Research Article

Validity and Reliability of the Persian Version of the Tinnitus and Hearing Survey Questionnaire

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Short running title: Validity and Reliability of the Persian…

Highlights:

- The Persian Tinnitus and Hearing Survey (THS) is a valid and reliable tool
- The Persian THS can be used in distinguishing tinnitus from hearing problems
- The Persian THS can be used in tinnitus interventions for Persian speaking people

ABSTRACT

Background and Aim: Hearing loss often coexists with various comorbidities and is commonly accompanied by tinnitus. Patients frequently report both tinnitus and hearing difficulties, posing challenges in distinguishing between the two complaints. This study aimed to assess the validity and reliability of the Persian version of the Tinnitus and Hearing Survey (THS) for distinguishing between tinnitus and hearing problems.

Methods: A psychometric study involved 100 participants aged 18–60, categorized into four groups based on hearing status and tinnitus presence. The Persian translation of a questionnaire underwent content and face validity assessments. Convergent validity for tinnitus and sound tolerance sections was evaluated using the Tinnitus Handicap Inventory (THI) and Hyperacusis Questionnaire (HQ) respectively, while pure-tone average assessed hearing section validity. Construct validity was confirmed via confirmatory factor analysis, and internal consistency and test-retest reliability were assessed using Cronbach's alpha and Intraclass Correlation Coefficient (ICC) respectively.

Results: The Persian version had strong face and content validity, with Cronbach's alpha values of 0.82 for tinnitus, 0.90 for hearing, and 0.80 overall. The ICC values for the tinnitus, hearing, and sound tolerance sections

were 0.8, 0.83, and 0.82. Convergent validity using the THI and HQ scores were reported 0.76 and 0.6, and the correlation value of the THS score with the PTA was 0.82. Confirmatory factor analysis confirmed a good 2-factor structure of the THS
Conclusion: The Persian THS is a valid and reliable tool for separating tinnitus from hearing problems in Persian-speaking people.
Keywords: Surveys and questionnaires; tinnitus and hearing; validity; reliability

Introduction

Tinnitus has attracted the attention of many specialists due to the increase in the number of affected people. Tinnitus refers to the perception of a sound in the absence of external sound stimuli [1]. The prevalence of chronic tinnitus in the general population is estimated to be 5–15%. This condition is associated with the development of serious psychosocial complications in about 1–3% of cases. Given demographic changes and increased exposure to occupational noise and loud sounds, it is anticipated that the prevalence of tinnitus will continue to increase [2]. Many people with a tinnitus problem may also have some degree of hearing loss [3]. According to various studies, 85–96% of patients with tinnitus have some degree of hearing loss. [4, 5]. The notion that tinnitus is the main cause of hearing problems is a common perception among those with bothersome tinnitus [6]. Some problems in people with tinnitus such as distress and discomfort caused by tinnitus, may be due to hearing problems, making it difficult to communicate with others. Therefore, considering the relationship between hearing loss and tinnitus and the effects of these disorders on the quality of life of affected people, it is necessary to separate the complaints caused by tinnitus and hearing loss to identify the dominant problem of these people, develop effective interventions, and consequently improve their quality of life [7].

To evaluate the effect of functional hearing problems such as tinnitus and hearing loss, self-report questionnaires are commonly employed. One of these tools is the Tinnitus and Hearing Survey (THS), designed by James Henry. It aims to separate tinnitus problems from hearing problems, and can help identify potential issues related to reduced sound tolerance. The THS has three sections; the first section focuses on tinnitus, the second section is related to hearing problems, and the third section measure sound tolerance problems. The first section has four items asking about difficulty in sleeping, concentrating, relaxing, and taking mind off of tinnitus. The second part has also four items asking about hearing problems in noisy places, understanding speech, understanding soft voices, and understanding group conversations. The items in the first and second sections rated from 0 (not a problem) to 4 (a very big problem). Therefore, the total score for each section ranges from 0 to 16. The third section has 2 items related to the loudness of sounds. This section is used within the context of progressive tinnitus management to identify people who are unable to participate in group education [7]. As mentioned above, a significant number of people experiencing both hearing and tinnitus problems tend to attribute their hearing challenges to the presence of tinnitus [6]. Consequently, when answering to the items related to tinnitus problems, some may exaggerate due to this misconception, leading to an artificially elevated THS score. Although other tinnitus questionnaires, such as the Tinnitus Handicap Inventory (THI), have also been validated, they are susceptible to the influence of hearing problems. This susceptibility complicates their applicability in accurately determining the need for specific interventions on tinnitus [6, 7].

The lack of a Persian version of questionnaires for distinguishing between tinnitus and hearing problems is one of the clinical and research problems in Iran. Therefore, the present study aims to translate the THS into Persian language and determine its validity and reliability.

Methods

After obtaining permission from the designer of the THS, the translation was done based on the International Quality of Life Assessment (IQOLA) protocol [8] by two proficient translators who were fluent in English and experts in Persian language. Then, to compare the translated version with the original version, a third expert proficient in both languages, back-translated the obtained version into English. The English version was presented to the main author and after his approval, the draft was presented to 5 people with tinnitus and hearing loss and 10 audiologists active in the field of tinnitus and hearing loss problems to assess its face validity and content validity [9]. Then, the Lawshe method was used to determine the content validity ratio (CVR) [10], while the Waltz and Bausell method was used to determine the Content Validity Index (CVI) [11]. The CVR values more than 0.69 and the CVI values more than 0.79 are considered acceptable values [9].

In this study, participants were 100 Persian speaking people aged 18–60 years. They were first assessed with an audiometer (AD229b, Interacoustics, Denmark) at a frequency range of 250–8000 Hz. Then, they were categorized into four groups based on the Pure Tone Average (PTA) at frequencies of 0.5, 1, 2, and 4 kHz:

normal-hearing group (those without tinnitus and hearing loss), hearing loss group (those with hearing loss but no tinnitus), tinnitus group (those with tinnitus but no hearing loss), and tinnitus+hearing loss group (those with both tinnitus and hearing loss) (Table 1). Normal hearing and hearing loss were determined according to World Health Organization standards [12]. In this regard, the PTA≤25 dB indicated normal hearing, and PTA>25 dB indicated hearing loss. The entry criteria were having complaints of chronic tinnitus more than 6 months (in the tinnitus and tinnitus+hearing loss groups) and the absence of pulsatile tinnitus. The final Persian version of the THS (Appendix A) was presented to all participants. They were also asked to complete the Persian version of the THI [13] to assess convergent validity of the THS's tinnitus section. The THI is one the most common instruments for evaluating the effect of tinnitus [14]. Additionally, the PTA results of participants were used to determine their correlations with the THS's hearing section. All participants also filled out the Persian version of the Hyperacusis Questionnaire (HQ) [15], designed to assess hyperacusis [16]. The score of the HQ was used to assess the convergent validity of the THS's sound tolerance section.

To examine the factor structure of the Persian THS, the confirmatory factor analysis was used with the maximum likelihood method based on the variance-covariance matrix. In this regard, chi-square ($\chi 2$), relative chi-square ($\chi 2/df$), Comparative Fit Index (CFI), Normed Fit Index (NFI), Goodness of Fit Index (GFI), Root Mean Square Error of Approximation (RMSEA) and standardized root mean square residual were calculated. In some sources, it is suggested that $\chi 2/df$ should be less than 2 to accept the model. The CFI, NFI, and GFI values should be between 0 and 1; the values ≥0.9 indicate good and favorable fit. Also, the RMSEA and SRMR values <0.08 indicate a good fit of the model [17-20]. Finally, to assess the reliability of the questionnaire, the Persian THS was administered to 40 participants in two stages with a two-week interval [20]. Test-retest reliability assessment was done using the Intraclass Correlation Coefficient (ICC) and Cronbach's alpha was used for determining internal consistency.

The data were statistically analyzed in SPSS v.17 software, and the significance level set at 0.05. Construct validity was examined using AMOS software. Spearman's correlation test was used for assessing convergent validity. Inferential analyses among the four groups were conducted using the Kruskal-Wallis test, followed by pairwise comparison.

Results

Based on the evaluations of 10 audiologists, the Persian THS had acceptable content validity. Each item had CVR values in a range of 0.8–1. Moreover, the average CVI scores based on relevance, clarity, and simplicity was calculated as 1, 0.98, and 0.99, respectively, which is higher than 0.79 and indicates a suitable CVI. The correlation coefficient between the THS score (tinnitus section) and the THI score was 0.76, which was significant ($p<0.001$). Also, the correlation coefficient between the THS (sound tolerance section) and the HQ score was 0.6which was significant ($p<0.001$). According to Cohen's standard, correlation coefficients ≥0.5 indicate a large correlation [18]. Also, the correlation between the THS score (hearing section) and the PTA was significant ($r=0.82$, $p<0.001$). The mean scores of Persian THS, THI, HQ and the PTA values are presented in Table 2.

The confirmatory factor analysis was performed on the two-factor model (including tinnitus and hearing factors) of the Persian THS. The fit indices indicate that the two-factor model had a good fit to the data ($\chi 2/df=1.18$, CFI=0.991, NFI=0.948, NFI=0.947 GFI, RMSEA=0.043 and SRMR=0.024). All factor loadings were significant and ranged from 0.70 (item 2) to 0.91 (item 6) (Figure 1).

The Kruskal-Wallis test results showed a significant difference in the scores of tinnitus and hearing sections among the groups ($p<0.001$), while no significant difference was found in the score of sound tolerance section ($p=0.234$). A significant difference was identified in the tinnitus score between hearing loss and tinnitus groups, between hearing loss and tinnitus+hearing loss groups, between normal-hearing and tinnitus groups, and between normal-hearing and tinnitus+hearing loss groups ($p<0.001$). Regarding the hearing section score, there was a significant difference between hearing loss and tinnitus groups, between tinnitus and tinnitus+hearing loss groups, between normal-hearing and hearing loss groups, and between normal-hearing and tinnitus+hearing loss groups. The tinnitus and tinnitus+hearing loss groups obtained the highest scores in the tinnitus section, while the hearing loss and tinnitus+hearing loss groups achieved the highest scores in the hearing section. In the sound tolerance section, all groups reported some level of sound intolerance, where the tinnitus+hearing loss group reported the most complaints and the normal-hearing group had the least complaints. The mean scores of THS sections for the groups are listed in Table 3.

In evaluating the test-retest reliability, the ICC values for the tinnitus, hearing, and sound tolerance sections at a two-week interval were 0.8, 0.83, and 0.82, respectively. These coefficients suggest the high reliability of the

Persian THS questionnaire. Regarding internal consistency, the Cronbach's alpha values for the tinnitus and hearing sections were 0.82 and 0.90, respectively, and for the overall scale, it was 0.8.

Discussion

The present study evaluated the content validity, face validity, convergent validity, test-retest reliability, and internal consistency of the Persian version of the THS. The ICC values for the tinnitus, hearing, and sound tolerance sections were 0.8, 0.83 and 0.82, respectively. These values indicated the high test-retest reliability of the Persian THS. Internal consistency using Cronbach's alpha coefficient for the tinnitus and hearing sections of the questionnaire was also confirmed (α=0.82 and 0.90, respectively). Our results are consistent with the results of Henry et al. for the main version, who reported Cronbach alpha values of 0.76 and 0.83 for the tinnitus and hearing sections, respectively [7].

The results of the confirmatory factor analysis showed that the two-factor structure of the THS questionnaire (including tinnitus and hearing loss factors) had a good fit to the data. All factor loadings for the two-factor model were greater than 0.4 and significant. These findings are consistent with the results for the original version [7] and the results of Raj-Koziak et al. [21] in Poland. They also showed that the THS had the ability to identify the two factors of tinnitus and hearing problems. The 2-factor structure proposed by the THS developer is thus confirmed in our study.

In our study, the tinnitus and tinnitus+hearing loss groups had the highest scores in the tinnitus section, while, the hearing loss and tinnitus+hearing loss groups obtained higher scores in the hearing section. This is consistent with the results of Scheffer et al. [22]. In their study, people with tinnitus also had higher scores in the tinnitus section and people with hearing loss had the higher scores in the hearing section. Therefore, the THS questionnaire can be a useful and simple tool for understanding and distinguishing between tinnitus and hearing problems. Also, the THS score can help experts in choosing the right way to manage tinnitus along with other necessary evaluations such as psychological and psychoacoustic evaluations. A coefficient of 0.76 for the correlation between the score of tinnitus section and the THI score and a coefficient of 0.82 for the correlation between the score of hearing section and the PTA showed that the tinnitus and hearing sections of the THS had good convergent validity. This suggests that the THS questionnaire can be effective in assessing and differentiating tinnitus problems from hearing problems.

In the sound tolerance section, all groups reported some degree of reduced sound tolerance. This section is for identifying individuals who may be unable to participate in group education for tinnitus management. The reason for providing the score of this section apart from the other two sections is that, as indicated by the questionnaire designers, people may do not have the knowledge of sound tolerance problem. Moreover, they may not link their problems to sound intolerance during answering to the items of this section [7]. A positive response to this section merely indicates the possible existence of reduced sound tolerance. It does not indicate the specific type of reduced sound tolerance, such as hyperacusis and misophonia [23]. In this study, for the first time, we assessed the convergent validity of the third section of the THS using the HQ score, and the correlation coefficient between the score of this section and the HQ score was 0.6. Therefore, it can be concluded that the sound tolerance section of the THS also has good convergent validity.

One of the limitations of this research was the change in the patient conditions during in the test and retest phases for assessing reliability, especially the condition of those with tinnitus due to various factors such as anxiety. The next limitation was the difference in the mean age of the groups, which may affect the outcome.

Conclusion

The Persian version of the THS is a reliable and valid tool and can be helpful as a non-invasive clinical and research tool to distinguish between tinnitus and hearing problems in Iranian people to choose the best intervention method according to their dominant problems.

Ethical Considerations

Compliance with ethical guidelines

In this study, the research team has considered and applied ethical guidelines. The Ethics Committee of the University of Social Welfare and Rehabilitation Science approved this study method (Ethical Code: IR.USWR.REC.1402.169).

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Authors' contributions

SAAD: Data collection and writing the original draft; MR and MJ: Supervisor, conceptualization, design, writing, and editing; MV: Methodology and writing.

Conflict of interest

The authors declared no conflict of interest.

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Table 1. Mean and standard deviation of age of study participants in each group

Group	Age (mean±SD)		
	Total	Male	Female
Normal (n=32)	33.53 ±9.76	30.06±10.17	37.00±8.25
Hearing loss (n=24)	47.87±12.23	53.25±12.48	45.19±11.55
Tinnitus (n=21)	36.62±9.66	445.35±8.13	37.90±11.42
Tinnitus+hearing loss (n=23)	50.22±10.05	51.50±10.96	48.82±9.27

Table 2. Mean and standard deviation of scores of tinnitus and hearing survey, tinnitus handicap inventory, hyperacusis questionnaire questionnaires, and pure-tone average in each group

Group	Score (mean±SD)					
	Tinnitus section of THS	Hearing section of THS	Sound tolerance section of THS	THI	HQ	PTA
Normal	0.06±0.25	0.41±0.71	0.23±0.54	0.94±3.05	6.25±4.37	11.41±5.45
Hearing loss	0.04±0.2	3.87±3.77	0.42±0.75	0.75±1.75	8.08±6.56	34.01±6.27
Tinnitus	1.81±1.36	0.48±1.54	0.33±0.6	14.24±12.34	6.81±5.02	17.48±5.96
Tinnitus+hearing loss	2.57±2.31	4.70±3.21	0.52±0.79	19.57±18.44	9.48±7.25	38.32±6.99

THS; tinnitus and hearing survey, THI; tinnitus handicap inventory, HQ; hyperacusis questionnaire, PTA; pure-tone average

Table 3. Mean and standard deviation of scores of the four groups in different parts of the tinnitus and hearing survey

Group	Score (mean±SD)		
	Tinnitus section	Hearing section	Sound tolerance section
Normal	0.06±0.25	0.41±0.71	0.23±0.54
Hearing loss	0.04±0.2	3.87±3.77	0.42±0.75
Tinnitus	1.81±1.36	0.48±1.54	0.33±0.6
Tinnitus+hearing loss	2.57±2.31	4.70±3.21	0.52±0.79

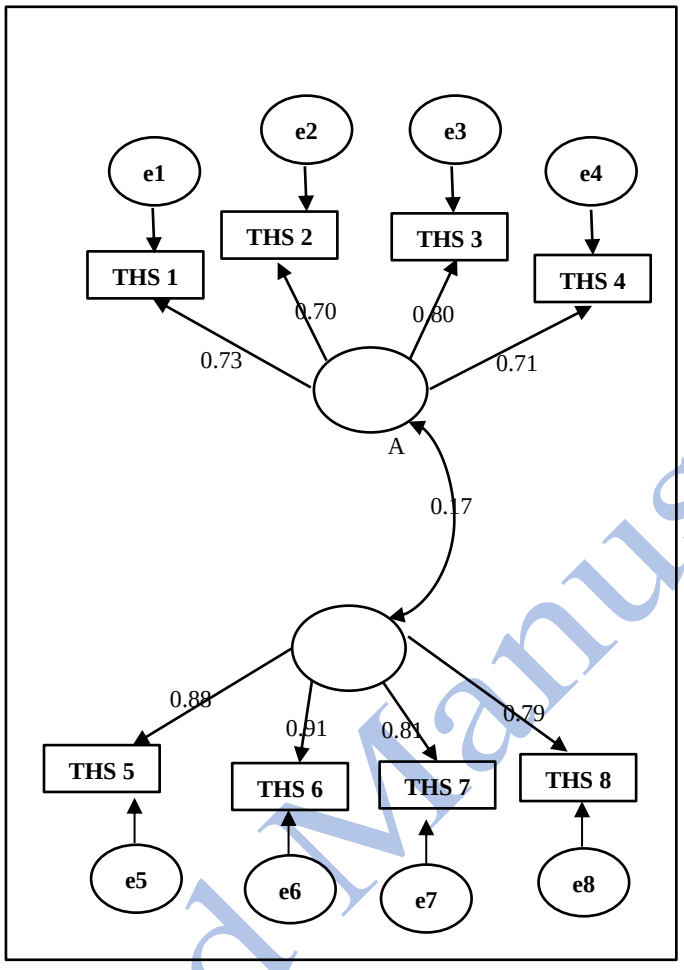

Figure 1. The values of the standardized factor loadings of the two-factor model of the tinnitus and hearing survey questionnaire using confirmatory factor analysis