Research Article

The Persian Version of the Inventory of Hyperacusis Symptoms: The Translation Process, Psychometric Properties, and Diagnostic Criteria in Compared with Hyperacusis Questionnaire

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Highlights

- The Persian IHS is a valid tool for assessing hyperacusis signs in clinical practice
- The Persian IHS can differentiate hyperacusis patients from normal-hearing people
- The cutoff point of P-IHS is 48, with high specificity in diagnosing hyperacusis

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ABSTRACT

Background and Aim: One of the important loudness perception problems is hyperacusis. It is generally defined as sensitivity to average-intensity sounds, which are perceived as excessively loud or uncomfortable. Assessing symptoms of sound intolerance and their impact on patients' lives is crucial. The study aims to determine the validity and reliability of the Persian version of the Inventory of Hyperacusis Symptoms (IHS), assess its validity in differentiating normal-hearing and hyperacusis adults, and measure its cutoff point.

Methods: The questionnaire was translated according to the international quality of life assessment protocol. After determining both qualitative and quantitative face validity and content validity, it was completed by 120 adults (60 with normal hearing and 60 with hyperacusis) to evaluate the differential validity and reliability. The reliability assessment was conducted using the test-retest method for all participants. For assessing the convergent validity, the correlation of the Persian IHS score with the score of the Hyperacusis Questionnaire (HQ) was evaluated.

Results: The questionnaire had good face validity and content validity. The Cronbach coefficient α was 0.93 for the overall scale. The Interclass Correlation Coefficient (ICC=0.97) confirmed reliability. The cutoff point of the Persian IHS score was 48, with 91% sensitivity and 96% specificity. Additionally, a strong significant correlation was found between the scores of IHS and HQ (r=0.82).

Conclusion: The Persian version of the IHS has high validity and reliability for use in hyperacusis clinics and research.

Keywords: Hyperacusis; inventory of hyperacusis symptoms; validity; reliability

Introduction

Hyperacusis is composed of two words; "hyper" implying excessive and abnormal, and "acusis" meaning sound [1]. Intolerance to everyday sounds perceived as excessively loud or uncomfortable leads to distress and impairment in daily activities [2]. Hyperacusis is classified into loudness, annoyance, fear, and pain hyperacusis [1], which can have serious side effects such as anxiety and concentration disorders. The prevalence of hyperacusis in the general population is 8.6–15.5% [3-5]. Among patients with the main complaint of tinnitus, the prevalence of hyperacusis is higher (40%). In patients whose main complaint is hyperacusis, the prevalence of tinnitus is about 86% [3, 4, 6]. Hyperacusis is highly related to tinnitus which can be measured by the Tinnitus Handicap Index (THI) [7] and the Iowa Tinnitus Primary Function (ITPF) [8]. Possible mechanisms are the disruption of the 5-HT gene [9, 10], dysfunction of the auditory efferent system [11], dysfunction of the facial nerve that innervates the stapedius reflex response [12], and impaired central gain modulation [13]. The treatment of hyperacusis depends on what caused it, but the main goal for its treatment is sound desensitization. The treatment methods used for hyperacusis include Cognitive Behavioral Therapy (CBT) [14], sound therapy [15] through desensitization and recalibration methods [16], and sound therapy as a part of tinnitus retraining therapy [6]. The diagnostic tests for hyperacusis include the Pure Tone Average (PTA) test, speech discrimination test, loudness matching test, frequency matching test, and Loudness Discomfort Level (LDL). Due to their limitations, these tests cannot accurately diagnose hyperacusis in clinical practice. For example, even by measuring the LDL, it is not possible to determine the degree of annoyance caused by hyperacusis and its psychological and social consequences in each person because of its limitations such as low test-retest reliability, and its high dependence on the type of instructions given to the patient [9]. For assessing the effects of functional and subjective hearing disorders like tinnitus and hyperacusis, professional interviews and standard self-report tools are often needed to explore various emotional and social aspects in affected individuals. The most common questionnaires for hyperacusis include the Hyperacusis Questionnaire (HQ) [17], the German questionnaire on hypersensitivity to sound [18], the multiple-activity scale for hyperacusis [19], the Inventory of Hyperacusis Symptoms (IHS) [16], the hyperacusis impact questionnaire [20], and the sound sensitivity symptoms questionnaire [20]. The IHS was developed in 2018 by Greenberg and Carlos with 25 items rated on a 4-point Likert scale: Not at all (1 point), a little (2 points), somewhat (3 points), and very much so (4 points) and five dimensions of general loudness, emotional arousal, psychosocial, functional impact, and communication. The total score ranges from 25 to 100 [16]. There are no Persian versions of these questionnaires in Iran, except for HQ [21], which can cause challenges in research and clinical practice. Therefore, this study aimed to evaluate the reliability and convergent validity of the Persian version of this and also determine its differential validity and cutoff point for Iranian patients with hyperacusis.

Methods

After obtaining permission from the main IHS developer [16], this questionnaire was translated from English to Persian according to the International Quality of Life Assessment (IQOLA) protocol [22, 23]. Initially, two experts in English translation and one expert in Persian linguistics performed the translation to Persian, and one experienced expert translated it back to English. The English version was then sent to the developer for approval. Afterwards, the initial version was presented to 5 adults with hyperacusis and at least a secondary school education. Then, 10 audiologists who were experts in tinnitus and hyperacusis were asked to provide qualitative feedback to assess its face validity and content validity. The Lawshe method was used to assess Content Validity Ratio (CVR) [24]. The Content Validity Index (CVI) was measured based on the Waltz and Basel method [25]. These indices were calculated for each item. CVR>0.69 and CVI>0.79 are considered acceptable. After necessary modifications based on the feedback received from the experts, the final draft was prepared and administered to all participants who met the inclusion criteria.

Participants were 60 adults referred to audiology clinics with complaints of hyperacusis (34 males and 26 females) with a mean age of 38.7±8.2 years. A control group consisting of 60 healthy individuals matched for age were also selected to assess differential validity. The characteristics of the two hyperacusis and control groups are presented in Table 1. Exclusion criteria were an air-bone gap more than 10 dB or hearing loss over 25 dB HL at 250–8000 Hz, a history of any psychiatric

Table 1. Descriptive statistics of variables

	Control group	Hyperacusis group
	Mean±SD	Mean±SD
Age (y)		
Total	N=60 38.7±7.71	N=60 38.7±8.22
Male	N=34 40.82±6.42	N=36 40.5±6.71
Female	N=26 35.92±8.41	N=24 36.13±9.72
IHS score	35.01±6.22	56.96±10.62
HQ score	6.2±3.53	20.45±5.81
Hearing threshold	13.1±2.52	14.35±3.12
Loudness discomfort level	106.81±3.21	85.29±2.11

IHS; inventory of hyperacusis symptoms, HQ; hyperacusis questionnaire

or neurological diseases, or the use of hearing aids. Then, the Persian versions of IHS and HQ [21] were given to the participants to complete. Explanations were provided to them if the questions were ambiguous. The participants underwent a pure tone audiometry test at 250–8000 Hz using an audiometer (AD229b, Interacoustics, Denmark). In addition, their LDLs were evaluated at 250–4000 Hz frequencies. Tympanometry and acoustic reflex tests were also used to rule out transient tympanic membrane/middle ear lesions using a tympanometer (AT235, Interacoustics, Denmark). For determining the test-retest reliability using the Interclass Correlation Coefficient (ICC), the questionnaire was completed by all 120 participants at a two-week interval. Internal consistency was evaluated using Cronbach α coefficient [26] for the total questionnaire and its different dimensions (α>0.7 shows acceptable consistency, and α>0.8 indicates very good consistency).

Statistical Analysis was performed in IBM SPSS Statistics (version 12). The significance level was set at 0.05. The data distribution normality was assessed using skewness and kurtosis statistics. The t-test was employed to assess the differential validity between the two groups of control and hyperacusis. To find the cutoff point of the Persian IHS score, Receiver Operating Characteristic (ROC) curve analysis was used. Also, for convergent validity the Pearson correlation coefficient was applied to examine the correlation between the scores of two questionnaires, IHS and HQ, and their relationship with LDL and PTA.

Results

According to the opinions of 10 audiologists, the Persian IHS had acceptable content validity, with CVR values ranging from 0.8 to 1 for the items. The CVI score for relevance, clarity, and simplicity was 0.996, 0.992, and 0.992, respectively, which are higher than 0.79, indicating that the Persian version of IHS had appropriate content validity. To evaluate the differential validity of the questionnaire, the mean total score of the control group (35.01) was compared with the mean total score of hyperacusis group (56.96) using t-test, and the P value was lower than 0.05. There was no significant difference in IHS and HQ scores between the study groups in terms of gender, but there was a significant gender difference in hearing threshold between the two groups ($p<0.05$), where females had lower hearing threshold than males. There was a significant difference between the two groups in all five dimensions of the IHS ($p<0.001$). The patients with hyperacusis showed higher IHS scores compared to the control group in all five dimensions. Based on the Pearson correlation test results, the LDL had a significant negative correlation with IHS and HQ scores, indicating that the lower LDL causes higher IHS and HQ scores. Also, there was a significant positive correlation between the Persian IHS and HQ scores ($r=0.829$, $p<0.001$), but no significant correlation was found between the Persian IHS score and PTA or between the Persian HQ score and PTA, indicating that hyperacusis severity was not directly related to hearing thresholds (Figure 1).

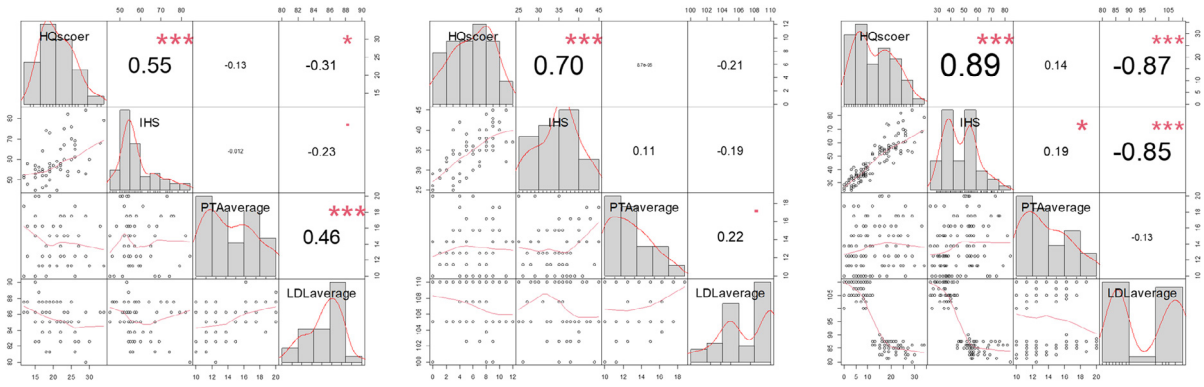

Figure 1. a, b, c: Correlation matrix of a) hyperacusis, b) control, and c) all groups , the (absolute) value of the correlation plus the result of the correlation test as stars (at the top of each panel) and, the bivariate scatterplots, with a fitted line (at the bottom of each panel). HQ; hyperacusis questionnaire, IHS; inventory of hyperacusis symptoms, PTA; pure tone average, LDL; loudness discomfort level

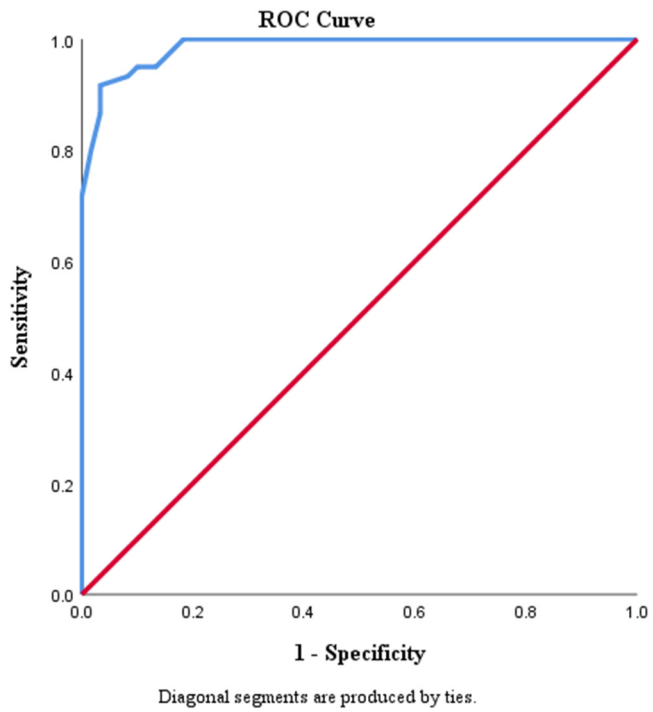

Figure 2. Receiver operating characteristic curve for cut-off point determining with highest sensitivity and specificity

The study identified a cutoff point of 48 for the Persian IHS score using the ROC curve analysis. Scores equal to or above 48 indicate the presence of hyperacusis with a sensitivity of 0.91 and specificity of 0.96 (Figure 2). In assessing the test-retest reliability, the ICC for the total IHS score at a two-week interval was obtained 0.97 ($p<0.05$), indicating a significant correlation between the two measurements. For internal consistency, the Cronbach α was obtained 0.93 for the overall scale. For the subscales of the Persian HIS, the values of Cronbach α coefficients were as following: General loudness=0.69, emotional arousal=0.79, psychosocial=0.86, functional impact=0.84, and communication=0.66.

Discussion

The current study evaluated the content validity, face validity, test-retest reliability, and internal consistency of the Persian version of IHS. For the test-retest reliability, the ICC value was 0.97, indicating optimal reliability of the questionnaire. The internal consistency using the Cronbach α coefficient was obtained 0.93 for

the overall scale. This high coefficient shows a strong interrelationship among the items and their ability to measure the consequences of hyperacusis. Our results are consistent with the results of Greenberg and Carlos and Aazh et al., regarding Cronbach α values for the subscales of the IHS [16, 26]. In Greenberg and Carlos's study [16], the highest Cronbach α was for the psychosocial and emotional arousal dimensions. In Aazh et al.'s study [26], Cronbach α was 0.92 for the psychosocial dimension and 0.89 for the functional impact. In our study, there was a significant negative correlation between the IHS and HQ scores and the LDL, indicating that with decreased LDL in cases with hyperacusis, the scores of HQ and IHS increases, which shows more difficulties in daily life. However, the IHS and HQ scores had no significant correlation with PTA, which is consistent with studies conducted in 2018 and 2021 [16, 26]. This finding confirms that the conventional method of hearing threshold assessment is not appropriate for diagnosing hyperacusis and determining the problems caused by hyperacusis; therefore, to identify and follow up the rehabilitations for this hearing disorder, other tools including valid and reliable questionnaires are needed. We found a significant correlation between the scores of Persian IHS and HQ.

In our study, the cutoff point of the Persian IHS score was 48, with 91% sensitivity and 96% specificity for 120 people with hyperacusis (not with tinnitus). The cutoff point in Greenberg and Carlos's study was 69, with a sensitivity of 48% and a specificity of 91% for 450 people with tinnitus and hyperacusis. In Aazh et al.'s study, the cutoff point was 56, with 74% sensitivity and 82% specificity for 100 people with tinnitus and hyperacusis.

Limitations

One of the limitations of this study was the interval between the test and retest phases for assessing reliability because the patient's condition may change during this period, especially the conditions of those in an acute phase, due to different factors such as stress.

Conclusion

The Persian version of the inventory of hyperacusis symptoms have high validity and reliability. It is a useful non-invasive tool for differentiating hyperacusis patients and following up on the effects of rehabilitation and management programs for people with hyperacusis at varying degrees. It assesses five distinct domains of hyperacusis impact: general loudness, emotional arousal, psychosocial, functional impact, and communication. The rehabilitation programs can be tailored based on the scores of each domain to effectively address the specific areas of concern.

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.1400.337).

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Authors' contributions

MH: Data collection and writing the original draft; 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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