test was used for inferential analyses between the 4 groups and then the Pairwise multiple comparison test was applied to specify the significance found.

RESULTS

The composition of the four groups was defined as follows: Group 1 was composed of 13 women (65%) and seven men (35%) with an average age for women of 46.2 ± 14.8 and for men of 28.6 ± 8.6, without hearing loss and without tinnitus; Group 2 was composed of eight women (57.1%) and six men (42.9%), with a mean age of 62.2 ± 5.6 and men 66.6 ± 14.0 and with hearing loss and no tinnitus, Group 3 was composed of six women (42.9%) and eight men (57.1%) with a mean age of 43.3 ± 19.0 for women and 46.1 ± 14.5 for men; without hearing loss and with tinnitus, and Group 4 was composed of nine women (40.9%) and 13 men (59.1%) with a mean age of 52.2 ± 16.5 among women and 62.3 ± 9.5 among men; with hearing loss and tinnitus. The general mean of the sample was 50.8 ± 15.6 years for women and 52.4 ± 18.1 years for men, highlighting the homogeneity of the group.

Table 1 presents the description of the sample.

Regarding the analysis of the total between the groups by the Kruskal-Wallis test, significant differences ($p < 0.05$) were found in Sections A and B (Tinnitus and Hearing Loss), but there was no significance in Section C regarding sound tolerance ($p = 0.476$). Figures 1-3 show the averages of the totals per group according to the descriptive analysis of the results.



Caption: Group 1 = no tinnitus and no hearing loss; Group 2 = with hearing loss and without tinnitus; Group 3 = no hearing loss and tinnitus; Group 4 = with hearing loss and tinnitus; Kruskal-Wallis ($p < 0.05$) *.

Figure 1. Representative graph of the average of the answers to the questions about tinnitus of the THS among the 4 groups.

Table 1. Descriptive analysis of gender and age profile of the sample by group.

	Group 1		Group 2		Group 3		Group 4	
	Women	Men	Women	Men	Women	Men	Women	Men
Sample (%)	13 (65%)	7 (35%)	8 (57.1%)	6 (42.9%)	6 (42.9%)	8 (57.1%)	9 (40.9%)	13 (59.1%)
Age (sd)	46.2 (14.8)	28.6 (8.6)	62.2 (5.6)	66.6(14.0)	43.3 (190)	46.1 (145)	52.2 (165)	62.6 (9.5)

Caption: SD= standard deviation.

Table 2. Analysis of comparisons of the total between groups in the tinnitus section.

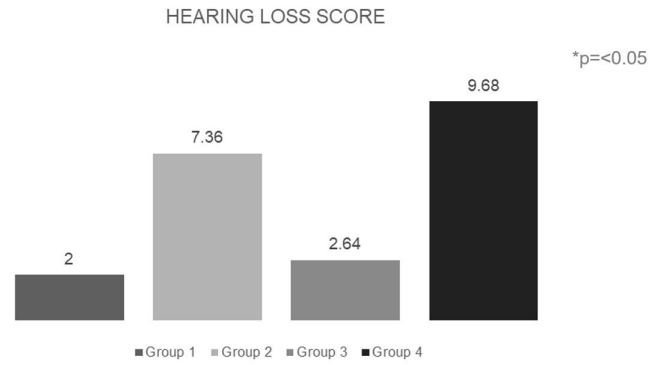
Groups	Test statistics	Standard Error	p
Groups and Group 4	31.568	6.265	0.000*
Group 1 and Group 4	31.568	5.662	0.000*
Group 2 and Group 3	25.393	6.926	0.000*
Group 1 and Group 3	25.393	6.386	0.000*
Group 1 and Group 2	0.000	6.386	1.000
Group 3 and Group 4	6.175	6.265	0.324

Caption: Group 1 = no tinnitus and no hearing loss; Group 2 = with hearing loss and without tinnitus; Group 3 = no hearing loss and tinnitus; Group 4 = with hearing loss and tinnitus. Comparisons by the Pairwise Group Method (* p <0.05.).

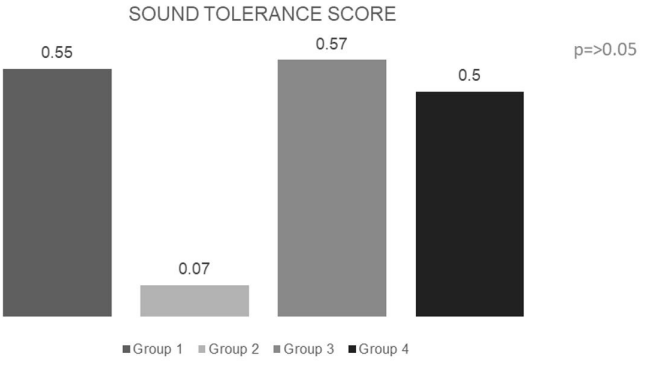
Table 3. Analysis of comparisons of the total between groups in the hearing loss section.

Groups	Test statistics	Standard Error	p
Group 1 and Group 3	1.357	7.001	0.846
Group 1 and Group 2	20.679	7.001	0.003*
Group 1 and Group 4	28.932	6.207	0.000*
Group 2 and Group 3	-19.321	7.593	0.011*
Group 3 and Group 4	27.575	6.869	0.000*
Group 2 and Group 4	8.253	6.869	0.230

Caption: Group 1 = no tinnitus and no hearing loss; Group 2 = with hearing loss and without tinnitus; Group 3 = no hearing loss and tinnitus; Group 4 = with hearing loss and tinnitus. Comparisons by the Pairwise Group Method (* p <0.05).



Caption: Group 1 = no tinnitus and no hearing loss; Group 2 = with hearing loss and without tinnitus; Group 3 = no hearing loss and tinnitus; Group 4 = with hearing loss and tinnitus; Kruskal-Wallis (p <0.05) *.
Figure 2. Representative graph of the average of the answers to the questions about hearing loss of the THS among the 4 groups.



Caption: Group 1 = no tinnitus and no hearing loss; Group 2 = with hearing loss and without tinnitus; Group 3 = no hearing loss and tinnitus; Group 4 = with hearing loss and tinnitus; Kruskal-Wallis (p <0.05). *
Figure 3. Representative graph of the average of the answers to the question about THS sound tolerance among the 4 groups.

In the analysis of comparisons using the Pairwise method of the total between groups, significant differences (p <0.05) were found in the section on tinnitus between Groups 2-4; 1-4; 2-3 and 1-3, as shown in Table 2.

In the Hearing Loss section, significant differences (p <0.05) were found between Groups 1-2; 1-4; 2-3 and 3-4, as shown in Table 3.

DISCUSSION

Tinnitus is characterized by being a complex symptom referred to in different ways and can damage the quality of life of the individual who refers it. Sometimes hearing loss is associated with the symptom and makes it difficult to clarify what is a complaint related to tinnitus and what is a complaint arising from hearing loss. Thus, the present study selected different groups of individuals to verify the effectiveness and applicability of the THS in measuring and differentiating complaints of tinnitus, hearing loss and sound tolerance.

Seventy individuals were evaluated by applying the THS, the sample consisting of 36 women and 34 men in total (Table 1). Groups 3 and 4 that presented tinnitus associated or not with hearing loss, presented more men than women with the symptom, as well as the average age of these individuals was between 64.1 and 58.4, corroborating with other studies[20-23]. On the other hand, Groups 1 and 2, that included individuals who did not have tinnitus, had a sample composed of more women than men. This difference was probably observed due to the different composition of the groups, since individuals with and without tinnitus were allocated to different groups, inherently being different because of their composition.

When comparing the four groups in relation to questions about tinnitus, Groups 3 (mean = 4.05) and 4 (mean = 2.79)

were the ones with the most complaints since both included individuals who had tinnitus. (Figure 1).

It was found that the patients who did not have hearing loss and have tinnitus, reported more discomfort than those who had both symptoms. Due to the heterogeneity of the symptom, the interpretation of tinnitus annoyance is complex and depends on many factors inherent to the individual, and each individual must be understood within its specificities[24].

However, it is believed that the annoyance caused by tinnitus, as well as the difficulty in measuring it, cause very negative impacts on the lives of the affected individuals, in addition to limiting a greater knowledge of this symptom and its relationship with other factors such as hearing loss. For example, making it difficult to assess the therapeutic results, reducing concentration, sleep and compromising emotional balance and social life, causing these individuals to have more complaints[23,25].

As for hearing loss, it is clear that Groups 2 and 4 had higher scores on the questionnaire, showing that HRT can be useful in identifying patients with hearing problems (Figure 2). However, even the groups without loss scored low on this scale, which makes us think that many patients have hearing difficulties in noisy environments. This can happen since the understanding of speech in silence can be completely different than in situations of competitive conversation, and the speech tests used in audiological evaluations may therefore not be efficient in detecting the functional capacity of the individual to perceive and understand speech in noisy environments[26].

The aforementioned fact could also be explained by the possible disorders of central auditory processing that individuals could present, since audiometry is an exam that assesses auditory sensitivity to pre-established frequencies, but does not guarantee the integrity of central auditory processing, mainly for sounds found in the individual's daily routine[27].

Regarding sound tolerance, all groups reported some degree of sound intolerance, with Group 3 (without loss with tinnitus) having the highest complaint and Group 2 (with loss without tinnitus) having the lowest (Figure 3). Among the possible etiologies of hyperacusis are conditions involving the peripheral auditory system, such as noise-induced hearing loss, Menière's disease, as well as central nervous system diseases and syndromes and hormonal and infectious diseases, however, normal hearing thresholds do not necessarily reflect the normal hearing thresholds for an absence of damage to the cochlea or auditory nerve[28,29].

It is possible to affirm that the association between hypersensitivity to sound and tinnitus can have serious implications in the research and in the management of both conditions, and the two disorders can have a significant influence on the auditory activity patterns in response to external sounds and are related to limitations such as difficulties sleeping, listening and concentration difficulties, as well as social problems, both at work and in interpersonal relationships[28,30].

Therefore, in view of the facts presented, considering the use of the THS to better understand the patient in the face of different audiological complaints can bring positive results for future complaint interventions or even in the patient's greater engagement with therapy, since it makes it possible to understand the complaint that most affects them and also facilitates the understanding of the need for treatment.

CONCLUSION

In view of the need to understand and differentiate auditory complaints from tinnitus complaints, as well as to identify patients' sound tolerance complaints, the THS proved to be a possible precise tool to assist in this process, since, according to the results presented, the patients with hearing loss scored more in the hearing category and those with tinnitus scored more in the tinnitus category, in addition to being a quick and simple questionnaire. It was also possible to notice from the analysis of the results of the sound tolerance that even individuals without hearing complaints or tinnitus can present complaints of tolerance. These individuals may be the target of future studies since this population generally does not know which professional to look for when presenting these complaints. Thus, the development of future studies would be of great value to prove and expand the knowledge regarding the sensitivity of the THS in differentiating the hearing complaints, in addition to complaints regarding the tolerance to sounds.

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Authors' contribution

ARS was responsible for collecting, analyzing, and interpreting the data, analyzing the theoretical content, and writing the article; MCF was responsible for writing the article, critical review, submission, and procedures of the article; MFCGM participated as a supervisor, the conception of study, data analysis and correction and approval of the final version of the article.

ANNEX 1. BRAZILIAN TINNITUS AND HEARING SURVEY QUESTIONNAIRE[16].

Brazilian Tinnitus and Hearing Survey

A- Tinnitus	No, it is not a problem.	Yes, it is a small problem.	Yes, it is a moderate problem.	Yes, it is a big problem.	Yes, it is a very big problem.
In the past week, the tinnitus has prevented me from sleeping.	0	1	2	3	4
Last week, the tinnitus kept me from concentrating on reading.	0	1	2	3	4
In the past week, the tinnitus has prevented me from relaxing.	0	1	2	3	4
For the past week, I haven't been able to get the buzz out of my head.	0	1	2	3	4
TOTAL OF EACH COLUMN					
GRAND TOTAL					
B- Hearing	No, it is not a problem.	Yes, it is a small problem.	Yes, it is a moderate problem.	Yes, it is a big problem.	Yes, it is a very big problem.
In the past week, I haven't been able to understand what people were saying in a noisy place or with a lot of people.	0	1	2	3	4
In the last week, I couldn't understand what people were saying on TV or in the movies.	0	1	2	3	4
In the last week I didn't understand people who spoke softly.	0	1	2	3	4
In the past week, I haven't been able to understand what was being said in a conversation with several people together (or group conversation).	0	1	2	3	4
TOTAL OF EACH COLUMN					
GRAND TOTAL					
C- Sound tolerance	No, it is not a problem.	Yes, it is a small problem.	Yes, it is a moderate problem.	Yes, it is a big problem.	Yes, it is a very big problem.
In the last week, the sounds were too loud or uncomfortable for me while they seemed comfortable to the people around * (People chewing, crumpling paper)	0	1	2	3	4
If you answered 1, 2, 3 or 4 to the above statement:					
* Please list two examples of sounds that are too loud or uncomfortable for you, but seem normal to others					
	* If the sounds are uncomfortable when using the hearing aid, please consult your hearing care professional.				
For professional use only (II):	M		H		N