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RESEARCH ARTICLE

The relathinship between tinnitus functional index and tinnitus handicap inventory scores in patients with chronic tinnitus

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Abstract

Background and Aim: Tinnitus can affect daily life. The evaluation of the affected aspects of life quality is highly dependent on the subjects'perception. Self-report questionnaires have been used to identify these affected aspects. In the present study, the relationship between the Persian versions of tinnitus functional index (TFI-P) and tinnitus handicap inventory (THI-P) was investigated.

Methods: This is a comparative cross-sectional study conducted on 28 hearing-impaired and 27 normal hearing subjects with tinnitus in aged 18−60 years selected according to the inclusion criteria. Both groups completed the TFI-P and THI-P.

Results: There was a significant and relatively strong relationship between the total scores of THI-P and TFI-P (r = 0.65) and also between the emotional subscale of TFI-P and the catastrophic subscale of THI-P (r = 0.73). Moreover, there was a moderate relationship between age factor and total score of TFI-P (r = −0.32), and between the cognitive subscale of TFI-P and age (r = 0.40). However, no significant difference was found between hearing-impaired and normal hearing subjects in terms of the total score and subscale scores of TFI-P. Furthermore, we found a significant difference between female and male subjects in terms of the relaxation subscale of TFI-P, and between duration of tinnitus and the quality of life subscale (r = 0.33).

Conclusion: The scores of the THI-P and TFI-P questionnaires are related to each other and they can be used for measuring the negative effects of tinnitus.

Keywords: Tinnitus; tinnitus functional index; tinnitus handicap inventory

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Introduction

Subjective tinnitus is a phantom perception of a sound that does not have any physical external source and can deeply affect the quality of life. Tinnitus can potentially have serious consequences on many life domains, and because of its' subjective entity, its evaluation is dependent on

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patients' expressions [1,2]. In most instances, the underlying cause of tinnitus is unknown and it can occur secondary to a wide range of involvements from the cochlea to the auditory cortex. It is known that in many cases, tinnitus may accompany hearing loss, although the tinnitus without any apparent hearing loss in the conventional audiometry is also prevalent. In young adults and elderly people, exposure to noise and presbycusis are the most common causes of tinnitus [3]. In general, 15−20% of the world population suffers from tinnitus which affects the daily activities of 25% of this population [4]. Tinnitus can affect different aspects of life quality such as sleeping, concentration, enjoying occupational and leisure activities, and maintaining social interactions [5]. These effects are not related to the physical characteristics of tinnitus such as perceived loudness; although it's effects show high inter-subject variability. Therefore some questionnairs have been developed to solve this issue.

Questionnaires can be used to assess the patients' perception of tinnitus severity and its impact on their life. Tinnitus functional index (TFI) and tinnitus handicap inventory (THI) are the two most used tinnitus questionnaires. TFI was designed by Meikle et al. [6] and was translated into Persian by Mahdavi et al. and its' reliability was investigated in military population [7]. TFI was the first questionnaire for monitoring the patients' responses to treatment [8]. It includes 25 items and 8 subscales evaluating the most important functional domains that can be affected by tinnitus. These subscales are intrusiveness (I; items 1−3), redcued sense of control (SC; items 4−6), cognitive interference (C; items 7−9), sleep disturbance (SL; items 10−12), auditory difficulties attributed to tinnitus (A; items 13−15), interference with relaxation (R; 16−18), redcued quality of life (Q; items 19−22), and emotional distress (E; items 23−25) [6]. THI was introduced and revised by Newman et al. [9] and was translated to Persian named THI-P by Mahmoudian et al. [10]. It includes 25 items and 3 subscales of functional (items 1, 2, 4, 7, 9, 12−15, 18, 20, 24 related to functional aspects in the areas of mental, social/occupational, and physical functioning), emotional (items 3, 6, 10, 16, 17, 21, 22, 25 related to affective responses to tinnitus), and catastrophic (items 5, 8, 11, 19, 23 related to desperation, inability to escape from tinnitus, perception of having a terrible disease, lack of control, and inability to cope). THI is a valid tool for evaluating tinnitus and monitoring treatment effects. There are some studies conducted on TFI and THI in other languages and they were compared to each other [1,11-13]. These two questionnaires have been introduced to identify the affected aspects of life, the extent of tinnitus-related handicap and the efficacy of the various treatment strategies in patients suffering from tinnitus. These two questionnaires were selected because they are the two most frquently used questionnaires in tinnitus evaluations; both have 25 items and are comprehensive [6], but TFI has more detailes and subscales and is better in showing treatment-related changes [6]. On the other hand, THI was developed earlier and has been vastly studied; it is a valid and reliable tool for showing tinnitus severity and handicap. In all versions of the TFI (including English [1], German [11], Polish [13], etc), it has been compared to the THI to evaluate it's psychometric properties. The aim of the present study was to compare the scores of the Persian versions of TFI (TFI-P) and THI (THI-P).

Methods

This is a comparative cross-sectional study conducted on 28 hearing-impaired and 27 normal hearing subjects. They were selecetd from the study population consisted of people aged 18−60 years experiencing tinnitus at least for six months refereed to audiology clinic of Tehran University of Medical Sciences and Amir Alam Hospital in Tehran, Iran in Summer 2019. Subjects underwent the following tests: comprehensive case history, otoscopy, acoustic immittance, and pure tone/speech audiometry. The inclusion criteria were: literacy (at least with a premary education), no history of middle ear disease, taking any psychological and neurological medications with normal otoscopy, and a type An tympanogram. Normal hearing was

Table 1. Mean and standard deviation of age, tinnitus duration and sex of the hearing-impaired and normal hearing groups

Variable	Total population (n = 55)	Normal hearing subjects (n = 27)	Hearing-impaired subjects (n = 28)
Age (year)	47.83 ± 13.89	44.37 ± 13.19	51.25 ± 13.94
Duration of tinnitus (month)	32.50 ± 28.68	36.92 ± 32.78	28.42 ± 24.68
Sex			
Male	n = 29 (52.72%)	n = 15 (27.28%)	n = 14 (25.45%)
Female	n = 26 (47.27%)	n = 12 (21.82%)	n = 14 (25.45%)

defined as having a pure-tone average of ≤ 25 dBHL at 500, 1000, and 2000 Hz. For hearing-impaired subjects, the degree of hearing loss was defined according to the Goodman Scale [14], and only those with mild to severe hearing loss were included. Participants completed the THI-P and TFI-P questionnaires, after obtaining written informed consent from each subject and and ethical approval from the Research Ethics Committee of Tehran University of Medical Sciences (Code: IR.TUMS.FNM.REC.1398.158). Collected data were analyzed in SPSS 17 using descriptive statistics (frequency, mean and standard deviation). Kolmogorov-Smirnov test was used for testing the normality of data distribution. Based on its results, Pearson and Spearman correlation tests and independent t-test were used for analyzing data. The $p < 0.05$ was considered as a significance level.

Results

The age, tinnitus duration and gender of subjects are presented in Table 1, and the mean and standard deviation of the scores of THI-P) and TFI-P and their subscales are shown in Table 2. For THI-P, functional and catastrophic subscales showed the highest and lowest scores, respectively and for TFI-P, intrusiveness and quality of life had the most and least scores, respectively. The Spearman correlation test results showed a significant correlation between total scores of THI-P and TFI-P ($r = 0.65$; $p \leq 0.001$) and between emotional subscale of TFI-P and catastrophic subscale of THI-P ($r = 0.73$, $p \leq 0.001$) (Table 2). Scatterplots of these correlations are shown in Fig. 1.

The mean total score and the subscale scores of TFI-P were compared between males and female patients using independent t-test whose results showed no significant difference between them except in relaxation subscale. Female patients showed significantly higher mean relaxation scores ($p= 0.01$) than male patients (51.40 ± 23.78 vs. 37.81 ± 15.69) (Table 3). Furthermore, independent t-test showed that there was no significant difference between hearing-impaired and normal hearing subjects in terms of the mean total score and the subscale scores of TFI-P (Table 3).

Spearman correlation test was used for examining the correlation between age and the TFI-P score. Its results reported a significant correlation of age with the total score of TFI-P ($r = 0.32$; $p = 0.017$), and its cognitive subscale ($r = 0.40$; $p = 0.002$) (Table 3). Moreover, the Spearman correlation test was used for examining the correlation of tinnitus duration with the TFI-P score. The results showed a significant correlation between tinnitus duration and the quality of life subscale of TFI-P ($r = 0.33$; $p = 0.01$) (Table 4).

Discussion

The results of present study revealed that there was a significant relationship between the scores of TFI-P and THI-P. This is consistent with the results of other studies such as Meikle et al. for the original version [6], Fackrell et al. for the

Table 2. The central tendency measures of total and subscale scores of tinnitus handicap inventory-Persian and tinnitus functional index-Persian in the hearing-impaired and normal hearing groups

Variable	Mean (SD)	Median	Min-max
Total score of THI-P	38.34 (19.25)	36	2-96
Functional subscale (THI-P)	16.69 (9.43)	14	0-44
Emotional subscale (THI-P)	13.74 (6.41)	14	2-32
Catastrophic subscale (THI-P)	8.29 (4.90)	8	0-20
Total score of TFI-P	43.99 (17.41)	39.20	13-98
Intrusive (TFI-P)	65.87 (22.44)	70	20-100
Sense of control (TFI-P)	50.84 (25.82)	53.33	3.33-100
Cognitive (TFI-P)	41.93 (25.83)	33.33	0-100
Sleep (TFI-P)	38.12 (24.88)	30	0-100
Auditory (TFI-P)	38.30 (26.07)	30	0-100
Relaxation (TFI-P)	44.24 (20.89)	40	0-100
Quality of life (TFI-P)	20.41 (30.01)	25	0-100
Emotional (TFI-P)	47.02 (20.62)	46.66	3.33-100

THI-P; tinnitus handicap inventory-Persian, TFI-P; tinnitus functional index-Persian

UK version [1], Wrzosek et al. for the Polish version [13], Peter et al. [11] for the German version, Kumar et al. for the Bengali version [12] and Mahdavi et al. for the Persian version [7]. The present study showed lower correlation level between THI-P and TFI-P scores compared to similar studies reported for other language versions. This discrepancy may be due to the smaller sample size of the present study compared to others. To the best of our knowledge, there is no study on examining the correlation between the scors of TFI-P and THI-P subscales. Our results showed that the emotional subscale of TFI-P (related to depression, distress and anxiety) was significantly correlated to the catastrophic subscale of THI-P (related to impacts of tinnitus-related tiredness, anxiety and distress on tinnitus severity, enjoying daily living and annoyance). As these subscales evaluate the similar aspects of tinnitus effects on subjects' life, the high correlation between them is logical.

Based on the results of present study, gender had no statistically significant effect on the total and subscale scores of TFI-P except in the relaxation subscale where female subjects had higher mean scores than male subjects (51.40 vs. 37.81). This TFI-P subscale is related to the interference of tinnitus with peace, relaxation and quiet. In the present study, most of females were housekeepers and had more time spent in a quiet place. The different relaxation scores in males and females seems to be attributed to this difference in lifestyle. Other studies have shown that tinnitus, in general, has different effects on men and women and they have shown that women have different coping styles for managing stress and are more prone and sensitive to adverse effects of stress than men [15-17].

In the present study, there was a relatively good correlation between the cognitive subscale score of TFI-P and age. Younger patients showed higher cognitive involvement than older ones. Hallam et al. studied cognitive function of subjects with tinnitus and reported that in many of them tinnitus interferes with concentration. It can be due to the presence of distracting sounds inside the head which can consequently affect the cognitive process especially attention [18]. Younger adults are more involved in tasks that need concentration than older adults and this seems to be the reason for these results in our study. This result is not in agreement with the studies that reported older adults had more problems in concentration than young adults and they are more easily distracted [19].

There was a significant correlation between tinnitus duration and the quality of life score in

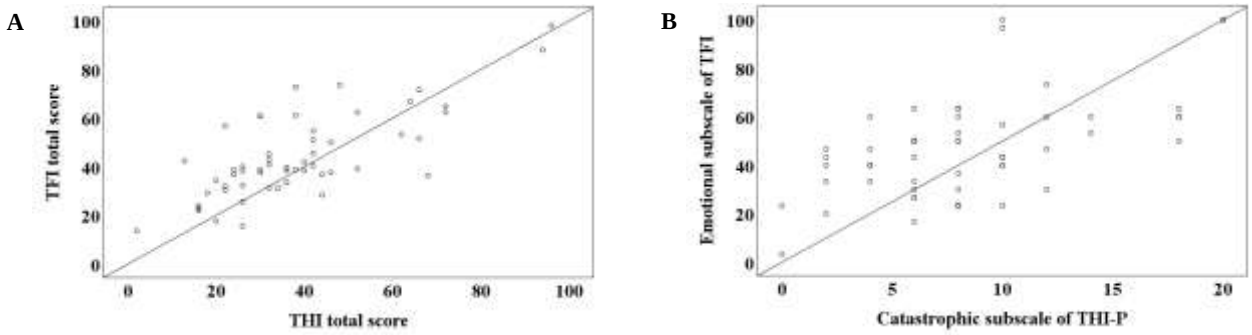

Fig. 1. Scatterplots of A) correlation between total score of tinnitus handicap inventory-Persian and tinnitus functional index-Persian, and B) correlation between emotional subscale of tinnitus functional index-Persian and catastrophic subscale of tinnitus handicap inventory-Persian.

TFI-P. Wrzosek et al. showed a significant relationship between auditory subscale and tinnitus duration (longer duration had more adverse effects) [13]. However, Erlandsson and Hallberg concluded that tinnitus with shorter duration has more adverse effects on the quality of life. According to them, subjects with recent tinnitus onset might experience severe stress secondary to psychological trauma because they are not adapted to tinnitus yet [20].

In the present study, the total and subscale scores of TFI-P were not significantly different between hearing-impaired and normal hearing subjects. This indicates that tinnitus was the main complaint and problem of these patients regardless of their hearing sensitivity, and TFI-P scores were similar in both groups. This is in agreement with the results of Kumar et al. [12]. They used Bangali TFI on 30 patients with tinnitus (mean age, 48.1 years) divided into two groups of hearing-impaired and normal hearing. They found that there was no significant correlation between the TFI scores of two groups [12]. On the other hand, Wrezosek et al. studied

Table 3. The comparison of total and subscale scores of tinnitus functional index-Persian between males and females and between hearing-impaired and normal hearing subjects

	Female (n = 26)	Male (n = 29)	p	Power	Normal hearing subjects (n = 27)	Hearing-impaired subjects (n = 28)	p	Power
Total score	42.57 ± 16.90	45.35 ± 18.10	0.07		42.57 ± 16.90	45.35 ± 18.10	0.60	
Subscale score								
Intrusive	69.23 ± 24.80	62.87 ± 20.05	0.29	0.43	67.65 ± 53.21	64.16 ± 23.54	0.56	0.10
Sense of control	53.59 ± 25.71	48.39 ± 26.11	0.46	0.27	47.03 ± 43.34	54.52 ± 23.76	0.28	0.29
Cognitive	47.56 ± 25.57	36.89 ± 25.44	0.1		42.34 ± 27.20	41.54 ± 24.93	0.80	
Sleep	44.23 ± 28.29	32.64 ± 20.34	0.24		39.75 ± 26.27	36.54 ± 23.83	0.57	
Auditory	45.64 ± 28.07	31.72 ± 22.63	0.05		32.83 ± 23.87	43.57 ± 27.42	0.20	
Relaxation	51.40 ± 23.78	37.81 ± 15.69	0.01	0.96	42.46 ± 22.33	45.94 ± 19.65	0.54	0.21
Quality of life	33.65 ± 21.97	26.75 ± 18.67	0.21		25.40 ± 19.23	34.46 ± 20.86	0.08	
Emotional	49.61 ± 20.00	44.71 ± 21.24	0.31		48.39 ± 23.15	45.71 ± 18.18	0.70	

Table 4. The correlation of age and tinnitus duration with total and subscale scores of tinnitus functional index-Persian in the hearing-impaired and normal hearing groups

	Age (year)			Duration of tinnitus (month)		
	r	p	Power	r	p	Power
Total score	-0.32	0.017		0.15	0.26	0.15
Subscale score						
Intrusive	-0.26	0.05	0.48	0.04	0.72	0.05
Sense of control	-0.26	0.05	0.48	0.008	0.95	0.04
Cognitive	-0.40	0.002		0.26	0.05	0.48
Sleep	0.07	0.6	0.07	0.07	0.59	0.07
Auditory	-0.15	0.25	0.19	0.21	0.10	0.33
Relaxation	-0.21	0.11	0.33	0.09	0.48	0.09
Quality of life	-0.05	0.67	0.66	0.33	0.01	
Emotional	-0.14	0.30	0.17	0.17	0.21	0.23

206 subjects (mean age, 51.72 years) and showed that the hearing loss affects the scores of auditory, quality of life, and emotional subscales. They showed that hearing-impaired subjects with tinnitus have higher scores in these subscales than normal hearing subjects with tinnitus [13]. The results of the present study are against the results of Wrezosek et al. The reason for this discrepancy might be the different samples and hearing loss criteria. Wrezosek et al. used the auditory threshold of > 25 dBHL at least at one frequency as the criterion for hearing loss [13].

Conclusion

There was a significant correlation between the scores of Persian tinnitus handicap inventory (THI-P) and Persian tinnitus functional index (TFI-P) questionnaires and they can be used for measuring the negative effects of tinnitus. Both questionnaires consisted of 25 items but TFI-P has more detailed subscales (n = 8) than THI-P (n = 3). Therefore, TFI-P can provide more details about the tinnitus effects and show treatment-related changes in more details. It is recommended that the TFI-P and THI-P versions should be compared in more studies with respect to their effectiveness in showing tinnitus treatment effects.

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Conflict of interest

The authors declared no conflicts of interest.

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