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RESEARCH ARTICLE

A preliminary study on the reliability of the Persian version of the tinnitus functional index in a military population

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Abstract

Background and Aim: Tinnitus functional index (TFI) has been introduced as a standard self-assessment questionnaire for the evaluation of tinnitus severity and its negative consequences with enough sensitivity to detect the outcomes of treatment. The purpose of this study was to translate the original tinnitus functional index into Persian and to evaluate its reliability in a military population.

Methods: The translation was performed in accordance with the Principles of Good Practice for the Translation and Cultural Adaptation Process for Patient-Reported Outcomes Measures. 32 military and veteran men with tinnitus aged 22−74 years participated in the current study. The participants completed the Persian version of the TFI and the second re-evaluation session was conducted over the telephone 10−14 days later. Both relative and absolute reliability indices were computed.

Results: Intraclass correlation coefficient$_{(2,1)}$ with consistency definition for the TFI subscales varied from good to excellent. The agreement between the TFI total scores in the evaluation and re-evaluation using Bland-Altman analysis was acceptable and only one case was not located within the limits of agreement.

Conclusion: Initial evaluation of the Persian version of TFI shows acceptable results in terms of reliability. The evaluation of the Persian TFI in different populations of patients with tinnitus and its validity would facilitate its clinical application.

Keywords: Tinnitus; questionnaire; Persian

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Introduction

Tinnitus is commonly defined as the perception of sound without any external acoustic sound source [1]. However, Jastreboff neurophysiological model presents a clearer and clinically usable definition. Tinnitus is as a sound-like perception with no mechanical source, even in the cochlea. In this model, tinnitus does not create a traveling wave in the inner ear cochlea and so does not follow the stimulation process of an external sound, as well as its psychoacoustics. In contrast, any vibration agent located in the para-auditory area whose mechanical energy is

transmitted through bone and tissue conduction into the inner ear is defined as somatosound [2]. The term *tinnitus* in the literature includes both disorders. Untreated tinnitus or somatosound affects the quality of life (QOL) of the affected person to varying degrees.

There is currently little information on the prevalence of tinnitus in the specific and general Iranian population. Jalessi et al. investigated the prevalence of tinnitus in a population aged 7−98 years living in Tehran Province by using the Persian version of the tinnitus questionnaire. The results of this study showed that 146 (4.6%) of the 3027 people had tinnitus [3]. Tinnitus and decreased sound tolerance were studied by Jafari et al. among 250 Iranian military men and veterans. The findings revealed that 71 (31.1%) of the studied participants showed some degree of hearing loss. Moreover, 195 participants (78%) had tinnitus, 191 (76.5%) reported DST, and 48 (19.1%) suffered from disabling tinnitus [4].

In the 1990s, the first formal tinnitus questionnaires, i.e. the Iowa tinnitus handicap questionnaire (THQ) [5] and tinnitus handicap inventory (THI) [6,7], were reported in the literature. Since then, several questionnaires have been constructed and statistically validated for initial evaluation of tinnitus impacts. However, none have been specifically designed for responsiveness to intervention-related changes. In addition, tinnitus effects have many dimensions that cannot be covered using a single questionnaire. Scaling and item formatting of the available tinnitus questionnaires are not similar. Consequently, the results of therapeutic interventions and clinical trials on tinnitus cannot be compared between centers and clinics. To address this problem, the Tinnitus Research Consortium (TRC) recommended that a self-assessment questionnaire be developed pre-entitled tinnitus functional index (TFI) with items highly sensitive for detecting outcomes of the tinnitus treatments [8,9]. According to Henry et al. [9,10] the questionnaire of TRC should meet the following criteria;"1) employing 10 specific domains of negative tinnitus impact; 2) avoiding overly-negative items (i.e. items that catastrophize); 3) not using items that refer only to hearing loss (and not tinnitus) or that pertain to more than one domain; 4) using only items having high construct validity for scaling of tinnitus severity; 5) using Likert-type response scales to provide high resolution of responses; and 6) using unambiguous wording that also addresses low health literacy".

Meikle et al. reported the five-step development of TFI [8], and proposed it as the standard questionnaire for tinnitus effects and outcome measurement. It is becoming a gold standard for the assessment of tinnitus severity and determining its negative effects on affected patients [11], TFI consists of 25 items and eight subscales, including the intrusiveness of tinnitus, the sense of control, cognitive interference, sleep disturbance, auditory issues, relaxation issues, QOL, and emotional distress. Respondents should record their response to each item on a 0−10 Likert scale. Except for the 4-item QOL subscale, all subscales have three items. If more than one item in the 3-item subscales and more than two items in the QOL subscale are unanswered, that subscale will be excluded from the total TFI score. TFI is valid only when at least 18 items are answered [8,10].

TFI has received international attention and has been translated into and adapted for many languages, including Dutch [12], Polish [13], Swedish [14], Japanese [11], and Chinese [15]. Currently, the Persian version of Iowa THQ and THI are available [16−18]. The present study aimed at adapting TFI to the Persian language and assessing its reliability in a military population.

Methods

Translation

Initially, a license for translating TFI to Persian was granted from the Oregon Health & Science University was granted to Shahid Beheshti University of Medical Sciences. The translation was performed in accordance with the Principles of Good Practice for the Translation and Cultural Adaptation Process for Patient-Reported Outcomes Measures defined by the International Society for Pharmacoecomonics and Outcomes

Table 1. Mean and standard deviation of Persian tinnitus functional index total score and its subscales in two sessions of evaluation and re-evaluation along with intraclass correlation coefficient and standard error of measurement values as reliability indices

	Mean (SD) score					ICC			
Subscales	**Evaluation**	**Re-evaluation**	**Mean difference**	**p***	**Power**	**$ICC_{(2,1)}$**	**95% CI**	**SEM**	**SEM%**
Intrusive	70.05 (23.7)	68.20 (21.5)	1.9	0.344	0.016	0.88	0.77−0.94	7.73	11.19
Sense of control	64.93 (20.8)	66.73 (20.9)	−1.8	0.269	0.019	0.90	0.81−0.95	6.38	9.7
Cognitive	41.36 (19.9)	42.39 (19.5)	−1	0.518	0.097	0.89	0.80−0.94	6.32	15.09
Sleep	44.05 (20.8)	43.21 (22.9)	0.8	0.589	0.083	0.92	0.84−0.96	6.14	14.08
Auditory	33.12 (19.3)	34.75 (22.0)	−1.6	0.321	0.164	0.90	0.81−0.95	6.45	19.01
Relaxation	51.39 (26.7)	51.01 (28.3)	0.4	0.852	0.054	0.91	0.83−0.95	8.08	15.79
Quality of life	40.63 (25.4)	41.43 (26.4)	−0.8	0.609	0.079	0.94	0.88−0.97	6.24	15.21
Emotional	38.08 (26.4)	36.56 (27.0)	1.5	0.416	0.126	0.92	0.84−0.96	7.4	19.83
Total TFI	47.95 (11.9)	48.04 (12.0)	−0.1	0.912	0.051	0.94	0.88−0.97	2.94	6.13

ICC; intraclass correlation coefficient, SEM; standard error of measurement, CI; confidence interval, SEM%; standard error of measurement percent
*p for paired t-test

Research [19].

Participants

Thirty two participants with the age range of 22−74 years and mean (± SD) age of 51.1 ± 14 were selected from among the veterans and military staff attending a military medical center. The inclusion criterion was chronic tinnitus for at least one year. Tinnitus duration among the participants varied from 1−25 years with a mean of 14.5 ± 7 years. The grand average of the pure tone audiogram in low to high frequencies showed a configuration of gradually sloping slight to moderate sensory-neural hearing loss. The participants completed the evaluation Persian TFI form under the guidance of the first author and completed the re-evaluation Persian TFI form over the telephone in the next 10−14 days.

Statistics

Using statistical software SPSS 18, data distribution was compared with the normal distribution using the Kolmogorov-Smirnoff test. The assumption of the normal distribution of data was not rejected for all data sets. The mean score of each subscale and total score of TFI were compared in two sessions of evaluation and re-evaluation using paired t-test at the significance level of 0.05. The standard error of measurement (SEM) and SEM% indices were used to assess absolute reliability and estimate typical variation. Intraclass correlation coefficient (ICC) was used for relative reliability and the Bland-Altman plot for visualizing the agreement of the Persian TFI total scores recorded in evaluation and re-evaluation sessions.

Results

The analysis of evaluation TFI showed that there were no ambiguous items, and all participants responded to all items.

Table 1 contains the total scores and scores of each subscale of the Persian version of the TFI in two evaluation and re-evaluation sessions, along with the correlation coefficient and absolute reliability index.

Paired t-test showed that the mean (± SD)

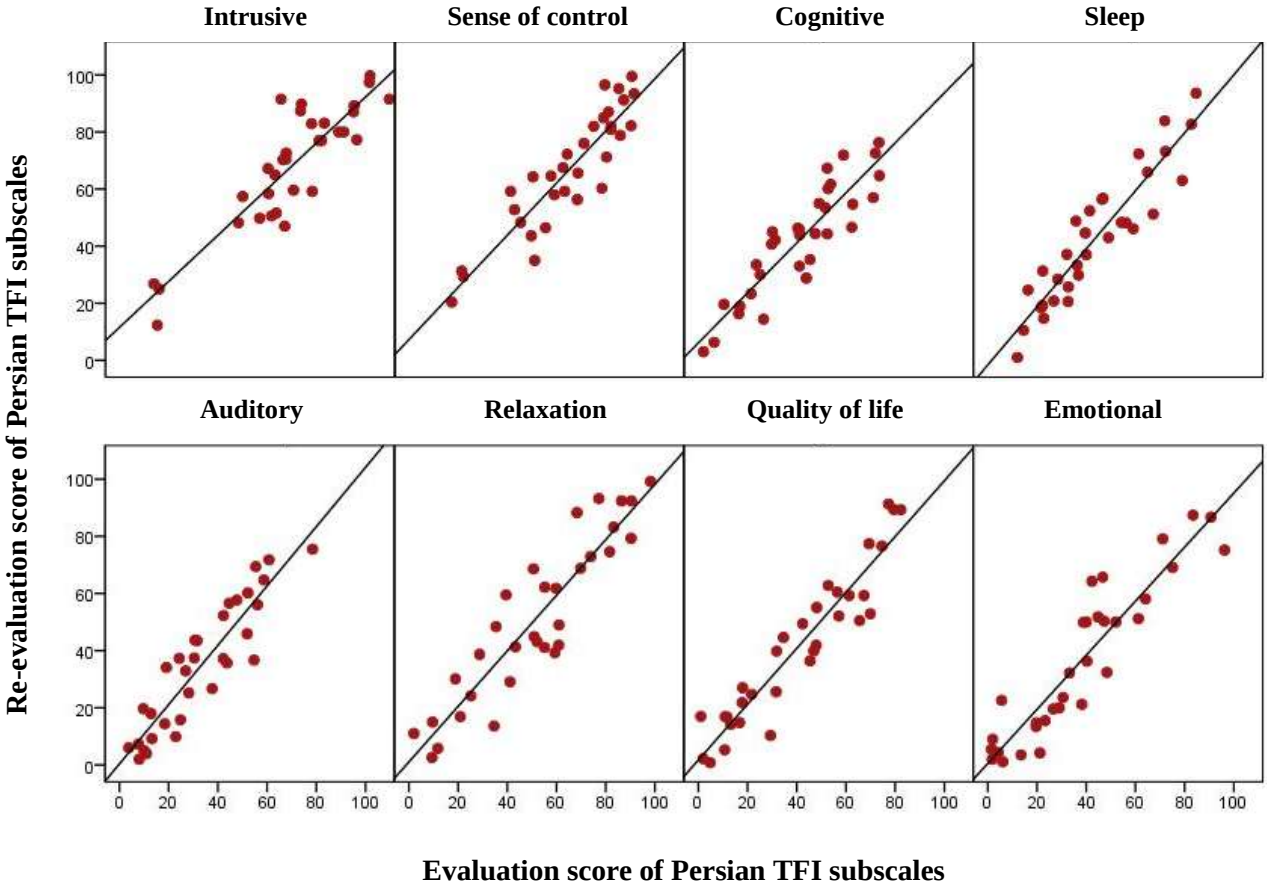

Fig. 1. Scatter graph of the individual values of Persian tinnitus functional index (TFI) subscales in two sessions of evaluation and re-evaluation.

evaluation Persian TFI (47.95 ± 11.9) did not significantly differ from the mean re-evaluation Persian TFI (48.04 ± 12).

TFI and its subscales showed good to excellent correlation coefficients, the highest of which belonged to QOL and the lowest to intrusive subscales (Fig. 1 and Table 1). As shown in Table 1, the SEM values were < 10, indicating the acceptable absolute reliability of the scores. The within-subject variability of the Persian TFI on repeated measurement was reported using SEM%. This coefficient of variation varied from 9.7% to 19.8% for the subscales and equaled 6.1% for the Persian TFI total score (Table 1).

Based on the Bland-Altman analysis (Fig. 2), the between-session difference plotted against the average of two sessions score was close to zero with a mean of −0.1, and only one participant was located outside the limits of agreement (mean ± 2 SD).

Discussion

The present study evaluated the reliability of the first translation of TFI from English to Persian. The results showed that the overall Persian TFI score is of high test-retest reliability. The SEM absolute reliability index was < 10, indicating an acceptable reliability and excellent agreement of the results of the two sessions.

The results of the present study are very similar to those reported by Mahmoudian et al. who translated THI into Persian. In their study, Pearson's correlation coefficient for THI score and its subscales varied from 0.83 to 0.96 [18]. The ICC values in the present study were 0.88−0.94 and in line with many studies adapting TFI to other

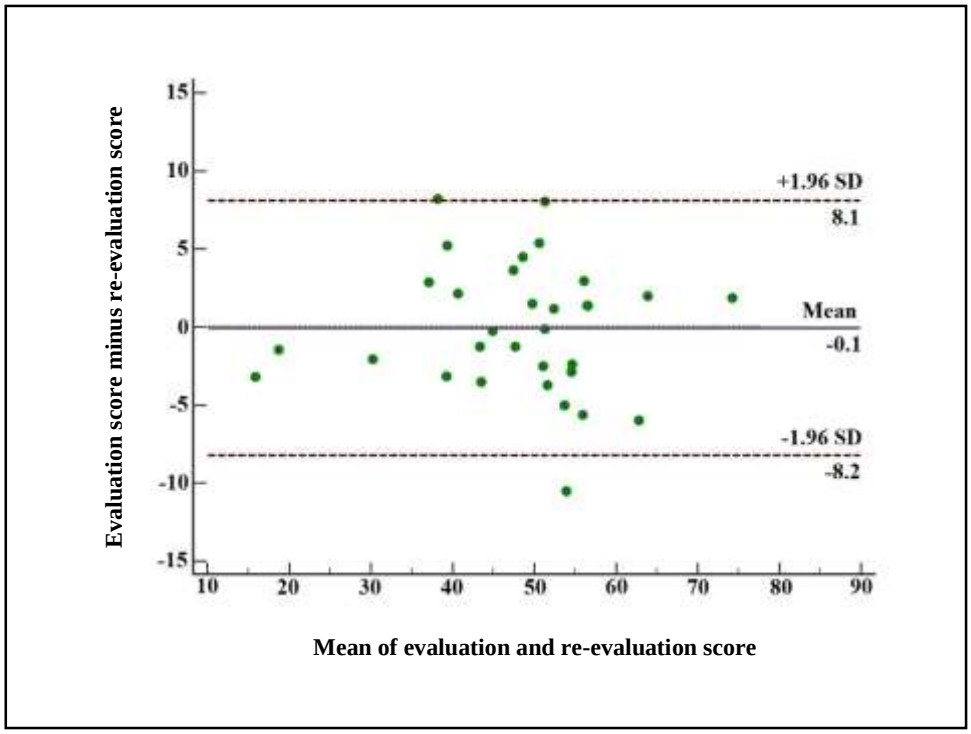

Fig. 2. Bland-Altman plot showing the average against the difference between evaluation and re-evaluation scores of the Persian tinnitus functional index total score.

languages [11,20,21].

Since TFI has been designed to detect intervention-related changes, it is useful to report absolute reliability indicators such as SEM as precision of a tool [22,23]. Downham et al. introduced SEM as an absolute reliability index and explained that the smaller the SEM for a variable, the easier it would be to detect treatment-related changes [23]. SEM indicates the precision of a tool that pertains to the measurement variability. SEM values smaller than 10 are desirable. SEM% as a more conservative index of typical variation is calculated by dividing SEM on the average of the results obtained in the repeated measurements and reported in percent [23,24].

Fackrell et al. reported the SEM value of 8.1 for the overall TFI score, and this index in the TFI subscales varied from 7.6 to 13.9, with relaxation and emotional subscales obtaining the highest SEM [25]. In our study, the SEM value for the overall TFI score was 2.94 and varied from 6.14 to 8.08 in the subscales.

Based on SEM%, the study results revealed that auditory and emotional subscales have more typical variation than the other subscales. SEM% has not been reported in the previous studies on TFI.

In the current study, one score (3%) was not within the limits of agreement. The case was an elder veteran suffering from the respiratory problem. In the study performed by Fackrell et al., 7% of the scores were out of the limits of agreement [25].

Prior to recommending the Persian version of TFI for clinical applications, it is necessary to evaluate the psychometric properties of the Persian TFI in larger samples and different populations of tinnitus patients, and the results of this study may change with increasing sample size.

Conclusion

The initial evaluation of the Persian version of the tinnitus functional index (TFI) provided satisfactory results in terms of reliability in our specific sample of tinnitus patients; however, the structural validity of the Persian TFI remains to

be assessed through confirmatory factor analysis.

Acknowledgments

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Conflict of interest

No potential conflict of interest relevant to this article was reported.

References

1. Bauer CA, Brozoski TJ. Tinnitus: theories mechanisms and treatments. In: Schacht J, Popper AN, Fay RR, editors. Auditory trauma, protection, and repair. Springer handbook of auditory repair. New York: Springer; 2008. p. 101-29.
2. Jastreboff PJ, Hazell JW. Tinnitus retraining therapy: implementing the neurophysiological model. Cambridge University Press; 2008.
3. Jalessi M, Farhadi M, Asghari A, Kamrava SK, Amin-tehran E, Ghalehbaghi S, et al. Tinnitus: an epidemiologic study in Iranian population. Acta Med Iran. 2013;51(12): 886-91.
4. Jafari Z, Malayeri S, Saboor M. The effects of noise of military environments on auditory system: a tinnitus and hypersensitivity to sound study. J Mil Med. 2008;10(2): 89-98.
5. Kuk FK, Tyler RS, Russell D, Jordan H. The psycho-metric properties of a tinnitus handicap questionnaire. Ear Hear. 1990;11(6):434-45. doi: 10.1097/00003446-199012000-00005
6. Newman CW, Jacobson GP, Spitzer JB. Development of the tinnitus handicap inventory. Arch Otolaryngol Head Neck Surg. 1996;122(2):143-8. doi: 10.1001/archotol.1996.01890140029007
7. Newman CW, Sandridge SA, Jacobson GP. Psychometric adequacy of the Tinnitus Handicap Inventory (THI) for evaluating treatment outcome. J Am Acad Audiol. 1998;9(2):153-60.
8. Meikle MB, Henry JA, Griest SE, Stewart BJ, Abrams HB, McArdle R, et al. The tinnitus functional index: development of a new clinical measure for chronic, intrusive tinnitus. Ear Hear. 2012;33(2):153-76. doi: 10.1097/AUD.0b013e31822f67c0
9. Henry JA, Griest S, Thielman E, McMillan G, Kaelin C, Carlson KF. Tinnitus Functional Index: Development, validation, outcomes research, and clinical application. Hear Res. 2016;334:58-64. doi: 10.1016/j.heares.2015.06.004
10. Henry J, Stewart B, Abrams H, Newman C, Griest S, Martin W, et al. Tinnitus functional index: development and clinical application. Audiology Today. 2014;26(6): 41-8.
11. Suzuki N, Oishi N, Ogawa K. Validation of the Japanese version of the tinnitus functional index (TFI). Int J Audiol. 2019;58(3):167-73. doi: 10.1080/14992027.2018.1534279
12. Rabau S, Wouters K, Van de Heyning P. Validation and translation of the Dutch tinnitus functional index. B-ENT. 2014;10(4):251-8.
13. Wrzosek M, Szymiec E, Klemens W, Kotyło P, Schlee W, Modrzyńska M, et al. Polish translation and validation of the tinnitus handicap inventory and the tinnitus functional index. Front Psychol. 2016;7:1871. doi: 10.3389/fpsyg.2016.01871
14. Hoff M, Kähäri K. A Swedish cross-cultural adaptation and validation of the Tinnitus Functional Index. Int J Audiol. 2017;56(4):277-85. doi: 10.1080/14992027.2016.1265154
15. Kam ACS, Leung EKS, Chan PYB, Tong MCF. Cross-cultural adaptation and psychometric properties of the Chinese tinnitus functional index. Int J Audiol. 2018; 57(2):91-7. doi: 10.1080/14992027.2017.1375162
16. Arian Nahad H, Rouzbahani M, Jarollahi F, Jalaie S, Pourbakht A, Mokrian H, et al. Translation, validity, and reliability of a Persian version of the iowa tinnitus handi-cap questionnaire. Iran J Otorhinolaryngol. 2014;26(75): 79-88. doi: 10.22038/IJORL.2014.2215
17. Jalali MM, Soleimani R, Fallahi M, Aghajanpour M, Elahi M. Psychometric properties of the Persian version of the tinnitus handicap inventory (THI-P). Iran J Otorhinolaryngol. 2015;27(79):83-94. doi: 10.22038/IJORL.2015.4037
18. Mahmoudian S, Shahmiri E, Rouzbahani M, Jafari Z, Keyhani M, Rahimi F, et al. Persian language version of the" Tinnitus Handicap Inventory": translation, standardi-zation, validity and reliability. Int Tinnitus J. 2011;16(2): 93-103.
19. Wild D, Grove A, Martin M, Eremenco S, McElroy S, Verjee-Lorenz A, et al. Principles of good practice for the translation and cultural adaptation process for patient-reported outcomes (PRO) measures: report of the ISPOR Task Force for Translation and Cultural Adaptation. Value Health. 2005;8(2):94-104. doi: 10.1111/j.1524-4733.2005.04054.x
20. Kumar S, Kumar H, Chatterjee I, Hota BP, Kumari A. Transadaptation and standardization of tinnitus functional index in Bengali. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS). 2017;16(6):36-44. doi: 10.9790/0853-1606023644
21. Peter N, Kleinjung T, Jeker R, Meyer M, Klaghofer R, Weidt S. Tinnitus functional index: validation of the German version for Switzerland. Health Qual Life Outcomes. 2017;15(1):94. doi: 10.1186/s12955-017-0669-x
22. Mahdavi ME, Pourbakht A, Parand A, Jalaie S. Test-retest reliability and minimal detectable change of rando-mized dichotic digits in learning-disabled children: implications for dichotic listening training. J Am Acad Audiol. 2018;29(3):223-32. doi: 10.3766/jaaa.16134
23. Downham DY, Holmbäck AM, Lexell J. Reliability of measurements in medical research and clinical prac-tice. Studies in multidisciplinarity. 2005;3:147-63. doi: 10.1016/S1571-0831(06)80013-4
24. Weir JP. Quantifying test-retest reliability using the intraclass correlation coefficient and the SEM. J Strength Cond Res. 2005;19(1):231-40. doi:10.1519/15184.1
25. Fackrell K, Hall DA, Barry JG, Hoare DJ. Psychometric properties of the Tinnitus Functional Index (TFI): Assessment in a UK research volunteer population. Hearing research. 2016;335:220-35. doi: 10.1016/j.heares.2015.09.009