Tinnitus Assessment : Chinese Version of Tinnitus Primary Function Questionnaire

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Research

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Abstract

OBJECTIVE: The aim of the study was to evaluate the Chinese version of Tinnitus Primary Function Questionnaire (TPFQ).

DESIGN: Tinnitus patients were administered the TPFQ, the Tinnitus Handicap Inventory (THI), the Beck Anxiety Inventory (BAI), the Beck Depression Inventory (BDI), and the Pittsburgh Sleep Quality Index (PSQI). Additionally, the magnitude estimate of tinnitus loudness, pure tone audiogram and tinnitus matching were obtained. The factor structure was measured by Kaiser-Meyer-Olkin. The internal consistency was examined using Cronbach coefficient alpha. The relationships between the TPFQ scores and other measurements were compared with Spearman rank correlation coefficient.

STUDY SAMPLE: 116 patients whose tinnitus lasting longer than 3 months were included in this study.

RESULTS: The Cronbach's α of the 20-item version TPFQ was 0.94, and the 12-item version TPFQ was 0.92. Both the 20-item and 12-item version TPFQ were significantly correlated with magnitude estimation of tinnitus loudness, THI, PSQI, BDI and BAI. The average pure tone hearing thresholds were significantly correlated with the hearing subscale.

CONCLUSIONS: The 20-item and 12-item versions of Chinese TPFQ are a reliable and valid measures of tinnitus. The TPFQ can be used in the assessment and management of tinnitus among the Chinese speaking population.

Introduction

Tinnitus is a common clinical symptom, and the influencing factors of tinnitus are complex and diverse. Most tinnitus cannot be eliminated. The core of treatments of tinnitus is how to reduce the impact of the tinnitus. There are many treatments for the tinnitus, including counseling, sound therapy and hearing aids. Counseling is even available on the internet (Beukes et al., 2018 and Jasper et al., 2014). Therefore, the comprehensive evaluation of the impact of tinnitus on patients is the important part of tinnitus treatment. A tinnitus questionnaire is the common method for guiding treatments and evaluating tinnitus research. Several questionnaires are widely used in the world, including the Tinnitus Handicap Questionnaire (THQ) (Kuk et al., 1990), the Tinnitus Handicap Inventory (THI) (Newman et al., 1996), the Tinnitus Primary Function Questionnaire (TPFQ) (Tyler et al., 2014), the Tinnitus Reaction Questionnaire (TRQ) (Wilson et al., 1991) and the Tinnitus Questionnaire (TQ) (Goebel and Hiller, 1994). Everyone can have different reactions to tinnitus, including impaired sleep, difficulty in concentrating, decreased social enjoyment, and interference with hearing (Bauer, 2018). The THI has been used in China (Liu et al., 2009), however it cannot distinguish these differences. Therefore it cannot play a guiding counseling in the treatment of tinnitus. Furthermore, the three-label category scale is insensitive (Tyler et al., 2007) in the treatment of tinnitus. The Tinnitus Primary Function Questionnaire (TPFQ) was developed to guide treatment and for research, and is widely used worldwide. Subjects are asked to rate using a scale ranging from 0 (strongly disagree) to 100 (strongly agree). Each item is scored in a wide range (a 0-100

interval scale), making it more likely to detect minor changes. TPFQ has four subscales; concentration, emotion and thoughts, hearing and sleep. It can more comprehensively evaluate the impact of tinnitus, and can indicate the treatment. TPFQ was once called TAQ, it was translated into Chinese version by Pan Tao et al. Factor analysis was used to test the reliability of the Chinese version of TAQ, but the reliability and validity of each dimension of the scale was not tested. The aim of this study is to comprehensively validate whether TPFQ can be used in Chinese-speaking patients and to provide evidence for its research and clinical application.

Methods

The original version of TPFQ was adapted to a cross-cultural Chinese setting. The main steps were: forward-backward translation and cognitive debriefing, ending up with a final Chinese version of TPFQ.

116 patients visited our clinic (Department of Otolaryngology, Peking University Third Hospital) for tinnitus from June 2013 to December 2015, and were included in this study. All patients had subjective tinnitus for longer than 3 months and all were native Chinese speakers. We used TPFQ, THI, magnitude estimation of tinnitus loudness, Beck Anxiety Inventory (BAI) (Beck et al., 1988), Beck Depression Inventory (BDI) (BECK et al., 1961) and Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989) for all tinnitus patients. All patients underwent physical examination in the Otorhinolaryngology Department to rule out middle-ear infection. Pure-tone audiogram, tinnitus pitch and loudness matching were performed at the same clinic visit. This study was approved by the ethics committee of Peking University Third Hospital and abided by the International Research Codes of the Declaration of Helsinki.

Statistical analysis

SPSS version 20.0 (IBM) was used for statistical evaluation. The factor structure of the questionnaire was measured by Kaiser-Meyer-Olkin. Internal consistency of the total TPFQ and subgroups was examined using Cronbach coefficient alpha. The relationships between the TPFQ scores and other measurements were compared with Spearman rank correlation coefficient.

Results

Chinese version of TPFQ

A Chinese translation of the scale is provided on the website of University of Iowa, but the website does not provide details of the translation. The original TPFQ was translated by two independent otologists, who were Chinese native-speakers with an advanced level of competence in English and had not read the Chinese translation of TPFQ on the website. Three senior otologists who had extensive experience in the management of tinnitus compared and discussed the three translated editions. Each expert received an evaluation questionnaire. Each item of the questionnaire was evaluated separately, which ranged from 0 (inaccurate translation) to 10 (excellent translation). If all three raters assigned a score less than 8, the translations was rejected and a new translation was required. The highest score of each item was greater

than 8. Then final translation of each item was agreed upon. This version was then back translated by two Chinese native-speaker otologists who was unaware of the original questionnaire. The authors compared them with the original version of TPFQ and concluded that there had no differ significantly in any aspect.

Ten adult tinnitus outpatients were randomly selected to fill in the Chinese version of TPFQ. The average time to fill in the questionnaire was 5 minutes. The patients reported no difficulty in understanding the items of the questionnaire and they stated that they believed that the questionnaire contained important issues related to tinnitus. This resulted in the final Chinese version of TPFQ (Appendix 2 of Supplementary material) to be evaluated.

Subjects

The study was conducted on 116 patients, and consisted of 54 (46.6%) males and 62 (53.4%) females, with mean age of 48.3±15.7 years. The mean duration of tinnitus was 18 (range of 3-360) months. The other subject characteristics are presented in Table 1.

Reliability

Internal consistency of the Chinese TPFQ was examined using Cronbach coefficient alpha. The total TPFQ Cronbach's alpha was 0.94. The Cronbach's alpha of factor Concentration, factor Emotion, factor Hearing, factor Sleep were respectively 0.88, 0.80, 0.87, 0.91. Table 2 shows the item score and item-total correlations for the 20-item version. The item-total correlations ranged from 0.48 to 0.74, and the median value was 0.66.

Factor Structure

One step was to examine the factor structure of the questionnaire using factor analysis techniques (Table 3). The Kaiser-Meyer-Olkin (KMO) measure was performed and a KMO ratio of 0.97 was obtained for the set of 20 items. The first factor included item 2, 3, 9, 14, 17 and explained 20.65% of the total variance (eigenvalue=4.13); the second factor included item 5, 13, 16, 18, 20 and explained 19.14% of the total variance (eigenvalue=3.83); the third factor included item 7, 10, 11, 12, 15, 19 and explained 19.05% of the total variance (eigenvalue=3.81); the fourth factor included item1, 4, 6, 8 and explained 11.79% of the total variance (eigenvalue=2.36). The communality of each variable explained by these four factors ranged from 0.37 to 0.83.

Construct Validity

A spearman correlation coefficient was calculated by comparing the total score of TPFQ with tinnitus loudness magnitude estimation and THI. As shown in Table 4, the correlation between TPFQ and loudness magnitude estimation was 0.42, and a high correlation of 0.73 was found between TPFQ and THI. We also compared the scores of PSQI, BAI, BDI and other characters with the total TPFQ and subscale scores. The total TPFQ, Concentration, Emotion and Sleep subscale correlated significantly with

the PSQI (r =0.43, 0.32, 0.35, 0.56, p < .01). The total TPFQ, Concentration, Emotions, Hearing and Sleep subscales correlated with the BAI and the BDI (p < .01)). The Hearing subscale was correlated with the bilateral average PTA (r =0 .21, p < .05). There was no significant correlation between tinnitus pitch and loudness matching with the TPFQ scores.

The 12-Item Version of the Chinese TPFQ

We also evaluated the 12-Item Version TPFQ. In the 12-item version, questions 7, 11, and 15 were chose for Concentration; questions 4, 8, and 10 were chose for Emotion; questions 2, 14, and 17 were chose for Hearing; questions 16, 18, and 20 were chose for Sleep.

Table 5 displays the mean total and subscale scores of the 12-item version. The mean total score of 26.58% was found for the 12 items, which is slightly below the mean score for all 20 items (31.87%). Mean subscale scores ranged from 23.13% to 32.07%.

Reliability

Internal consistency of the Chinese 12-item version TPFQ was also examined using Cronbach coefficient alpha. The total 12-item version TPFQ Cronbach's alpha was 0.92. The Cronbach's alpha of factor concentration, factor emotional, factor hearing, factor sleep were respectively 0.90, 0.79, 0.88, and 0.84. The 12-item version of the questionnaire also demonstrates good reliability.

Construct Validity

A spearman correlation coefficient was calculated to compare results for tinnitus loudness magnitude estimation, THI, PSQI, BDI, BAI, and the bilateral average PTA with the short version total score and subscale scores (Table 6). The total score and subscale scores from the 12-item version were significantly correlated with tinnitus loudness magnitude estimation, THI, PSQI, BDI and BAI. The bilateral average PTA was significantly correlated with the Hearing subscale (r =0 .24, p < .05).

Discussion

The results of this study demonstrated that the Chinese version of TPFQ has good reliability. The Cronbach's alpha values of the total Chinese TPFQ; the factors for Concentration, Emotion, Hearing and Sleep were 0.94, 0.88, 0.80, 0.87 and 0.91, respectively. This was similar to the English version of TPFQ (0.92, 0.88, 0.84, 0.81, and 0.94) (Tyler et al., 2014). The high Cronbach's alpha suggests better internal consistency reliability for this questionnaire. The Chinese TPFQ items showed moderate correlations with the total score of the questionnaire, similar to the English version (Tyler et al., 2014).

The original TPFQ has four subscales, including Concentration, Emotions and thoughts, Hearing and Sleep. The factor analysis in the Chinese version also found four factors, but the items in the subscales are slightly different from the original TPFQ. Factor 1 in the Chinese version addresses the influence of tinnitus on hearing, language comprehension, judgment and can be summarized as the Language &

Perception. Factor 2 in the Chinese version addresses the Sleep, which is consistent with the original version. Factor 3 in the Chinese version addresses the Emotions &Concentration. Factor 4 in the Chinese version addresses the Emotions and Hearing. In the Chinese version the effects of tinnitus on emotion, concentration and hearing are intertwined and mutually influenced. Emotion, concentration and hearing are all very important reactions to tinnitus. They are closely related to each other and influence each other. There have the similar situations in other questionnaire tests (Vanneste et al., 2011).

We used correlations between the TPFQ and the loudness magnitude estimation, THI, PSQI, BDI, BAI, bilateral average PTA, pitch matching and loudness matching as measures of construct validity. The TPFQ and subscale scores were well correlated with loudness magnitude estimation. The TPFQ did not show any correlation with the tinnitus pitch and loudness match. This finding is similar to the results of other studies (Kuk et al., 1990; Vanneste et al., 2011; Jun et al., 2015). Consistent with “psychological model of tinnitus” (Dauman and Tyler, 1992; Tyler et al., 1992; Kuk et al., 1990; Vanneste et al., 2011; Jun et al., 2015), the overall distress is influenced by tinnitus loudness, but also the psychological make-up of the patient. Correlations across subjects should not be expected to be high (Kuk et al., 1990; Vanneste et al., 2011; Jun et al., 2015).

A moderate correlation was noted between PSQI with the total TPFQ, and the Concentration, Emotions and Sleep subscales; similar to the English version (Tyler et al., 2014). This finding suggests that sleep can also affect the emotion and concentration of tinnitus patients. The total TPFQ and four subscales all moderate correlated with BAI and BDI. This suggests that the Emotion subscale does focus on the emotion. It is reasonable that emotions can also affect the concentration, hearing and sleep of tinnitus patients. The emotional problem is probably the most important factor in tinnitus patients. The bilateral average PTA correlated with the Hearing subscale. It is often difficult to separate hearing difficulties caused by the hearing loss, and those caused by the tinnitus.

The Chinese version of TPFQ was well correlated with the Chinese translated THI. In the clinic, we found that sometimes THI can’t assess the tinnitus patients comprehensively. Patients do report impaired sleep, difficulty in concentrating, decreased social enjoyment, and interference with hearing (Bauer, 2018). Everyone can have different reactions to tinnitus, and is affected differently by tinnitus. The THI cannot distinguish these differences and cannot provide a guiding role in the treatment of tinnitus.

The scaling method of TPFQ is different from THI. THI uses “yes, sometimes, no”. In the TPFQ, patients answer a scale from 0 (strongly disagree) through 100(strongly agree). The wide range scores make it more likely to detect minor changes. The short 12-item version of the questionnaire also demonstrates good reliability and construct validity. The short version are more convenient for patients. It is a good choice for an outpatient in clinic.

Conclusion

The present study demonstrates that the 20 and 12-item versions of the Chinese TPFQ are reliable and valid measures of tinnitus. The four subscales can help comprehensively evaluating tinnitus patients.

The Chinese TPFQ can be used in the assessment and management of tinnitus among the Chinese speaking population.

Declarations

Conflict of interests

The authors declare that there is no conflict of interests.

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The interested readers can access the materials of the TPFQ (20-Item Version) and the Chinese TPFQ (20-Item and 12-Item Version) at the appendix.

Financial Disclosures/Conflicts of Interest:

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The authors declare that there is no conflict of interests.

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Tables

Table 1.Characteristics of subjects

	N	Mean	±SD
PTA bilateral average (dBHL)	111	22.80	13.57
loudness matching	105	10.69	8.52
pitch matching (Hz)	108	4755.06	2402.43
PSQI total score	116	7.63	4.60
BAI total score	115	32.48	10.35
BDI total score	115	7.17	7.32
TPFQ concentration factor score	116	25.64	28.09
TPFQ emotional factor score	116	45.34	27.27
TPFQ hearing factor score	116	26.96	28.81
TPFQ sleep factor score	115	29.05	30.98
TPFQ total score	115	31.87	24.59
THI total score	112	35.54	23.25
tinnitus loudness(0–10)	115	4.96	2.22

PTA: pure tone average (500, 1000, 2000, 4000Hz)

PSQI: Pittsburgh Sleep Quality Index

BAI: Beck Anxiety Inventory

BDI: Beck Depression Inventory

TPFQ: Pittsburgh Sleep Quality Index

THI: tinnitus handicap inventory

Table 2.Itemscore, item-total correlations for the TPFQ.

Item	Mean±SD	Item-total correlation
1	51.78±39.68	0.74**
2	28.36±36.07	0.55**
3	18.36±29.67	0.66**
4	24.76±33.41	0.48**
5	35.95±38.91	0.61**
6	40.91±41.13	0.68**
7	27.50±34.65	0.71**
8	32.46±36.06	0.70**
9	18.92±31.37	0.58**
10	39.01±38.34	0.71**
11	23.23±33.06	0.68**
12	78.72±35.03	0.53**
13	38.66±40.30	0.62**
14	24.05±35.43	0.65**
15	27.63±35.36	0.70**
16	30.69±37.24	0.74**
17	22.54±33.63	0.69**
18	15.04±29.80	0.61**
19	31.47±36.67	0.63**
20	23.66±34.06	0.58**

*P<0.05 **P<0.01

TPFQ: Pittsburgh Sleep Quality Index

Table 3.Results of factor analysis using principal components extraction. The communality is the sum of the squared correlations between a variable and each of the four factors.

	Item	Communality
1	My tinnitus is annoying.	0.58
2	My tinnitus masks some speech sounds.	0.78
3	When there are lots of things happening at once, my tinnitus interferes with my ability to attend to the most important thing.	0.73
4	My emotional peace is one of the worst effects of my tinnitus.	0.70
5	I have difficulty getting to sleep at night because of my tinnitus.	0.81
6	The effects of tinnitus on my hearing are worse than the effects of my hearing loss.	0.60
7	I feel like my tinnitus makes it difficult for me to concentrate on some tasks.	0.80
8	I am depressed because of my tinnitus.	0.82
9	My tinnitus, not my hearing loss, interferes with my appreciation of music and songs.	0.63
10	I am anxious because of my tinnitus.	0.71
11	I have difficulty focusing my attention on some important tasks because of tinnitus.	0.81
12	I just wish my tinnitus would go away. It is so frustrating.	0.37
13	The difficulty I have sleeping is one of the worst effect of my tinnitus.	0.83
14	In addition to my hearing loss, my tinnitus interferes with my understanding of speech.	0.79
15	My inability to think about something undisturbed is one of the worst effects of my tinnitus.	0.72
16	I am tired during the day because my tinnitus has disrupted my sleep.	0.72
17	One of the worst things about my tinnitus is its effect on my speech understanding, over and above any effect of my hearing loss.	0.78
18	I lie awake at night because of my tinnitus.	0.71
19	I have trouble concentrating while I am reading in a quiet room because of tinnitus.	0.51
20	When I wake up in the night, my tinnitus makes it difficult to get back to sleep.	0.76

Factor	Eigenvalue	% of Variance	Cumulative % of Variance
1	4.13	20.65	20.65
2	3.83	19.14	39.79
3	3.81	19.05	58.85

4	2.36	11.79	70.64

Table 4. Spearman correlation coefficients of TPFQ (total score and subscale scores)

		TPFQ total	Concentration	Emotion	Hearing	sleep
Loudness magnitude estimation	r	0.42**	0.34**	0.35**	.43**	.32**
	p	0.00	0.00	0.00	0.00	0.00
	n	114	115	115	115	114
THI	r	0.73**	0.70**	0.73**	0.56**	0.56**
	p	0.00	0.00	0.00	0.00	0.00
	n	111	112	112	112	111
PSQI total score	r	0.42**	0.32**	0.35**	0.18	0.56**
	p	0.00	0.00	0.00	0.05	0.00
	n	115	116	116	116	115
BAI total score	r	0.46**	0.49**	0.42**	0.36**	0.37**
	p	0.00	0.00	0.00	0.00	0.00
	n	114	115	115	115	114
BDI total score	r	0.42**	0.36**	0.41**	0.34**	0.37**
	p	0.00	0.00	0.00	0.00	0.00
	n	114	115	115	115	114
PTA bilateral average	r	0.12	0.03	0.11	0.21*	0.05
	p	0.21	0.75	0.25	0.03	0.58
	n	110	111	111	111	110
pitch matching	r	0.14	0.16	0.12	0.10	0.13
	p	0.16	0.11	0.23	0.29	0.19
	n	107	108	108	108	107
loudness matching	r	0.16	0.18	0.16	0.11	010
	p	0.12	0.06	0.11	0.29	0.33
	n	104	105	105	105	104

*P<0.05 **P<0.01

PTA: pure tone average

PSQI: Pittsburgh Sleep Quality Index

BAI: Beck Anxiety Inventory

BDI: Beck Depression Inventory

TPFQ: Pittsburgh Sleep Quality Index

THI: tinnitus handicap inventory

Table 5 Mean scores of the 12-item version TPFQ

	N	Mean	±SD
Concentration	116	26.12	31.479
Emotion	116	32.07	30.147
Hearing	116	24.99	31.408
Sleep	116	23.13	29.502
Total	116	26.58	25.553

TPFQ: Pittsburgh Sleep Quality Index

Table 6. Spearman correlation coefficients of 12-item version TPFQ (total score and subscale scores)

		Total	Concentration	Emotion	Hearing	sleep
Loudness magnitude estimation	r	0.38**	0.30**	0.25**	0.35**	0.35**
	p	0.00	0.00	0.01	0.00	0.00
	n	115	115	115	115	115
THI	r	0.76**	0.69**	0.70**	0.52**	0.61**
	p	0.00	0.00	0.00	0.00	0.00
	n	112	112	112	112	112
PSQI total score	r	0.40**	0.31**	0.36**	0.23*	0.50**
	p	0.00	0.00	0.00	0.01	0.00
	n	116	116	116	116	116
BAI total score	r	0.50**	0.51**	0.47**	0.34**	0.38**
	p	0.00	0.00	0.00	0.00	0.00
	n	115	115	115	115	115
BDI total score	r	0.45**	0.35**	0.42**	0.35**	0.42**
	p	0.00	0.00	0.00	0.00	0.00
	n	115	115	115	115	115
PTA bilateral average	r	0.12	0.06	0.03	0.24*	0.11
	p	0.23	0.52	0.75	0.01	0.23
	n	111	111	111	111	111

*P<0.05 **P<0.01

PTA: pure tone average

PSQI: Pittsburgh Sleep Quality Index

BAI: Beck Anxiety Inventory

BDI: Beck Depression Inventory

TPFQ: Pittsburgh Sleep Quality Index

THI: tinnitus handicap inventory

Supplementary Files

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