

Persian language version of the “Tinnitus Handicap Inventory”: translation, standardization, validity and reliability

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Abstract

Tinnitus is a debilitating condition that is widespread yet difficult to successfully diagnose and treat. This symptom can seriously affect the individual's life quality. **Objectives:** The aim of current study was to compose and validate a Persian version of the Tinnitus Handicap Inventory (THI-P). **Materials and Methods:** The linguistic validation of the original version of THI into Persian version (THI-P) included translation, back translation and data gathering. The THI-P was administered to 112 tinnitus subjects. Age, gender, medical history and tinnitus characteristics were recorded as baseline information. All participants complained of chronic unilateral or bilateral subjective idiopathic tinnitus lasting for at least 6 months before consulting about their tinnitus. **Results:** There was no significant difference between gender, age, hearing impairment and total score and subscales of THI-P. Pearson product-moment correlations revealed adequate test-retest reliability for the THI-P ($r = 0.96$). Cronbach's-alpha coefficient indicated adequate internal stability of the THI-P ($r = 0.943$), with a total item correction varying between $r = 0.939$ and $r = 0.944$, indicating its reproducibility. **Conclusion:** The present study proved the internal consistency/ coherency of the Persian version of THI (THI-P). This provides satisfactory application in clinical/research environments.

Keywords: quality of life, questionnaires, reproducibility of results, tinnitus.

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INTRODUCTION

Regarding to McFadden (1982), Tinnitus is the “conscious experience of a sound that originates in an involuntary manner in the head of its owner or may appear to him to be so”¹. This symptom is a debilitating condition that is widespread yet difficult to successfully diagnose and treat. The prevalence of chronic tinnitus in the general population is estimated between 5-15% and causes to develop serious psychosocial complications in 1% to 3%¹. Epidemiological studies indicated that in developed countries such as Germany about 1.5 million people, in the United States about 10 million out of 40 million tinnitus sufferers and a similar ratio in the United Kingdom have been reported that were seriously affected by tinnitus²⁻⁴. An Asian population study conducted in Korea indicated an overall prevalence of 10.9%⁵. In addition, tinnitus is a common symptom of the auditory system disorders that is usually associated with sensory-neural hearing loss^{6,7}. An epidemiological study in Italy based on a tinnitus questionnaire demonstrated that the prevalence of tinnitus was 8% in normal hearing subjects while this amount rose up to 30.5% in the presence of auditory dysfunctions⁸. Most tinnitus patients tend to adapt to this phantom sound. Tinnitus may become a source of significant disability for those who fail to adapt. Therefore, the symptom of tinnitus has forced clinicians to attempt to establish protocols for accuracy of tinnitus diagnosis and treatment⁹.

Some underlying causes were defined for tinnitus, including otological diseases, tumors, ototoxicity, acoustic trauma, noise-induced and psychological disturbances. For some patients with tinnitus this sensation does not interfere with their daily activities and for others it is disabling and restricts their work, sleep, and social activities^{10,11}. It is reported that tinnitus can be severe enough to cause significant discomfort in one’s daily life¹². Tinnitus symptoms have been linked to various psychological and psychosomatic disorders¹³⁻¹⁵. It is shown that 48% to 60% of patients with chronic or disabling tinnitus have major depressive disorder (MDD)¹⁶. Asplund reported that among subjects with tinnitus poor sleep and frequent waking were more common in men and women¹⁷.

In fact, subjective tinnitus is a symptom with no objective reflects on blood biochemistry tests and/or radiography of the brain and that is why the assessment of a tinnitus patient is a complex task due to the lack of a standard protocol. Numerous studies using various open-ended or self-report structured questionnaires have been conducted. Finding the effects of tinnitus on the quality of life and assessing the individual’s reaction to tinnitus are very important. One of the most important methods in the assessment of the severity of tinnitus and

its effects on the lifestyle of a patient is the use of psychometrical evaluations. Such self-report questionnaires include the Tinnitus Questionnaire (TQ)¹⁸, Tinnitus Handicap Inventory (THI)¹⁹, Tinnitus Severity Scale (TSS)²⁰, Tinnitus Handicap Questionnaire (THQ)²¹, Subjective Tinnitus Severity Scale²² and Tinnitus Reaction Questionnaire (TRQ)²³. In this regard the client was questioned in order to find out which activity or performance of the patient is affected by tinnitus. In general, these questionnaires were developed to objectify the functional and psychosocial consequences of tinnitus and its impact on the quality of life, providing supplemental information to the conventional psychoacoustic assessment (e.g., pitch and loudness matching, minimum masking levels, residual inhibition) of tinnitus impairment²⁴. The other advantages of the questionnaires include the objectivity of scoring/interpretation methods and the use of identical questions for all individuals which facilitate clinical comparison and deduction. Also the valid questionnaires are valuable in the evaluation of results from before to after special treatment and its effect on the individual’s quality of life. The Tinnitus Handicap Inventory (THI)²⁵ has gained widespread acceptance as a self-report measure of tinnitus around the world.

Since almost the majority of tinnitus questionnaires for assessing individual’s reaction to tinnitus are in English language and there is still no standardized and valid questionnaire in Persian, the provision of a Persian version of these questionnaires according to the culture of Iranian society is inevitable. For this reason we perform according to the International Quality of Life Assessment protocol (IQOLA) approved by WHO in 1991. The aim of IQOLA is to translate and provide health questionnaires with high validity and reliability for using in different countries by their formal language²⁶.

Newman et al. in 1996 introduced a developed version of THI with 25 items. This version is both simple to administer and interpret and also a powerful psychometric tool. Nowadays, this is used in different health/treatment centers all over the world²⁷. The THI is a 25-item self-report instrument which is divided into three subscales including functional, emotional and catastrophic reactions to tinnitus. Analysis of the THI items suggested that this self-report instrument had excellent internal consistency reliability and adequate convergent and constructive validity²⁸. Therefore, the present study was conducted to research the clinical usefulness of THI to be used by different professionals who are involved with tinnitus subjects such as audiologists, otolaryngologists, psychiatrists, psychologists and other relative specialists in various medical/health centers in Iran.

The first aim of the current study was to investigate the linguistic validity of the Persian Version of the THI as a measure of tinnitus-related reactions in three dimensions

and the second aim was to assess test-retest reliability/repeatability of this questionnaire used for quantifying clinically significant test-retest differences for individual tinnitus subjects.

MATERIAL AND METHODS

The present study consists of translation and standardization of the original version of THI [25] into Persian version (Linguistic validation) then the reliability of the Persian version of THI has been identified. Craig Newman, author of the original questionnaire of THI, has permitted us to develop and use the Tinnitus Handicap Inventory in Persian Language Version.

Linguistic validation

The linguistic validation of the original version of the Tinnitus Handicap Inventory (THI-US) into the Persian version of Tinnitus Handicap Inventory (THI-P) and its psychometric specification included the following three steps:

Step 1. Translation

In the first step according to the IQOLA protocol²⁶, THI questionnaire was translated by two native speakers of Persian, bilingual in English and Persian, separately translated the original instrument into Farsi (Persian) language (translator 1 and 2). They were asked, if needed, to mention a list of possible translations for some words, sentences and phrases. After that, each of the expert translators were asked about the difficulties of the translations and they were attributed a score according to the 100 point visual analogue scale (VAS). In this criteria, zero point means easy translation and 100 means the most difficult one. On the basis of these two translations and their VAS scores to each THI items, we formed the pooled version that was then reviewed by presence of translators for considering suggested replacing words and difficulty in translation. It is worth to mention that in this step, for differentiation of the level of difficulty in translation, average scores less than 25 were considered as easy, more than 30 as difficult and between 25 and 30 as relatively easy. This agreed version of Persian THI translation was given to the two other translators who were expert to Persian philology (translator 3 and 4). These two translators were given a score for the quality of translation. The quality of translation means the suitability of words and sentences from aspects of clarity (use of simple and meaningful words), use of common language (avoiding professional, special or aggravated/artifactual words), similarity of content/meaning (having a meaningful context just like an original questionnaire). Therefore, these translators (3 and 4) for each question determined 3 scores on the basis of 100 point criteria. In this VAS, zero point means absolutely improper quality

and 100 means absolutely proper and satisfactory quality. Criteria for decision making in improper quality of each translation items was the average score less than 90 (determined by translators 3 and 4). Accordingly, in this step, Persian version of the THI was obtained, which regarding to all translators 1 to 4, had satisfactory quality.

Step 2. Back Translation

At the second step of linguistic validation, we used two other translators (5 and 6) with high level of proficiency in Persian and English languages. They back translated the pooled Persian version to English. Afterward, the pooled back translation was compared and formed by translators and then an agreement was obtained for one English version of THI questionnaire for finding the coherency with original version. Finally, we formulated the initial Persian version of the instrument with proper and satisfactory translation. This questionnaire was used as an initial instrument for gathering data from tinnitus subjects at next steps.

Step 3. Data Gathering

In this step contextual translation (not word-by-word) was used. On the other hand, the words and items on the level of reading ability of 14 years old or less were noticed for linguistic validation of THI-P. Therefore the formulated initial Persian version of the instrument was attended by 24 (10 female and 14 male) high school students in Tehran. All participants were native Persians. Each single item was read loudly and the participants were asked to follow the items on the given sheet. During this procedure the students had to answer two questions: 1. if they understood every single word in the presented items. 2. If they understood the concept of the whole questionnaire. Finally the answered questionnaires were gathered and processed by all translators. After that, the subsequent processing was attended by audiologists from department and research center of otolaryngology of Tehran University of Medical Sciences (TUMS).

Participants

We administered the final version of THI-P on 112 tinnitus subjects with and without hearing impairment, ranging in age from 19 to 73 years (73, 65.2% male, 39, 34.8% female; mean = 45.04 years; S.D = 13.67), which were following up at the tinnitus center of department and research center of Otolaryngology, Head and Neck of TUMS, Hazrate Rasoul Hospital. The education level of tinnitus subjects were diploma or higher in 84 (75%). All of our subjects were Persians. All participants were complaining of chronic unilateral (left or right, 61 participants) or bilateral (both ears or in the head, 51 participants) subjective idiopathic tinnitus lasting for at least 6 months (mean = 81.64; SD = 94.69 months) before

consultation and intractable to standard treatments for tinnitus. The final version of THI-P was administered in all tinnitus subjects who were managed in our center between September 2009 and May 2010. Age, gender, medical history and tinnitus characteristics were recorded as baseline information.

Inclusion criteria were: good general health, do not have any invasive therapeutic interventions, should not be pregnant, no history of vertigo/dizziness, no psychiatric disorders or its history (according to psychiatrist verification), dementia, seizure or alcohol/drug abuse in last six months, head and neck diseases or space occupying lesions, any organic disease that causes tinnitus. All subjects gave written informed consent in accord with the declaration of Helsinki before examinations.

Before the THI-P can be administered to assess the effects of tinnitus, its test-retest stability must be determined. So, in retest after one week from filling the first THI-P, the questionnaire was filled again by the same patients. The retest was done without informing the patients of the score of the previous test. There was no intervening treatment between test and retest conditions, e.g., drug trials, fitting of hearing aid or noise generator devices, or any psychological management.

The degree of hearing loss is defined as the severity of the hearing loss measured by audiometry. Hearing thresholds for each participant was classified in five categories: 1- Normal hearing (0 to 25 dB HL), 2- Mild hearing loss (25 to 40 dB HL), 3- Moderate hearing loss (40 to 60 dB HL), 4- Severe hearing loss (60 to 80 dB HL), 5- Profound hearing loss (80 dB HL or greater).

Patients were asked to complete the THI-P questionnaire as part of the initial assessment at the tinnitus center. The THI is a self-report measure 25-item questionnaire that is scored on a 3-point scale. Every individual must select only one choice of "Yes", "No" and "Occasionally". The score of "Yes", "No" and "Occasionally" were 4, 0 and 2, respectively in three subscales: emotional, functional and catastrophic. Finally, the total THI score was the sum of the scores for all three subscales.

Statistical Analysis

All analyses were performed using statistical package for social science (SPSS) version 16. Descriptive statistics, including frequency distributions, means and standard deviation were computed for each item of THI-P. The Cronbach's Coefficient Alpha test (where values > 0.70 indicate a satisfactory internal consistency) was used to test for the evaluating internal stability of the THI-P²⁹, and Pearson correlation coefficient was calculated between the total score of the THI-P and the scores of its subscales, age and pure tone average (PTA). Pearson's product moments also calculated the reliability of THI-P by retest.

Student t-test was used to test for differences between THI scores and its subscales and gender, hearing impairments and tinnitus laterality. Multiple linear regression analysis was used to study the effect of gender, hearing loss and the tinnitus laterality on the overall THI score as well as the functional, emotional and catastrophic subscales. All p-values were two-sided and the level of statistical significance was lower than 0.05.

Code of ethics

All subjects gave written informed consent in accord with the declaration of Helsinki. In this study, the research method and the role of subjects were explained clearly and completely. The individuals could quit the study whenever they wanted. All personal information in the questionnaire were confidential and only used in this research.

RESULTS

Linguistic validation

From the 25 items of THI-US version translated to Persian version of THI, thirteen items (52%) including 2, 3, 7, 8, 9, 10, 11, 15, 16, 20, 21 and 22 as an easy translation, six items (24%) including 6, 12, 14, 17, 18 and 19 as a relatively easy translation and finally other six items including 4, 5, 13, 23, 24 and 25 as a difficult translation were evaluated by translators. The translation clarity exception in one item (item 17) which was evaluated as relatively desirable, in the other 24 items (96%) of THI-P was evaluated as desirable. The common language score of THI-P was assessed as desirable in all 25 items (100%) and also the conceptual equivalence for three items (4, 10, 16) undesirable response (12%), for two items (23 and 14) in a relatively desirable level (8%), and the other items were desirable response (80%).

Reliability of THI-P

The tinnitus characteristics of the 112 subjects attending the tinnitus center to consult about tinnitus management have been summarized in Table 1. Most of tinnitus subjects (72.7%) perceived one type of tinnitus sound, while others complained of sensation of more than one type of sound on different occasions. The type of sound reported by most tinnitus subjects was subjectively described as high-pitch tone, matched by external stimuli (described by 52.3% of subjects). The other descriptions of tinnitus included cricket, sizzling, hissing, humming and other sounds. In total, more than 92% of tinnitus subjects who attended the current study revealed high pitch tinnitus, matched by external stimuli (>3000 Hz).

The mean PTA hearing threshold, calculated over 500-4000 Hz across both ears, ranging from 7.5 to 105 dB HL, mean 31.62 dB (SD=19.53). 40 (52%)

Table 1. The frequency of tinnitus characteristics among the 112 tinnitus subjects who attended the tinnitus center.

Tinnitus Characteristic	Number (%)	Mean	SD
Tinnitus Onset			
< 12 months	35 (31.25%)	8.57	2.08
12 months to < 3 years	32 (28.57%)	28.09	7.67
3 years to < 10 years	18 (16.07)	82.67	24.66
More than 10 years	27 (24.10%)	234.07	59.72
Tinnitus Laterality			
Only left	32 (28.57%)		
Only right	29 (25.90%)		
Bilateral	46 (41.07%)		
In the Head	5 (4.46%)		

of tinnitus subjects presented mild hearing impairment (mean=28.59, SD=6.29), 22 subjects (28.5%) showed moderate hearing impairment (mean=51.05, SD=7.88), 10 subjects (13%) revealed severe hearing impairment (mean=69.8, SD=6.54) and finally 5 subjects (6.5%) demonstrated profound hearing impairment (mean=96.25, SD=16.37) in both ears. Table 2 summarized the mean air conduction thresholds across frequencies of 500-4000 Hz for left and right ears.

Table 2. Mean and standard deviations (SDs) for Right and Left ear Pure Tone Air-Conduction Thresholds (dB HL) for Tinnitus Subjects (N=112).

Ear	Frequency (Hz)			
	500	1000	2000	4000
Right				
Mean	23.79	26.02	31.34	46.56
SD	19.60	20.76	21.87	22.85
Left				
Mean	22.05	24.69	31.03	43.04
SD	19.59	20.70	21.82	23.21

The frequency distribution of tinnitus subjects who answered the various items in the THI-P questionnaire has been outlined in Table 3. In the present study, the total mean of THI-P score in all subjects was 53.62 (SD=27.23, ranging from 4 to 100). The range of responses were from 26.8 to 73.2% for a "Yes" response, 10.7 to 40.2% for a "Sometimes" response and 16.1 to 48.2% for a "No" response by tinnitus subjects. As presented in Table 3, the highest score of "Yes" responses were noted for the following items relating to the emotional subscale: "Do you complain a great deal about your tinnitus?" (62.5%) and "Does your tinnitus make you angry?" (50%). In functional subscale, the highest scores were related to questions: "Does your tinnitus get worse when you are under stress?" (67.9%) and "Because of your tinnitus,

do you find that you are often irritable?" (50.0%). Finally, the other two questions which were accompanied by the highest score of "Yes" responses for catastrophic subscale were: "Do you feel that you have no control over your tinnitus?" (73.2%) and "Do you feel as though you cannot escape your tinnitus?" (42.9%).

The correlation of age and total THI-P score was calculated by Pearson's product and for calculating the effect of sex and total THI-P score we applied independent student t-test. The results of Pearson product correlation coefficient analysis did not demonstrate a statistically significant correlation between age and the total scores of the THI-P ($r = -0.205$), functional ($r = -0.186$), emotional ($r = -0.181$) and catastrophic responses ($r = -0.225$) subscales. As shown in Figure 1, the total score of THI-P and its subscales were not correlated with the age of tinnitus subjects. There was no significant difference between total score of THI-P and gender of subjects. Independent Student t-tests did not demonstrate statistically difference between total THI-P score and those with or without hearing impairment, neither did those with unilateral or bilateral tinnitus (Table 4). Independent Student t-tests did not demonstrate statistically significant differences between the means of total THI-P and gender of tinnitus subjects (Male: mean =54.77, SD =27.85; Female: mean =51.49, SD =26.28), functional (Male: mean =25.48, SD =13.53; Female: mean =23.38, SD =12.63), emotional (Male: mean =17.89, SD =10.51; Female: mean =17.44, SD =10.17) and catastrophic responses (Male: mean =11.40, SD =5.55; Female: mean =10.67, SD =5.83) scored by tinnitus subjects ($t = 0.60$; $p = 0.55$). The pure tone audiometry (PTA) threshold was within normal limit in 34 (mean=14.19, SD=3.44) tinnitus subjects, as evident in their audiograms. 78 (45.53, SD=22.90) of all the tinnitus subjects who were present with hearing loss had various degree of sensorineural high frequencies hearing impairment. The PTA threshold did not show any relationship between the total scores of the THI-P ($r = 0.05$) or the functional ($r = 0.05$), emotional ($r = 0.06$), or catastrophic response ($r = 0.009$) subscales (Table 4).

Pearson product-moment correlations were calculated between the first and second administrations of the THI-P among the tinnitus subjects to assess the strength of the relationship between tests and retest (Figure 2). As shown in Figure 2, the scatter plot indicates the correlation between the first (test) and second (retest) administration of the THI-P and their subscales on tinnitus subjects. In this analysis there was adequate test-retest reliability for the THI-P ($r = 0.96$).

As shown in Table 5, the correlations between the test and retest values ranged from 0.83 to 0.96.

We assessed the percentages of "Yes", "Sometimes" and "No" answers and then we calculated the reproducibility (internal consistency reliability) of items in

Table 3. Mean and Standard Deviation (SD) of Persian Version of THI (THI-P) items among the participants.

Subscale	*Items	Frequency (%)			Mean	SD
		Yes	Sometimes	No		
Emotional (E)						
E3	Does your tinnitus make you angry?	50	31,3	18,8	2,63	1,54
E6	Do you complain a great deal about your tinnitus?	62,5	13,4	24,1	2,77	1,70
E10	Because of your tinnitus, do you feel frustrated?	27,7	24,1	48,2	1,59	1,70
E16	Does your tinnitus make you upset?	48,2	31,3	20,5	2,55	1,57
E17	Do you feel that your tinnitus problem has placed stress on your relationships?	39,3	22,3	38,4	2,02	1,77
E21	Because of your tinnitus, do you feel depressed?	34,8	25,9	39,3	1,91	1,73
E22	Does your tinnitus make you feel anxious?	49,1	30,4	20,5	2,57	1,58
E25	Does your tinnitus make you feel insecure?	31,3	22,3	46,4	1,70	1,74
Functional (F)						
F1	Because of your tinnitus, is it difficult for you to concentrate?	28,6	40,2	31,3	1,95	1,55
F2	Does the loudness of your tinnitus make it difficult for you to hear people?	40,2	25	34,8	2,11	1,74
F4	Does your tinnitus make you feel confused?	34,8	33	32,1	2,05	1,64
F7	Because of your tinnitus, do you have trouble falling asleep at night?	28,6	33,9	37,5	1,82	1,62
F9	Does your tinnitus interfere with your ability to enjoy social activities?	29,5	22,3	48,2	1,63	1,73
F12	Does your tinnitus make it difficult for you to enjoy life?	38,4	24,1	37,5	2,02	1,75
F13	Does your tinnitus interfere with your job or household responsibilities?	35,7	26,8	37,5	1,96	1,72
F14	Because of your tinnitus, do you find that you are often irritable?	50	25	25	2,50	1,67
F15	Because of your tinnitus, is it difficult for you to read?	26,8	30,4	42,9	1,68	1,65
F18	Do you find it difficult to focus your attention away from your tinnitus and on other things?	32,1	34,8	33	1,98	1,62
F20	Because of your tinnitus, do you often feel tired?	36,6	30,4	33	2,07	1,68
F24	Does your tinnitus get worse when you are under stress?	67,9	13,4	18,8	2,98	1,59
Catastrophic C						
C5	Because of your tinnitus, do you feel desperate?	36,6	24,1	39,3	1,95	1,75
C8	Do you feel as though you cannot escape your tinnitus?	42,9	28,6	28,6	2,29	1,67
C11	Because of your tinnitus, do you feel that you have a terrible disease?	36,6	16,1	47,3	1,79	1,83
C19	Do you feel that you have no control over your tinnitus?	73,2	10,7	16,1	3,14	1,51
C23	Do you feel that you can no longer cope with your tinnitus?	36,6	25,9	37,5	1,98	1,73

*item describes the subscales (E: emotional, F: functional and C: catastrophic) and items number as it appears in the THI questionnaire.

THI-P using the Cronbach's-alpha coefficient. This value was 0.943, with a total items correction varying between $r=0.939$ and $r=0.944$, indicating its reproducibility. Total score of the THI-P and its associated subscales are very close to corresponding values in the original THI-US (Table 6).

The statistical evaluation of THI-P Items with total scores is characterized in Table 7. There is no change in total value of Cronbach's α (0.943) when is omitting every item of THI-P.

DISCUSSION

In recent years, the need to assess and consider the consequences of diseases as well as distressing symptoms has been specifically considered in all special facilities of medical and rehabilitation. Researches

in many different countries around the world in this area indicate the global emphasis on the importance of these assessments. In Iran, in order to converge and coordinate with the ongoing research at the international level concerning the evaluation of consequences of diseases, impairments, handicaps, treatments and rehabilitation, we should create a new movement.

Hence, as a first step, standardization and validation of appropriate tools such as psychometric questionnaires are very important in order to evaluate disease or monitor treatment outcomes.

Tinnitus complaint does not consist of one single domain. This symptom is as a common problem which can affect several aspects of patients' life including: going to sleep, understanding speech, depression, irritation, concentration and worse on awakening. Sense of the various problems among the subject sufferer from tin-

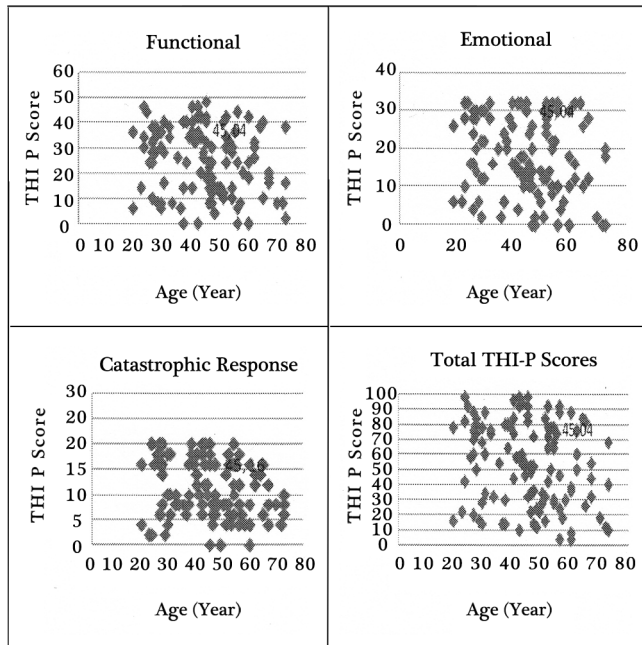


Figure 1. Scatter plots illustration the relationship between the THI-P score and the age in all subscales.

nitus and understanding the impact of tinnitus on their quality of life are of the uttermost importance. Tinnitus is a subjective idiopathic symptom in which it is not detected by blood examination and CT scan or like this. The main problem with tinnitus is its subjective nature so that evaluation of this complaint always depends upon patient's words. At present, we have four approaches for the evaluation of subjective idiopathic tinnitus that includes: psychoacoustical evaluations (e.g., pitch match, loudness match, masking trials and residual inhibition measurement), functional imaging (e.g., PET, SPECT and fMRI), electrophysiological approaches and finally psychometrical assessments. These approaches are inadequate for describing a patient's reactions to the perceived tinnitus sensation/s except psychometrical assessments³⁰⁻³². Therefore, the valid psychometrical evaluations such as THI can be administered as a robust instrument to objectify tinnitus distress, but additional measures might be needed in order to catch the dimensions of tinnitus-related problems.

One of our ultimate goals for validating the Persian version of THI and for conducting current study was to develop a standard self-report tinnitus instrument, appropriate to the Persian's culture so that it could be administered as a criterion measure in clinical and research approaches available to clinicians and other researchers who are involved in different aspects of tinnitus subjects. To acquire this expressed goal, it was necessary to translate and standardize the original version of THI and then to evaluate the test-retest reliability of the THI-P.

Table 4. Comparison of the Persian-version THI (THI-P) severity score and the subscale severity score between genders, the presence or absence of hearing loss, and tinnitus characteristics.

Parameter	Mean value ± SD	p-value
Total THI-P Score		
Gender		
Male (n=73)	54.77 ± 27.85	0.55
Female (n=39)	58.10 ± 26.66	
Hearing Loss		
PTA within normal limits(n=34)	55.47 ± 26.67	0.57
Hearing loss present (n=78)	52.36 ± 27.69	
Tinnitus laterality		
Bilateral (n=51)	50.51 ± 27.95	0.27
Unilateral (n=61)	56.20 ± 26.52	
THI-P subscale - functional		
Gender		
Male (n=73)	25.48 ± 13.53	0.43
Female (n=39)	23.38 ± 12.63	
Hearing loss		
Hearing within normal limit (n=38)	24.86 ± 13.05	0.92
Hearing loss present (n=74)	25.5 ± 13.23	
Tinnitus laterality		
Bilateral (n=51)	23.33 ± 13.62	0.30
Unilateral (n=61)	25.93 ± 12.84	
THI-P subscale - emotional		
Gender		
Male (n=73)	17.89 ± 10.51	0.83
Female (n=39)	17.44 ± 10.17	
Hearing loss		
Hearing within normal limit (n=38)	17.41 ± 9.93	0.82
Hearing loss present (n=74)	17.89 ± 10.61	
Tinnitus laterality		
Bilateral (n=51)	16.82 ± 10.96	0.40
Unilateral (n=61)	18.49 ± 9.84	
THI-P subscale - catastrophic		
Gender		
Male (n=73)	11.40 ± 5.55	0.52
Female (n=39)	10.67 ± 5.83	
Hearing loss		
Hearing within normal limit (n=38)	11.24 ± 6.19	0.90
Hearing loss present (n=74)	11.09 ± 5.39	
Tinnitus laterality		
Bilateral (n=51)	10.35 ± 5.15	0.26
Unilateral (n=61)	11.57 ± 6.00	

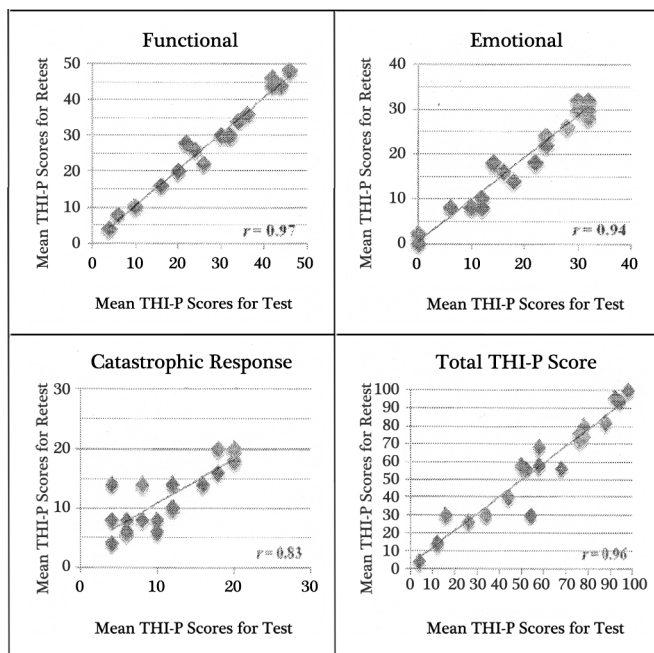


Figure 2. Scatter plots illustration the correlation between the first (test) and second (retest) administration of the THI-P and their subscales.

Table 5. Pearson product moment correlation coefficients, Standard Error (Se) of measurement, 95% Confidence Intervals (CIs), Mean and standard deviation (SD), range values associated with the test-retest administrations of the Persian version of Tinnitus Handicap Inventory (THI-P) subscales and total scores (N=60).

THI-P	Test	Retest	Correlation Coefficients	S _e	95% (CI)
Functional¹					
Mean	26.70	26.30	0.961	2.43	6.02
SD	13.74	14.54			
Range	0-46	0-48			
Emotional²					
Mean	19.40	18.80	0.935	2.50	4.70
SD	10.72	10.37			
Range	0-32	0-32			
Catastrophic response³					
Mean	11.70	12.10	0.830	3.36	2.63
SD	5.99	5.33			
Range	4-20	4-20			
Total⁴					
Mean	57.80	57.20	0.960	8.11	12.40
SD	28.29	28.09			
Range	4-98	4-98			

¹Maximum score = 48;

²Maximum score = 32;

³Maximum score = 20;

⁴maximum score = 100

It is widely agreed that in addition to desirable translation to validate an assessment tool, we should

Table 6. The mean scores and standard deviation (mean ± SD), range of scores and Cronbach's-alpha of total THI scale and subscales of Persian translation (THI-P) and original version (THI-US).

	THI Total	Functional	Emotional	Catastrophic
P-THI (mean ± SD) (n=112)	53.63 ± 27.24	24.75 ± 13.15	17.73 ± 10.35	11.14 ± 5.64
THI-US (mean ± SD) (n=66)	25.4 ± 20.5	11.0 ± 9.7	8.2 ± 8.4	6.1 ± 4.5
P-THI (range) (n=112)	0-98	0-48	0-32	0-20
THI-US (range) (n=66)	0-92	0-44	0-32	0-18
P-THI Cronbach's α (n=112)	0.943	0.941	0.939	0.942
THI-US Cronbach's α (n=66)	0.93	0.86	0.87	0.68

also use the terms adapted for socio-cultural setting of the population which will serve. The measure of difficulty of Persian translation of THI was evaluated by translator 1 and 2 using a visual analogue scale from easy up to difficult (VAS; 100 mm total length). Translation of the original questionnaire of THI in Persian language in overall was easy due to its simple sentences, whereas, the translators in six items acknowledged difficult translation (items of 4, 5, 13, 23, 24 and 25). In this regard, translator 1 and 2 were asked to provide a list of possible alternative translations for the replacement in relatively difficult and difficult items of THI-P. These alternative items were reviewed again by translator 3 and 4 in order to optimize quality of translation and finally revised for appropriate items.

The translation quality was assessed by translator 3 and 4 using a VAS criterion (from desirable up to absolute undesirable score). The measure of this criterion administers three measures including clarity scores, common language and identifies conceptual equivalence. The translation clarity in 24 items of THI-P was evaluated desirable and only one item (item 17) evaluated as relatively desirable. In common language of translation all items had complete desirable translation. In conceptual equivalence of the translation, three items had undesirable response (4, 10 and 16) and two items had relatively desirable response. Thus, items with undesirable translation were revised by translator 5 and 6 and revised by suggested replacing proper words, sentences and phrases. Finally, the results of the present investigation suggest that the THI-P was simple and clear, without losing its equivalence towards cultural issues. In

Table 7. Statistical evaluation of THI-P Items with total scores.

Item	Total mean when item is omitted	Total variance when item is omitted	Item total correlation coefficient	Squared multiple correlation coefficient (R^2)	Cronbach's α when item is omitted
1	51/67	696/54	0/52	0/48	0/94
2	51/51	705/17	0/36	0/38	0/94
3	51/00	690/59	0/60	0/52	0/94
4	51/57	685/72	0/62	0/56	0/94
5	51/67	674/27	0/71	0/71	0/94
6	50/85	675/22	0/72	0/67	0/94
7	51/80	701/97	0/43	0/34	0/94
8	51/33	704/02	0/39	0/42	0/94
9	52/00	674/37	0/71	0/68	0/94
10	52/03	671/20	0/77	0/81	0/93
11	51/83	676/98	0/64	0/59	0/94
12	51/60	667/80	0/78	0/75	0/93
13	51/66	675/37	0/71	0/61	0/94
14	51/12	677/75	0/70	0/67	0/94
15	51/94	693/87	0/52	0/52	0/94
16	51/07	674/73	0/79	0/77	0/93
17	51/60	673/21	0/71	0/67	0/94
18	51/64	687/58	0/60	0/58	0/94
19	50/48	721/96	0/21	0/38	0/94
20	51/55	679/40	0/68	0/62	0/94
21	51/71	670/54	0/76	0/76	0/93
22	51/05	686/62	0/64	0/64	0/94
23	51/64	692/05	0/51	0/45	0/94
24	50/64	699/40	0/47	0/44	0/94
25	51/92	678/33	0/66	0/61	0/94

overall the translation quality of THI-P was evaluated as desirable from both aspects of a careful translation and adapted to the socio-cultural setting.

In order to determine the divergent or discriminate validity of THI-P, we used the effects of three factors including hearing impairment, gender and age of the tinnitus subjects on the questionnaire scores.

Regarding to other studies, in order to identify validity of THI questionnaires (German, Brazilian, Danish versions), authors administered the correlation between items in translated THI with the other standardized questionnaires (convergent validity structure)³³. Both convergent and discriminate validity methods were used for identifying validity of original English version of THI¹⁹. Majority of epidemiological tinnitus studies have reported a positive relationship between tinnitus and hearing loss^{4,34-35}. The prevalence of tinnitus among normal hearing subjects has been reported between 7%-10%³⁶⁻³⁷. Consistent with other studies which have been conducted among the tinnitus patients with different degrees of hearing impairment^{28,38-41}, the present

study investigated the tinnitus subjects with bilateral high frequency hearing loss across 3-8 KHz (N=77; 68.7%). As reported in several studies for the original version (US), Italian, Turkish, Danish, Portuguese and Singapore translations of THI^{19,28,38-41}, the Persian version of THI was not significantly different in the handicap scores between those with normal hearing and those with hearing impairment with regard to the degree of handicap severity. We did not find any significant correlation between age and THI-P scores in the present study (N = 112; $r = -0.202$). The value of this correlation was not significant in original English version of THI ($r = -0.06$; $p = 0.64$) and was also compatible with reports by other authors^{19,27,38-41}. Student t-test showed no significant difference between gender and THI-P scores ($t = 0.605$; $p = 0.504$). Therefore, the Persian translation of THI was not affected by hearing impairment, gender and age factors.

The most important specifications of one assessing instrument are always including repeatability, consistency and validity of obtained scores. In current research the reliability of THI-P was evaluated from two

aspects of test-retest reliability and Interclass Correlation Coefficient (ICC). Comparison of consistency in the finding of this research with the original English version by Cronbach's alpha revealed significant correlation of the Persian version (0.94) with the English version (0.93)¹⁹. Also, Cronbach's alpha coefficients in Turkish, Portuguese and Danish languages were 0.88, 0.90 and 0.74, respectively^{27,39-40}. The present study proved the internal consistency/ coherency of the Persian version of THI (THI-P). This provides its satisfactory application in clinical/research environments.

The other part of consistency was related to the correlation between test-retest which was evaluated by Pearson correlation coefficient. We obtained 0.96 in Persian THI version, consistent with significant correlation in retest. Pearson correlation coefficient in Turkish language was 0.83²⁷.

In this study, with omitting any of the THI-P items, the acquired score of Cronbach's alpha coefficient as calculated by the total score of Cronbach's alpha coefficient was very close ($r = 0.943$). The findings showed that none of the items of the Persian version of the questionnaire need to be removed.

As seen in Table 7, there were no big differences between the statistics. It is expected that item-total correlation should be greater than 0.25 for any item. The minimum and maximum item-total correlations were 0.366 and 0.794, respectively, in our study. These correlations were between 0.22 and 0.76 in the original version of THI¹⁹. The squared multiple correlation (R^2) was calculated between 0.343 and 0.812 and R^2 in any items was not low. Eventually it became clear that internal consistency was high and the response of every item to the response of total items was matched. All values of item-total correlation coefficient are greater than 0.3 which also indicated high internal consistency in THI-P except item 19. In the research conducted in Turkey, the squared multiple correlation was reported between 0.31 and 0.66 and in the current study it is also noted that all of the items are highly R^2 .

Corrected item correlation to total score was calculated between 0.218 and 0.794 and all items except item 19 had scores above 3.0. This also showed that the response of every item to the response of total items matched. In the Turkish version of THI, Corrected item correlation to total score was reported between 0.24 and 0.64 and also expressed that the total score to each item score was compatible.

CONCLUSION

In conclusion, this study demonstrated that the Persian version of THI (THI-P) is a valid and reproducible tool to assess the psychological complaints of tinnitus sufferers. Also, THI-P could be administered as a stan-

dard measuring instrument for patients and clinicians all over Iran.

We find that THI-P in structural and practical point of view is compatible with the original English version of THI.

In this era, the determination of both objective and subjective effects of clinical intervention is critical, because clinicians using outcome measures could make decision about patient's status and the effective treatment. Henceforth, THI-P could be used for both clinical and research purposes by different professionals like audiologists, otolaryngologists, psychiatrists and could be also used for monitoring, treatment and rehabilitative effects on the life's quality of tinnitus sufferers. This valid tool allows us to quantify how much tinnitus impacts the life's quality of these individuals.

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