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Cross-Cultural Adaptation and Psychometric Properties of Tinnitus Functional Index for Thai Patients

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ABSTRACT

OBJECTIVE This study aims to cross-culturally translate the Tinnitus Functional Index (TFI) questionnaire into Thai, and to determine the psychometric properties of Thai version (TFI-Th).

METHODS TFI was translated into a Thai version (TFI-Th) using a forward - backward translation procedure. All participants completed the following questionnaires in random order: TFI-Th, Visual analog scales, Tinnitus Handicap Inventory Thai Version (THI-T), and Thai Hospital Anxiety and Depression Scales (Thai HADS).

RESULTS The content validity index (CVI) of the TFI-Th was high. The TFI-Th showed adequate convergent and divergent validity. The correlation between TFI-Th and other measurements were calculated and showed a high correlation with THI-T (r = 0.82), a moderate-to-high correlations with each items of VAS (r = 0.66-0.86), and a moderate correlation with depression (r = 0.58) and anxiety (r = 0.62) of Thai HADS. The internal consistency reliability of TFI-Th was excellent (μ = 0.97).

CONCLUSIONS The results of the present study revealed that the cross-cultural TFI-Th had similar reliability and validity to the original TFI and suitable for the evaluation of Thai tinnitus patients.

KEYWORDS tinnitus, Thai Tinnitus Functional Index, psychometric properties, reliability

INTRODUCTION

Tinnitus is the perceived sensation of sound in the ears without an external acoustic stimulus. This sound is usually described as a buzzing, whistling, chirping, or clicking. In a systematic review, McCormack et al. (1) reported that the worldwide prevalence of tinnitus ranged from 5.1% to 42.7% in individuals aged 18 and above. In Thailand, no reports have examined tinnitus prevalence in the general population. However, at the Hearing Clinic of Ramathibodi Hospital, a review of medical records showed that 1,394 patients underwent audiometric examinations in 2015, and 556 of these individuals (approximately 40%) exhibited signs of tinnitus on at least one side.

A number of studies have examined the impact of tinnitus on quality of life. In 2014, a peer-reviewed article described the negative impacts of tinnitus, including annoyance, sleeping problems, difficulty concentrating, anxiety, social isolation, ongoing depression, and inability to work. Other investigators have described debilitating effects of tinnitus such

as frustration, insomnia, headaches, and depression, which even led to suicide in some cases (2-4). Several questionnaires have been used to evaluate the impact of tinnitus prior to treatment, with the goal of generating information that will facilitate the development of effective interventions. To date, most of these existing questionnaires measure the negative impacts and rate the severity of symptoms, but do not consider sensitivity to changes in the severity of tinnitus. To address this, Meikle and a group of colleagues including audiologists, otologists, hearing specialists and other health care researchers (5) developed a questionnaire that could be used as a universal standard for measuring tinnitus symptoms. By gathering information from nine different tinnitus-related questionnaires, the team developed the Tinnitus Functional Index (TFI). The TFI is a relatively novel self-reported questionnaire with high sensitivity and validity (r = 0.86 with Tinnitus Handicap Inventory; THI). The internal consistency was confirm by Cronbach's alpha coefficient of 0.97. It is used to determine the degree of symptom severity, the negative impacts of tinnitus, and the responsiveness to treatment to assess treatment-related changes. The TFI includes eight subscales that cover the negative impacts of tinnitus related to intrusiveness, sense of control, cognition, sleep, auditory function, relaxation, quality of life, and emotional factors. The TFI is distinct from other tinnitus questionnaires in that it measures sensitivity to treatment-related changes in tinnitus.

Information about tinnitus impact and severity is critical when making decisions about appropriate interventions, as well as monitoring treatment outcomes. Therefore, in the present study, we sought to translate and cross-culturally adapt the TFI into the Thai language so that it could be used to evaluate Thai patients. The translated questionnaire will be useful for obtaining information related to effective treatment in both clinical and research settings in Thai patients. For instance, it could be used to measure treatment-related outcomes for monitoring and therapeutic trials. Most importantly, translation of the TFI will substantially improve Thai medical assessment of tinnitus patients.

METHODS

Participants

The target population comprised tinnitus patients who sought medical treatment at the ear, nose, and throat outpatient department (ENT-OPD) and the communication disorders clinic at Ramathibodi Hospital. All participants were required to have tinnitus, defined as the perception of sound with no external source in one or both ears, or inside the head. The participants were 18 years old and older, and were able to read and write in the Thai language, as well as to understand spoken Thai.

The sample size was calculated for exploratory factor analysis. Accordingly, the number of participants needed to be at least ten times more than the number of variables, which equaled the number of questionnaire items (6). The present study recruited 252 participants with tinnitus, and we excluded two participants who did not complete all of the questionnaire items. A total of 250 participants completed the set of questionnaires. The participants ranged in age from 18 to 88 years.

Materials

We translated the original TFI (5) into Thai, and called the Thai language version the TFI-Th. We then evaluated the psychometric properties of the TFI-Th using the THI-T (Thai version of the Tinnitus Handicap Inventory), VAS (Visual Analog Scale), and the Hospital Anxiety and Depression Scale (HADS).

The THI-T is a self-reported 25-item questionnaire pertaining to the degree of tinnitus severity. Each item has three alternative choices (i.e., "Yes", "No", and "Sometimes"). In addition to the total score, items can be categorized into three subscales: functional, emotional, and catastrophic. The internal consistency (reliability) of the original version is relatively high (Cronbach's alpha = 0.902) (7).

We used a VAS to analyze the negative impacts of tinnitus in terms of intrusiveness, emotions, sense of control, cognition, sleep, audition, relaxation, and quality of life according to the subscales of the TFI-Th. The VAS comprised 8 items with the following questions: "How intrusive is your tinnitus?", "To what degree is your sense of control related to tinnitus?", "To

what degree does tinnitus interfere with your cognitive function?", "To what degree does tinnitus interfere with your sleep?", "To what degree does tinnitus interfere with your auditory function?", "To what degree does your tinnitus interfere with relaxation?", "To what degree does tinnitus impact your quality of life?", "To what degree has your tinnitus led to emotional distress?". The VAS ranged from 0 to 10, which was converted from marked positions on a 10-cm line.

The HADS is a self-reported 14-item assessment scale used to identify and analyze states of depression and anxiety. It has been translated into Thai, and the sensitivity and specificity of the Thai HADS are 100% and 86.0% for the anxiety subscale and 85.71% and 91.3% for the depression subscale, respectively (8).

Method

Translation and cultural adaptation process

The TFI was translated and adapted culturally into Thai using the "Principles of Good Practice for the Translation and Cultural Adaptation Process for Patient-Reported Outcomes (PRO)"(9) which maintained content validity.

The original TFI was translated using a forward - backward translation procedure (9,10). First, the TFI was translated into Thai by a group of five independent experts. One of the experts was a professional translator from the Center for Translation and Language Services at the Research Institute for Languages and Cultures of Asia at Mahidol University. The other four translators were experienced audiologists working in the four main regions of Thailand. The forward translators were instructed to maintain conceptual, item, and semantic equivalences with the original instrument. Each translator independently translated the questionnaire into Thai and rated the degree of difficulty in translating each TFI item using a Likert scale (11). The forward translations were reconciled to create a final forward translation. The final forward translation was approved by other five professionals (a neuro-otologist, an otolaryngologist, two audiologists, and a psycholinguist) using the content validity index (CVI). Then, the final forward translation was back translated into the English by two translators (one English native speaker and one otolaryngologist). The back translations were reconciled to create a single back translation. The final items in the back translation were chosen by considering the degree of congruence between the final back translation and the original questionnaire. Additionally, Dr. James Henry, the corresponding author of the original TFI, provided comments and suggestions before approving the congruence of the meaning between the items in the original TFI and the final back translation version.

Ten Thai-speaking patients were purposively selected for cognitive debriefing (10). These patients varied in age, gender, region of residence, and education level. They were asked to complete the TFI-Th while verbalizing their thoughts to explain the reasons for each of their responses. The final translation of the TFI-Th was then formatted and proofread.

Data collection

After final translation had been proofed, we performed data collection at the ENT-OPD and the communication disorders clinic at Ramathibodi Hospital, Bangkok, Thailand. All participants signed written informed consent forms. They were interviewed and asked to complete a history intake form to collect their sociodemographic information (i.e., sex and tinnitus symptoms). Then, the participants were asked to complete the TFI-Th, THI-T, VAS, and Thai HADS (8). The study was approved by Ethics Committee of the Faculty of Medicine, Ramathibodi Hospital, Mahidol University (No. 09-61-55).

RESULTS

The statistical data were analyzed using Stata version 16.0 software (StataCorp, College Station, Texas, USA). There were a total of 250 participants, 92 (36.8%) men and 158 (63.2%) women. Their median age was 55 years (50^{th} percentile). Almost 72.8% of the participants had persistent tinnitus, and about 27.2% had intermittent tinnitus. Tinnitus was unilateral in 162 participants (64.8%), bilateral in 77 participants (30.8%), and 11 participants (4.4%) perceived tinnitus as originating in the head. Among those with unilateral tinnitus, there was a small difference in the number of participants

with tinnitus in the right (82, 32.8%) versus left ear (80, 32%).

Translation and cultural adaptation process

Content validity

The TFI measures the impact of tinnitus in terms of general behavioral phenomena and other personal factors such as sleeping, working, feelings, emotions, and sensations (12,13).

The CVI was determined based on the experts' ratings of relevance. The scores were recategorized such that 1 corresponded to relevant (a rating of 3 or 4 out of 4) and 0 corresponded to not relevant (a rating of 1 or 2 out of 4). These were used to compute both the item-level (I-CVI) and scale-level (S-CVI) CVI.

All 25 items were given ratings of either 3 or 4 points on the 4-point scale of item relevance, corresponding to I-CVI scores of 1 (14, (15). The S-CVI scores were 1 because all raters agreed on the content validity (Table 1).

Table 1. Ratings for the items and scale of the content validity index

Items	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	I - CVI
1	4	4	3	4	3	1
2	3	4	3	4	4	1
3	3	4	4	4	4	1
4	4	3	3	3	4	1
5	3	3	3	4	3	1
6	4	4	4	4	3	1
7	4	4	3	3	4	1
8	4	4	4	4	4	1
9	4	4	4	4	4	1
10	4	4	4	4	3	1
11	3	4	3	4	4	1
12	4	4	4	4	4	1
13	4	4	4	4	4	1
14	4	4	4	4	3	1
15	4	4	3	3	4	1
16	3	4	4	4	3	1
17	4	4	3	4	4	1
18	4	4	3	3	4	1
19	4	4	4	4	4	1
20	4	4	4	4	4	1
21	4	4	4	4	4	1
22	3	3	4	4	4	1
23	4	4	4	4	4	1
24	4	3	4	4	3	1
25	4	4	4	4	3	1
					S - CVI	1

I-CVI: The item-level content validity index.
S-CVI: The scale-level content validity index

Psychometric properties of the TFI-Th

Convergent validity

Two hundred and fifty participants completed the TFI-Th, THI-T, VAS, and HADS. The resulting data were used to compute the mean score, as well as the standard deviations, medians, maximums, and minimums. For the TFI-Th, the mean score was 42 (SD = 23.84) and the median score was 41.2. The median scores for the eight subscales of the TFI-Th, i.e., (a) intrusiveness, (b) sense of control, (c) cognitive function, (d) sleep, (e) auditory function, (f) relaxation, (g) quality of life, and (h) emotion, were 18, 12, 12, 9, 12, 12, 12, and 12, respectively (Table 2).

Table 2. Descriptive statistics pertaining to the TFI-Th

	Mean	SD	Median	25th Percentile	78th Percentile	Min	Max
TFI-Th							
Overall	42.00	23.84	41.20	24	58.4	0	99.20
TFI subscales							
Intrusiveness	17.03	7.28	18	12	22	0	30
Sense of control	12.52	8.24	12	6	18	0	30
Cognitive	12.62	8.42	12	6	19	0	30
Sleep	10.98	9.86	9	2	19	0	30
Auditory	12.56	8.52	12	6	18	0	30
Relaxation	12.61	8.94	12	5	20	0	30
Quality of life	14.28	11.28	12	4	22	0	40
Emotion	12.70	9.19	12	5	20	0	30

SD, standard deviation; Min, minimum; Max, maximum

The total scores of the THI-T were used to calculate a median score of 38. The median scores of the VAS for the items measuring (a) intrusiveness, (b) sense of control, (c) cognitive function, (d) sleep, (e) auditory function, (f) relaxation, (g) quality of life, and (h) emotion were 5, 5, 4, 3, 5, 4, 3, and 4, respectively. The median scores of the Thai HADS-Anxiety and Thai HADS-Depression were 5.5 and 4, respectively (Table 3).

We computed the correlation coefficients between the total scores of the TFI-Th and the total scores of the THI-T. The Spearman correlation coefficient was 0.82. The correlation coefficients between the subscales of the TFI-Th and VAS for (a) intrusiveness, (b) sense of control, (c) cognitive function, (d) sleep, (e) auditory function, (f) relaxation, (g) quality of life, and (h) emotion were 0.73, 0.66, 0.74, 0.86, 0.79, 0.76, 0.81, and 0.80, respectively. In addition, the correlation coefficients between the TFI-Th and HADS for anxiety and depression were 0.62 and 0.58, respectively. The correlation coefficients between the emotions subscale of the TFI-Th and the Thai HADS for anxiety and depression were 0.66 and 0.59, respectively (Table 4).

Parallel forms reliability

The parallel forms reliability measures the correlation between different versions of an assessment tool. We examined the correlation between the eight subscales of the TFI-Th and the eight items of VAS. The parallel forms reliability of the eight subscales of the TFI-Th with

Table 3. Descriptive statistics pertaining to the THI, VAS, and HADS

	Mean	SD	Median	25th Percentile	78th Percentile	Min	Max
THI	40.25	23.75	38	20	56	0	100
VAS							
Intrusiveness	5.29	2.75	5	3	8	0	10
Sense of control	4.23	2.44	5	2	6	0	10
Cognitive	4.14	2.86	4	1	6	0	10
Sleep	3.76	2.99	3	1	6	0	10
Auditory	4.72	2.76	5	2.5	7	0	10
Relaxation	4.22	2.82	4	2	6	0	10
Quality of life	4.01	2.86	3	2	6	0	10
Emotion	4.46	2.83	4	2	7	0	10
HADS							
Anxiety	6.17	4.03	5.5	3	9		19
Depression	4.57	3.84	4	2	7		17

SD, standard deviation; Min, minimum; Max, maximum

Table 4. Spearman correlation coefficients between TFI-Th, THI, VAS, and HADS

	TFI-Th								
	Total	Intrusive	Sense of control	Cognitive	Sleep	Auditory	Relax	Quality of life	Emotion
THI	0.82								
VAS									
Intrusive		0.73							
Sense of control			0.66						
Cognitive				0.74					
Sleep					0.86				
Auditory						0.79			
Relax							0.76		
Quality of life								0.81	
Emotion									0.80
HADS									
Anxiety	0.62								0.66
Depression	0.58								0.59

respect to the VAS was represented by Spearman correlation coefficients of 0.73, 0.66, 0.74, 0.86, 0.79, 0.76, 0.81, and 0.80 for the (a) intrusiveness, (b) sense of control, (c) cognitive function, (d) sleep, (e) auditory function, (f) relaxation, (g) quality of life, and (h) emotion subscales, respectively. The sense of control subscale had the smallest correlation coefficient, i.e., 0.66. Thus, all of the coefficients for the eight subscales of the TFI-Th were higher than 0.5, indicating sufficient parallel forms reliability (16).

Item analysis

The item-total correlation statistic reflects the correlation between the score for each item and the overall TFI-Th score. The item-total correlation ranged from 0.54 to 0.88. The corrected item-total correlation, called the item-rest correlation in Stata, is the correlation between each item score and the other 24 items. The corrected item-total correlation in this study ranged from 0.50 to 0.86. Both the item-total and the corrected item-total correlations were considered acceptable if the correlation value was above 0.5 (17). The inter-item correlation is the average corrected item-total correlation for each item, and has a minimum acceptable value of 0.3 (18). In this study, the inter-item correlation ranged from 0.57 to 0.59. In addition, the average Cronbach's alpha if an item was deleted ranged from 0.9693 to 0.9720 for that item (Table 5).

Internal consistency reliability

We computed the internal consistency using Cronbach's alpha coefficient. Cronbach's alpha coefficient ranges from 0.00 to 1.00. The Cronbach's alpha coefficient of the TFI-Th for the total scale was 0.97. An alpha coefficient higher than 0.7 was considered to reflect an acceptable reliability coefficient (16).

DISCUSSION

We recruited a total of 250 participants from the ENT-OPD and communication disorders clinic at Ramathibodi Hospital, including 158 women (63.2%) and 92 men (36.8%). The relationship between tinnitus and gender has not been confirmed. Although several studies have

Table 5. Item-total statistics

Item No.	Item-total correlation	Corrected item-total correlation	Inter-item correlation	Cronbach's alpha if item deleted
1	0.5411	0.5028	0.5914	0.9720
2	0.6818	0.6525	0.5816	0.9709
3	0.8131	0.7943	0.5725	0.9698
4	0.7014	0.6735	0.5802	0.9707
5	0.7780	0.7562	0.5749	0.9701
6	0.7552	0.7315	0.5765	0.9703
7	0.8348	0.8179	0.5709	0.9696
8	0.8273	0.8097	0.5715	0.9697
9	0.8165	0.7980	0.5722	0.9698
10	0.7148	0.6879	0.5793	0.9706
11	0.7710	0.7486	0.5754	0.9702
12	0.7385	0.7135	0.5776	0.9704
13	0.7214	0.6950	0.5788	0.9706
14	0.6886	0.6598	0.5811	0.9708
15	0.7259	0.6998	0.5785	0.9705
16	0.8137	0.7950	0.5724	0.9698
17	0.8439	0.8279	0.5703	0.9696
18	0.7652	0.7424	0.5758	0.9702
19	0.8106	0.7916	0.5726	0.9698
20	0.8606	0.8462	0.5691	0.9694
21	0.7932	0.7726	0.5738	0.9700
22	0.7545	0.7307	0.5765	0.9703
23	0.8233	0.8054	0.5717	0.9697
24	0.8759	0.8629	0.5681	0.9693
25	0.7926	0.7720	0.5739	0.9700

reported the prevalence of tinnitus to be higher in female versus male participants (19,20), a number of studies have reported a higher prevalence of tinnitus in male participants (1, 21,22). Furthermore, other studies reported non-significant gender differences in tinnitus prevalence rates (23-26).

Translation and cultural adaptation process

Content validity

The content validation procedure provided information about the harmonized translation, its semantic equivalence, and the degree of literalness between the original TFI version and the Thai version. Dr. James Henry, the corresponding author of the original TFI, confirmed the congruence between the final back translation and the original version.

The CVI was determined based on professional ratings of relevance. The scores were recategorized such that 1 reflected a relevant rating (3 or 4) and 0 indicated a non-relevant rating (1 or 2). The CVI was computed for each item on the scale (I-CVI) and for the overall scale (S-CVI). Each item was given a relevance score of 3 or 4. From the results in Table 1 the I-CVI of the TFI-Th had a score of 1, which was considered excellent (27), and the S-CVI scores were 1.

According to Polit and Beck (27), an I-CVI of 0.78 or higher and a S-CVI of 0.90 or higher represented excellent content validity. Accordingly, the CVI results in the present study indicated that the TFI-Th was well adapted in terms of local context and that it was the semantic equivalent of the original version.

Psychometric properties of the TFI-Th

Convergent validity

We assessed convergent validity by determining the correlations between the subscales of the TFI-Th, THI-T, VAS, and Thai HADS. To this end, we used Spearman correlation coefficient analysis.

In the present study, the Spearman correlation coefficient between the total scores of the TFI-Th and THI-T was 0.82, and a Spearman correlation coefficient of 0.5 or higher was considered acceptable (16). Thus, this Spearman correlation coefficient was interpreted to indicate a strong correlation. We compared the correlations between the TFI-Th and THI-T, as well as the other translated versions of the TFI. The result in the present study was similar to that for versions of the TFI translated into other languages. The correlation coefficients between the TFI and THI for the original American (5), Swedish (13), German for Switzerland (28), Bengali (29), Hebrew (30), Chinese (31), and Japanese (32) versions are 0.86, 0.80, 0.86, 0.85, 0.80, 0.86, and 0.83, respectively.

From the results in Table 4, the correlation coefficients between the subscales of the TFI-Th and VAS were 0.73, 0.66, 0.74, 0.86, 0.79, 0.76, 0.81, and 0.80 for intrusiveness, sense of control, cognitive function, sleep, auditory function, relaxation, quality of life, and emotion, respectively. This indicated a moderate-to-high correlation between each TFI-Th subscale and the corresponding VAS subscale. The sense of control subscale had a small correlation coefficient, which indicated a moderate correlation. Further analysis indicated that the VAS question for sense of control corresponded only to item 4 of the TFI.

The correlation coefficients between the total scores of the TFI-Th and Thai HADS were moderate for anxiety (r = 0.62) and depression (r = 0.58). In terms of the emotions subscale, the correlation coefficients between the TFI-Th and the Thai HADS were 0.66 for anxiety and 0.59 for depression. Thus, these correlation coefficients were slightly higher than the correlation coefficients between the total scores of the TFI-Th and Thai HADS for anxiety and depression. The emotions subscale scores were slightly higher than the total scores used to assess anxiety and depression. These results were consistent with the findings of Arnold et al. (33), who reported moderate correlation coefficients between the emotions subscale scores of the TFI (Dutch version) and the HADS (r = 0. 65 for anxiety, r = 0.65 for depression). Furthermore, Bruggemann et al. (34) reported that the total scores of the TFI (German version) had correlation coefficients of 0.51 for anxiety and 0.49 for depression. Hoff and Kahari (13) reported that the total scores of the TFI (Swedish version) had correlation coefficients of 0.59 for anxiety and 0.60 for depression. These results

indicated a weak-to-moderate correlation between the total TFI scores and Thai HADS scores, which was likely because they measured different psychological constructs. These correlation coefficients were less than 0.85 (35), indicating that the TFI-Th had a satisfactory level of discriminant validity.

Parallel forms reliability

We used the parallel forms reliability to determine the correlations between the subscales of the TFI-Th and VAS for each subscale that assessed the same aspects of tinnitus. The Spearman correlation coefficients, ranging from 0.66 to 0.86 (Table 4), represented a moderate-to-high correlation. As the VAS sense of control subscale did not cover all of the issues included in the sense of control subscale in the TFI-Th, these subscales were only moderately correlated. Although the minimum correlation coefficient was 0.66, this reflected an acceptable level of reliability.

Item analysis

The item analysis represented the homogeneity for each item of the TFI-Th, and was computed in several different ways. The item-total correlation was found to range from 0.54 to 0.88. These values were considered acceptable. Although the first item had the lowest value (0.54), this was considered acceptable, and indicated a positive correlation between the individual item scores and the overall score on the TFI-Th.

The corrected item-total correlation showed the relationship between each item and the summed score of the other 24 items. The correlation was expected to be above 0.5, and varied from 0.50 to 0.86. The first item had the lowest value (0.5028), indicating an acceptable correlation.

The inter-item correlation was another measure of the relative significance of each item or question in terms of reliability. The reliability for an item was expected to exceed 0.3, indicating a positive relationship. An inter-item correlation between 0.50 and 1.00 indicated a strong relationship. For the TFI-Th, the inter-item correlations all ranged from 0.57 to 0.59, indicating strong correlations. The Cronbach's alpha if an item was deleted represented the alpha value if the given item was not included. In this study, the Cronbach's alpha was 0.9713 for the 25 items, which indicated high reliability. The Cronbach's alpha for deleted items ranged from 0.9693 to 0.9720, and omitting any of the 24 items except the first one decreased the overall reliability. When the first item was omitted from the TFI-Th, the reliability increased slightly (from 0.9713 to 0.9720), although this was not significant. Although the item-total and inter-item correlations were acceptable without it, we opted to include the first item.

Internal consistency reliability

We computed the internal consistency using Cronbach's alpha coefficient. A reliability coefficient of 0.70 or higher was considered acceptable (16). Cronbach's alpha coefficient for the TFI-Th total score was 0.97, indicating excellent internal consistency reliability. This internal consistency reliability was similar to that of the original version and the versions for Switzerland and New Zealand (Cronbach's alpha of 0.97). In addition, the reliability of the TFI-Th was similar to that in other languages such as Dutch, Swedish, and Chinese. These results indicate that the reliability of the TFI-Th was equivalent to that in the original version and the other versions.

The TFI is disease-specific questionnaire in regard to tinnitus which can be a firm evidence base for the impact of tinnitus. The TFI cover the negative impacts related to intrusiveness, sense of control, cognition, sleep, auditory function, relaxation, quality of life, and emotional factors. The quality of life, this subscale of TFI was performed a strong correlation ($r = -0.627$, $p < 0.001$) with the physical and psychological subscales of the World Health Organization Quality of Life (36) (WHOQOL-BREF). WHOQOL-BREF is health related quality of life (HRQoL) questionnaire. However, the use of TFI-Th should be particularly considered time to complete for avoiding false positives.

CONCLUSIONS

The TFI is widely used to evaluate treatment responsiveness and symptom severity in tinnitus patients. This tool is sensitive to changes in severity, making it popular among audiology clinicians. In this study, we cross-culturally

Table 6. The Cronbach's alpha coefficients of the TFI for each study

	Cronbach's alpha coefficient
The present study (Thai version)	0.97
The original English version (United states)	0.97
English version (United Kingdom)	0.80
English version (New Zealand)	0.97
German version (Switzerland)	0.97
German version (German)	0.93
Dutch version (Belgium)	0.96
Dutch version (Netherlands)	0.95
Swedish version (Sweden)	0.95
Chinese version (Hong Kong)	0.94
Chinese (Mandarin) version (Taiwan)	0.97
Bengali version (India)	0.97
Polish version (Poland)	0.96
Hebrew version (Israel)	0.96
Japanese version (Japan)	0.95

translated the TFI into Thai and validated this new version of the measure. Our results show that the Thai version of the TFI (TFI-Th) has suitable validity and reliability, and that it is comparable with the original English version of the TFI. In sum, the newly developed TFI-Th is an appropriate tool for assessing the impact of tinnitus in Thai patients in both research settings and clinical tinnitus evaluations.

Recommendations

1. Future studies should examine the test-retest reliability of the TFI-Th.

2. Future studies should consider sample sizes for each geographic region of Thailand, such as the north-eastern, northern, southern, and western regions.

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CONFLICTS OF INTEREST

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