

The THI Questionnaire: Psychometric Data for Reliability and Validity of the Italian Version

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Abstract: The main objective of this study was to determine reliability, validity, and reproducibility of the Italian version of the Tinnitus Handicap Inventory (THI) self-administered questionnaire aimed at evaluating the impact of tinnitus on the quality of life of subjects affected by this symptom. The questionnaire was presented to a sample of 443 subjects (285 men and 158 women; ages 19–86; mean age, 53) who were referred to our Tinnitus Centre in Rome and came from the entire national territory. All subjects reported as their main problem a tinnitus that had persisted for at least 6 months. Statistical analysis carried out on THI questionnaire results showed high internal consistency and reliability for the total scale (Cronbach's $\alpha = .94$). Despite the poor number of items, the THI proved useful for the functional scale (0.86), the emotional scale (0.89), and the catastrophic scale (0.75).

Key Words: tinnitus; Tinnitus Handicap Inventory

Over time, different authors have made various attempts at defining and classifying tinnitus; however, that none of their proposals has proved to be exhaustively descriptive suggests the great level of complexity of the pathogenesis and phenomenology associated with tinnitus.

One of the first definitions was coined by Itard (1774–1838), who described tinnitus as “an extremely irksome discomfort, which leads to a profound sadness in affected individuals.” He advised several therapeutic approaches to gain relief, among which was the use of environmental noise [1,2]. Shulman [1] defined tinnitus as “the aberrant perception of sound reported by a patient that is unrelated to an external source of stimulation,” whereas Jastreboff [2] mainly referred to the most recent neurophysiological acquisitions regarding the auditory function and described tinnitus as “the perception of sound that results exclusively from activity within the nervous system without any corresponding mechanical, vibratory activity within the cochlea and not

related to external stimulation of any kind” [3]. In our view, the most exhaustive definition, including the numerous aspects of this symptom, is McFadden's: “Tinnitus is the conscious experience of a sound that originates in the head or neck, and without voluntary origin obvious to that person” [3].

Tinnitus should be considered a symptom rather than a disease [4,5]. Among the various pathologies that may cause or accompany tinnitus are otitis media, otosclerosis, Ménière's disease, presbycusis, exposure to noise and ototoxic drugs, sudden deafness, head trauma, acoustic neuroma, meningitis, and temporomandibular joint disorders [6–10]. Recent hypotheses refer to sensorineural hearing loss of autoimmune and neuroendocrine origin and metabolic disease. Hypotheses regarding the mechanism of tinnitus generation abound [11–20]. They range from peripheral disorders (e.g., inner hair cell and glutamate excitotoxicity) to middle central nervous system involvement, such as dorsal nucleus hyperactivity and GABA and inferior colliculus dysfunction or poor reactivity, to higher central nervous system and complex pathogenetic or holistic hypotheses, such as cross-modal and stress mechanisms and interactions among hair cells, inferior colliculus, amygdala, and limbic and cortical projections.

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Our opinion is that no single theory, model, or hypothesis will be exhaustive in all the affected patients [21]. Tinnitus is a very frequent symptom among the population and, indeed, some epidemiological studies report that temporary tinnitus can be commonly perceived by individuals of any age [22,23]. The reported prevalence of continuous tinnitus is 6–30%, of which only a portion (0.5–2%) of the population turns out to be significantly affected.

Tinnitus may be continuous or intermittent and it can be localized at the ear level, bilaterally or unilaterally, or at various points in the head [24]. It can manifest suddenly or gradually, and sufferers describe it in a broad variety of qualitative features, from hissing to tinkling, from buzzing to steaming, or as a pool of undefined sound components, all descriptions that, unfortunately, do not provide the clinician with helpful indications for therapy or pathogenesis. Even from a quantitative viewpoint, descriptions given by tinnitus sufferers do not provide useful clinical correlates, as numerous factors can affect the patients, such as environmental noise and the level of attention that the subject pays to the symptom.

The population of tinnitus sufferers does not constitute a homogeneous group. The distress degree depends on the impact of this symptom on various areas of activities of daily living, such as change or cessation of habits (or both); loss or decrease of “relaxing activities;” qualitative or quantitative alterations of sleep, concentration capacity, or work performance; decrease of social interaction skills; and frequent requests for medical attention.

Therefore, because the tinnitus symptom is not always associated with a specific and easily detectable pathogenic factor and varies greatly in both qualitative and quantitative terms, it escapes instrumental evaluation. As a matter of fact, no currently available methods are able to ascertain the presence of tinnitus or its severity in audiological terms: hence the necessity of alternative assessment instruments ranging beyond the audiology area and focusing instead on the impact of tinnitus on affected subjects’ activities of daily living [25]. In this regard, the observations of Tyler and Baker [25] of 72 patients—members of a tinnitus self-help group—are a starting point for the formulation of some specific tests. Of the 72 patients, 93% (67) reported consequent changes in their lifestyle, 56% (40) reported effects on their general health, and 70% (50) reported emotional difficulties [26–29].

Further studies showed that the level of distress is not related to type, assumed cause, or features (such as pitch and loudness) of tinnitus [30–32]. To account for the differences between tinnitus sufferers and nonsufferers, many authors considered the cognitive factor,

thus identifying cognitive reactions to tinnitus as crucial to the development of habituation [33–35]. In addition, a psychological predisposition that was hypothesized can affect tinnitus-coping abilities. House [36] stated, in this regard, that the perception of tinnitus could be determined by specific personality characteristics, a viewpoint shared by other authors as well. In any case, it is necessary to have an initial basic measurement backing up the clinical audiological evaluation and indicating the degree of tinnitus impact on the sufferers’ quality of life. This would allow other professionals (e.g., psychiatrists, psychologists) to establish the effect of treatments on the symptom.

TINNITUS SELF-ASSESSMENT SCALES

In the course of the last two decades, several self-administration questionnaires for the investigation of the disabling aspects of tinnitus have been reported in the literature [37,38], using various evaluation systems and presenting different features. Some of these were formulated by audiologists, some others by psychologists and multidisciplinary teams.

In 1988, Hallam et al. [39] introduced the Tinnitus Effect Questionnaire (TEQ), made up of 52 items that evaluate three main factors: sleep disorders, emotional distress, and acoustic difficulties. In 1990, Sweetow and Levy [40] introduced the Tinnitus Severity Scale (TSS), with 15 items and five relevant factors: symptom intrusiveness, distress, hearing loss, sleep disorders, and drug use. Psychometric analysis is not available for this questionnaire. The Tinnitus Handicap Questionnaire (THQ), formulated in 1990 by Kuk et al. [41], is made up of 27 items embracing three factors. The main factor is relevant to the social and emotional spheres and to problems of sleep and rest. The second factor refers to hearing capacity, and the third covers patients’ opinions on tinnitus. Its authors provided factorial analysis and test-retest correlation.

On the occasion of the Fourth International Tinnitus Seminar in Bordeaux in 1991, Halford and Anderson [42] introduced the Subjective Tinnitus Severity Scale (STSS), composed of 16 items and a single factor evaluating severity of tinnitus in terms of intrusiveness and interference with sleep, relaxing capacity, and distress level. The scale’s authors provided factorial analysis for this test. On the same occasion, Coles et al. [43] proposed the Tinnitus Severity Grading instrument, made up of 10 items analyzing two factors: tinnitus effects and day-versus-night intrusiveness. Each of the instruments described are meant to evaluate the direct effects of tinnitus on hearing and on function in terms of disability level. In the same year, the Tinnitus Handicap/Support Scale was also proposed, consisting of 28 items

and covering three factors: perceived attitudes, social support, and disability-handicap [44]. This scale refers to the reactions of people interacting daily with tinnitus sufferers; therefore, rather than assessing the sufferers themselves, it is an additional instrument for the evaluation of how relatives, friends, and colleagues support or interact with sufferers.

The two instruments discussed in the following paragraphs focus mainly on psychological reactions to tinnitus, a further confirmation of a trend in the most recent literature that takes into account tinnitus-coping strategies more than symptom severity. Such a change of focus is researchers' answer to the growing evidence that tinnitus responds more readily to a global and multidisciplinary approach than to medical treatments.

The widely known Tinnitus Reaction Questionnaire (TRQ), proposed by Wilson et al [45], is made up of 26 items investigating four factors: general distress, level of interference in work performance, severe distress, and avoidance strategies. The TRQ is based primarily on data provided by Tyler and Baker [25] and on that from the aforementioned TEQ, THQ, and TSS. The Tinnitus Handicap Inventory (THI) [46] is a questionnaire made up of 25 items divided into three subscales: functional, emotional, and catastrophic. It is the most widely used instrument, and it is the main focus of our study.

THE TINNITUS HANDICAP INVENTORY

Normally, the tinnitus sufferer turns, in the first place, to specialists, such as an otolaryngologist or an audiologist. Such specialists make a clinical evaluation of the auditory apparatus to exclude or detect the presence of pathological situations causing tinnitus. As previously stated, specialists who normally see tinnitus sufferers know well that the symptom's severity is not directly related to the triggering pathology or to psychoacoustic characteristics of the symptom. A correlation between the symptom's severity and the emotional sphere is widely shared.

We believe, therefore, that clinicians (e.g., audiologists) should be able to avail themselves of an instrument that is easy to apply and that allows them to assess the global dimension of distress. It should provide indications for a multidisciplinary therapeutic approach and also serve for the assessment of therapeutic outcomes.

The THI proposed in 1996 by Newman et al. [46] is a questionnaire made up of 25 items divided into three subscales: functional, emotional, and catastrophic. Specifically, 11 items are included in the functional scale, 9 in the emotional scale, and 5 in the catastrophic scale. Each item is made up of a statement that the subject can rate on a Likert scale with three alternative assessments: 0 (no), 2 (sometimes), and 4 (yes). The score of

each scale is the sum of the answers to the items that constitute the scale itself. The THI has been widely employed at an international level in clinical contexts, both to evaluate the subjective perception of handicap level and to measure the outcomes of treatments [47–51]. The test has, indeed, been translated and validated into Danish, Spanish, Korean, Brazilian Portuguese, and German. Considering the growing interest in tinnitus in Italy, our study objective was to work at the cultural adaptation of the questionnaire to the Italian language and to its validation.

One of the criticisms leveled at the THI in the past was that, compared with other self-assessment scales (Tinnitus Questionnaire [TQ], THQ, TRQ), its factorial structure had not been validated [52–54]. Such validation was later provided by a Danish working group [47] and by Baguley and Andersson [52], who defined it as a distress-specific monofactorial scale. These authors found the reliability of the test-retest to be high and reported a high validity correlating with other distress-measuring scales, specifically the TQ, as shown by Baguley et al. [53]. The author stated that both questionnaires are easily used and can be completed quickly—in about 5–15 minutes for the TQ and 10 minutes for the THI—and that directions for operator's use are rather simple, though the THI shows some advantages in terms of reproducibility because it is not subject to copyright. Perhaps this is the reason for the frequent choice of the THI by several work teams in recent years. According to Dobie [54] as well, both the TQ and the THI are likely to become common instruments for any work team involved in the diagnosis and treatment of tinnitus [55,56]. Unfortunately, neither of the two questionnaires takes into consideration the presence of hyperacusis as an accessory phenomenon, though the relevant literature states that some 40% of tinnitus sufferers report this symptom as well.

The THI has been adopted as either a primary outcome measure or in association with other evaluation scales and has been used in double-blind trials with a control group to assess the effect of pharmacological treatments administered to tinnitus sufferers. The THI was employed to evaluate the efficacy of baclofen, melatonin, and glycopyrrolate in the treatment of Ménière's disease and of *Ginkgo biloba*, botulinum toxin type A, gabapentin, and melatonin on tinnitus and, in the case of melatonin, on sleep [57–63]. The use of the THI in association with other instruments, such as the Tinnitus Coping Style Questionnaire, has been reported in assessing the efficacy of low-power laser on tinnitus [64]. The THI was also the main instrument employed in the study of the effects of an acoustic prosthesis on tinnitus, which evaluated 34 patients affected by tinnitus and hyperacusis and using a hearing aid for the first time [65].

A study conducted by Chiossoine-Kerdel et al. [66] evaluated the incidence of tinnitus and of the handicap associated with it and leading to sudden deafness in 38 subjects, using the THI in association with other questionnaires, such as the Hearing Handicap Inventory for Adults [55,67]. Its validity was confirmed as an outcome-measuring instrument determining the efficacy of tinnitus retraining therapy as compared to acoustical masking [68].

The work carried out by Isaacson et al. [69] on the association between tinnitus and chronic pain is interesting, as it reveals a high incidence of tinnitus in the sample affected by chronic pain, though the THI score appeared favorable to nondistressing tinnitus. The first version of the questionnaire (the alpha version) constituted 45 items, some based on interviews with patients and others adapted from both the Hearing Handicap Inventory for the Elderly and the Dizziness Handicap Inventory and others based on the symptomatic categories defined by Tyler and Baker [25]. The THI beta version is the one currently being used and is the object of our work (Table 1). It consists of 25 items, as a result of a

selection made from the previous 45, item selection being unaffected by age, gender, and hearing level.

VALIDATION AND STANDARDIZATION OF THE ITALIAN VERSION OF THE THI

Material

The THI (beta version) proposed by Newman et al. [46] in 1996 is a questionnaire made up of 25 items divided into three subscales: functional, emotional, and catastrophic (see Table 1). Specifically, the THI devotes 11 items to the functional scale, 9 to the emotional scale, and 5 to the catastrophic scale. Each item is made up of a statement that affected subjects can rate on a Likert scale with three gradations: 0 (no), 2 (sometimes), and 4 (yes). The score of each scale is the sum of the answers to the items that constitute the scale itself. We had the questionnaire translated a first time by a bilingual translator; since then, the translated test has been back-translated into the original language to guarantee that the author's scope was respected for each question.

Table 1. Items Comprising the Beta Version of the Tinnitus Handicap Inventory, with Associated Endorsement Rates and Item-Total Correlations

Item	Question	Endorsement Rates (%)			Item Total Correlation
		Yes	Sometimes	No	
F1	Il suo acufene le rende difficile la concentrazione?	30.9	43.8	25.3	0.61
F2	Il volume del suo acufene le rende difficile ascoltare le persone?	18.0	34.1	47.9	0.43
E3	Il suo acufene la fa arrabbiare?	43.6	40.4	16.0	0.65
F4	Il suo acufene la fa sentire confuso?	27.7	33.2	39.1	0.62
C5	A causa del suo acufene si sente disperato?	17.8	39.1	43.1	0.77
E6	Si lamenta molto del suo acufene?	35.3	43.3	21.4	0.59
F7	Ha difficoltà ad addormentarsi la sera a causa del suo acufene?	28.7	32.7	38.6	0.56
C8	Prova la sensazione di non potersi liberare del suo acufene?	54.6	28.5	16.9	0.57
F9	Il suo acufene riduce il piacere durante le attività sociali? (andare a cena fuori, andare al cinema ecc.)?	25.3	24.8	49.9	0.66
E10	Si sente frustrato a causa del suo acufene?	34.1	32.5	33.4	0.75
C11	A causa del suo acufene sente di avere una terribile malattia?	14.7	21.7	63.6	0.57
F12	Il suo acufene le rende difficile godersi la vita?	29.3	33.2	37.5	0.77
F13	Il suo acufene interferisce con il lavoro o con le attività domestiche?	23.9	33.0	43.1	0.69
E14	Si sente spesso nervoso a causa del suo acufene?	43.1	30.7	26.2	0.71
F15	Il suo acufene le rende difficile leggere?	23.5	26.4	50.1	0.58
E16	Il suo acufene la avvilisce?	17.6	31.2	51.2	0.73
E17	Pensa che i suoi problemi di acufene abbiano reso tesi i suoi rapporti con i familiari e amici?	18.5	24.4	57.1	0.65
F18	Le risulta difficile allontanare la sua attenzione dall'acufene per concentrarsi su altre cose?	24.1	47.2	28.7	0.66
C19	Sente di non aver nessun controllo sul suo acufene?	57.1	26.4	16.5	0.43
F20	Si sente spesso stanco a causa del suo acufene?	34.1	29.1	36.8	0.62
E21	Si sente depresso a causa del suo acufene?	33.6	37.5	28.9	0.75
E22	Il suo acufene la rende ansioso?	44.2	27.1	28.7	0.72
C23	Sente di non farcela più a sopportare il suo acufene?	33.4	29.6	37.0	0.51
F24	Il suo acufene peggiora quando è stressato?	67.0	18.6	14.4	0.41
E25	Il suo acufene le dà insicurezza?	32.1	28.6	39.3	0.70

Note: Mean = 48.41; SD = 24.76; Cronbach's α = 0.94.

Method

The test was presented to a sample of 443 subjects (285 men and 158 women; ages, 19–86; mean, 53 years) who were referred to the AIRS (Associazione Italiana per la Ricerca sulla Sordità or Italian Deafness Research Association) Tinnitus Centre from the entire national territory. The Centre is located at the University of Rome Sapienza, Department of Otorhinolaryngology, Audiology, and Phoniatrics, G. Ferreri. All subjects reported as their main problem a tinnitus that had persisted for at least 6 months. For our purposes, we considered audiological data gathered by means of half-octave tonal liminal audiometry and impedanciometry.

In 18.3% of patients (81), tinnitus was perceived on the right side and, in 32.4% (144), on the left; it was bilateral for 42.2% (187) of sufferers, and 7.1% (31) reported tinnitus in the head. In 30.1% of the bilateral cases (133), perception of tinnitus was symmetrical, whereas 10.7% of sufferers (47) reported predominance on the left and 6.5% (29) to the right. Only 10% of the total sample

(44) gave no evidence of alteration in the audiometric curve. Each subject self-administered the test before the audiological evaluation and was instructed as to scope and completion procedure (i.e., that the questionnaire's scope was to help operators better understand difficulties experienced by tinnitus sufferers). Subjects were told to read each question carefully and to answer by choosing one of the three possible answers—yes, no, and sometimes—without skipping any question. Each subject returned the completed test within the same assessment session. The maximum possible score for a single subject is 100. The final score obtained is directly proportional to the impact of tinnitus on the sufferer's life.

We analyzed data using SPSS statistical software for Windows (version 9.0, Chicago, IL). We performed descriptive statistics for all variables measured. Total item correlations and internal consistency reliability of the THI–Italian Version was calculated using Cronbach's α for the THI total scale and separately for the three subscales: functional, emotional, and catastrophic (Table 2). We also computed Pearson's product-moment

Table 2. Item-Total Correlations for Functional, Emotional, and Catastrophic Subscales

Item	Question	Item Total Correlation
Functional subscale ^a		
F1	Il suo acufene le rende difficile la concentrazione?	0.71
F2	Il volume del suo acufene le rende difficile ascoltare le persone?	0.50
F4	Il suo acufene la fa sentire confuso?	0.68
F7	Ha difficoltà ad addormentarsi la sera a causa del suo acufene?	0.56
F9	Il suo acufene riduce il piacere durante le attività sociali (andare a cena fuori, andare al cinema ecc.)?	0.71
F12	Il suo acufene le rende difficile godersi la vita?	0.74
F13	Il suo acufene interferisce con il lavoro o con le attività domestiche?	0.74
F15	Il suo acufene le rende difficile leggere?	0.66
F18	Le risulta difficile allontanare la sua attenzione dall'acufene per concentrarsi su altre cose?	0.69
F20	Si sente spesso stanco a causa del suo acufene?	0.64
F24	Il suo acufene peggiora quando è stressato?	0.43
Emotional subscale ^b		
E3	Il suo acufene la fa arrabbiare?	0.71
E6	Si lamenta molto del suo acufene?	0.63
E10	Si sente frustrato a causa del suo acufene ?	0.78
E14	Si sente spesso nervoso a causa del suo acufene?	0.76
E16	Il suo acufene la avvilisce?	0.76
E17	Pensa che i suoi problemi di acufene abbiano reso tesi i suoi rapporti con i familiari e amici?	0.68
E21	Si sente depresso a causa del suo acufene?	0.81
E22	Il suo acufene la rende ansioso?	0.78
E25	Il suo acufene le dà insicurezza?	0.71
Catastrophic subscale ^c		
C5	A causa del suo acufene si sente disperato?	0.74
C8	Prova la sensazione di non potersi liberare del suo acufene?	0.70
C11	A causa del suo acufene sente di avere una terribile malattia?	0.68
C19	Sente di non aver nessun controllo sul suo acufene?	0.68
C23	Sente di non farcela più a sopportare il suo acufene?	0.73

^aMean = 20.43; SD = 11.23; Cronbach's α = 0.86.

^bMean = 17.97; SD 10.5; Cronbach's α = 0.86.

^cMean = 10.01; SD = 5.42; Cronbach's α = 0.75.

Table 3. Pearson Product-Moment Correlations Among Tinnitus Handicap Inventory: Total, Functional, Emotional, and Catastrophic Response Subscales (N = 443)

Response Subscale	Total	Functional	Emotional
Total	1.000	—	—
Functional	0.933 ($p = .000$)	1.000	—
Emotional	0.944 ($p = .000$)	0.805 ($p = .000$)	1.000
Catastrophic	0.805 ($p = .000$)	0.630 ($p = .000$)	0.707 ($p = .000$)

correlations between the THI and the three subscales (Table 3). A Student's t -test for independent samples was used to detect differences between women and men regarding the perception of tinnitus distress (Table 4). In all analyses, an α level of 5% was considered significant.

DISCUSSION

In light of our Italian clinical experience, we chose to evaluate reliability, validity, and psychometric properties of the THI, for we believe that among all tests described in this study, its questions are the most easily understood and provide an exhaustive framework for tinnitus impact on the sufferers' everyday life and function. Furthermore, the THI is easily interpreted. These properties provide clinicians or health operators with an instrument that completes the audiology diagnosis, thus indicating the necessity for involving other professionals who are not directly related to audiology, such as psychologists and neuropsychiatrists. Each question is

Table 4. Gender Differences in Perceived Tinnitus Handicap

Gender	No.	Mean	SD	t	df	p
Functional						
M	285	19.64	11.34	-1.99	441	.048
F	158	21.85	10.93			
Total	443	20.43	11.23			
Emotional						
M	285	16.38	10.31	-4.37	441	.000
F	158	20.84	10.25			
Total	443	17.97	10.50			
Catastrophic						
M	285	9.52	5.17	-2.59	441	.010
F	158	10.90	5.76			
Total	443	10.00	5.42			
Total						
M	285	45.54	24.34	-3.31	441	.001
F	158	53.58	24.74			
Total	443	48.41	24.76			

p = independent samples, Student's t test (N = 443).

easily and precisely formulated and allows time for the responders to reflect on the actual impact of the symptom on their everyday life situations, unlike a standard interview. Our choice is supported by the results of the test-retest performed on the questionnaire, which corroborated its validity and solidity as a measuring instrument. It is interesting to note that item 24, relating to the effect of stress on tinnitus, turns out to be the least correlated to the total score of the scale. This indicates the extent to which stress is a fundamental element in determining the degree of distress, independent of severity of tinnitus. Statistical analysis shows that the scales exhibit a directly proportional increase. The scale that appears to be most independent of the others is the catastrophic scale; however, the low number of items in this scale should be taken into account.

High total scores are always suggestive of high scores in the catastrophic scale, in support of the findings of McCombe et al. [70]. In that interesting and very useful study, the authors provide a characterization of the type of impact that tinnitus causes in connection with the subject's ratings. Scores are divided into five grades of severity, defined in detail as follows:

- Grade 1: very mild (score 0–16). Tinnitus is perceived only in silence and is easily masked. It does not interfere with sleep or with daily activities.
- Grade 2: mild (score 18–36). Tinnitus is easily masked by environmental sounds and forgotten during daily activities. It can occasionally interfere with sleep but not with daily activities.
- Grade 3: moderate (score 38–56). Tinnitus is perceived even in the presence of environmental sound; however, daily activities are not impaired. It is perceived less under concentration. Interference with sleep and relaxing activities is not infrequent.
- Grade 4: severe (score 58–76). Tinnitus is continuously perceived and hardly masked by external noise. It alters the sleep cycle and can interfere with the subject's daily activities. Relaxing activities are compromised. Subjects with this level of tinnitus often require medical consultations.
- Grade 5: catastrophic (78–90). All side effects caused by tinnitus are present at a very severe level. The subject requires medical assistance very frequently, including neuropsychiatric help.

These definitions based on grading are very useful in clinical practice and help doctors to quickly identify the most appropriate therapeutic choices.

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