

## Research Article

# Psychometric Properties of the Persian Version of the Tinnitus Acceptance Questionnaire and Its Correlation with Psychoacoustic Parameters in Patients with Chronic Subjective Tinnitus

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**Citation:** Nayeri N, Farahani S, Fatahi F, Faghihzadeh E. Psychometric Properties of the Persian Version of the Tinnitus Acceptance Questionnaire and Its Correlation with Psychoacoustic Parameters in Patients with Chronic Subjective Tinnitus. *Aud Vestib Res.* 2025;34(2):?-?.

### Article info:

Received: 17 Mar 2024

Revised: 17 Jun 2024

Accepted: 30 Jun 2024

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**Short running title:** Psychometric Properties of the Persian...

### Highlights:

- The P-TAQ is a valid and reliable tool to measure acceptance of tinnitus
- The total P-TAQ score had a weak negative correlation with the PTA of both ears

### ABSTRACT

**Background and Aim:** Acceptance of tinnitus may influence the perceived intensity and the distress it causes. The Tinnitus Acceptance Questionnaire (TAQ) is a useful tool for assessing tinnitus acceptance. This study aimed to assess the validity and reliability of the Persian version of the TAQ (P-TAQ) and determine the correlation of its scores with psychoacoustic measures in patients with chronic tinnitus.

**Methods:** After translation and confirming face validity, 85 patients with chronic tinnitus completed the P-TAQ, along with the Persian versions of the Hospital Anxiety and Depression Scale (HADS) and Tinnitus Handicap Inventory (THI). To determine the reliability, the P-TAQ was completed by 30 patients after two weeks. Psychoacoustic parameters including pitch matching, loudness matching, and Minimum Masking Level (MML) were measured for all patients.

**Results:** The P-TAQ had high face validity. The internal consistency was confirmed using Cronbach's alpha ( $\alpha=0.92$ ). The interclass correlation coefficient (0.994) confirmed reliability. A strong negative correlation was found between the total P-TAQ score and total THI score ( $p<0.001$ ,  $r=-0.788$ ), and the scores of the HADS

subscales of anxiety ( $p < 0.001$ ,  $r = -0.623$ ) and depression ( $p < 0.001$ ,  $r = -0.728$ ). The total P-TAQ score showed a weak negative correlation with tinnitus loudness ( $p = 0.003$ ,  $r = -0.322$ ) and PTA of both ears ( $r = -0.223$ ,  $p = 0.040$ ). There was no significant correlation between the total P-TAQ score and the factors of age, tinnitus duration, tinnitus pitch, or MML.

**Conclusion:** The P-TAQ has excellent validity and reliability. Therefore, it can be used to assess tinnitus acceptance among Persian-speaking patients with chronic tinnitus.

**Keywords:** Acceptance; tinnitus; tinnitus annoyance; tinnitus acceptance questionnaire

## Introduction

Tinnitus refers to the perception of sound in the head or ears without the presence of an external source. Epidemiological studies have indicated that approximately 10–15% of all adults in various countries experience tinnitus [1, 2]. Although there are numerous theories about the pathophysiology of tinnitus, its mechanism of creation is still unclear. However, according to the proposed theories, subjective tinnitus occurs through peripheral and central auditory pathways [3, 4]. So far, numerous treatments for tinnitus have been investigated in various studies. Cognitive-Behavioral Therapy (CBT) is one of the approaches that has been shown to be effective in reducing the annoyance caused by tinnitus. A common strategy used in this method is the identification and modification of dysfunctional beliefs to increase the acceptance of tinnitus. Recent studies have indicated that the acceptance of tinnitus can be a significant factor in behavioral treatments and professional counseling for tinnitus [5, 6].

Acceptance is a conscious approach to accept inner emotions and thoughts or physical feelings [7]. Psychological variables such as acceptance can act as mediators between the perception of tinnitus and the resulting disability [8, 9]. According to Hesser et al., acceptance has a strong and inverse relationship with tinnitus severity and anxiety or depressive symptoms [10]. Also, in the study by Weise et al., specific acceptance of tinnitus was shown to be a mediator of the relationship between the subjective loudness of tinnitus and its annoyance [11]. Studies on the effectiveness of tinnitus treatment need to evaluate the impact of tinnitus on patients' lives. The evaluation of tinnitus can generally be divided into two approaches. The first approach focuses on measuring tinnitus as perceived sound with characteristics such as loudness and pitch. Psychoacoustic tests are evaluated for two purposes: defining the auditory characteristics of tinnitus and determining how external sounds affect these characteristics. For instance, loudness level and pitch matching are quantitative measures to monitor tinnitus worsening or improvement, which may have diagnostic values and help categorize the type of tinnitus. Minimum Masking Level (MML) can measure the effect of noise on the perception of tinnitus. Another measure is the residual inhibition which refers to the temporary suppression or decrease of tinnitus after prolonged acoustic stimulation [12, 13].

The second approach involves using questionnaires to evaluate how tinnitus affects a person's life [14]. Psychoacoustic assessments take more time and require specific acoustic equipment and protocols. Furthermore, studies have indicated that the psychoacoustic characteristics of tinnitus, including pitch and loudness, cannot explain the tinnitus annoyance and seem not to be related to the impact of tinnitus or reaction to tinnitus [15-17]. Self-assessment questionnaires can be valuable tools for clinical use which do not require the involvement of an experimenter. The use of questionnaires can complement psychoacoustic assessments by providing an important quantitative method to evaluate the differences between people regarding the effects of tinnitus on their daily lives, including sleep quality and annoyance [18, 19]. Numerous questionnaires have been developed to assess tinnitus but the Tinnitus Acceptance Questionnaire (TAQ) is different, since it evaluates the specific acceptance of tinnitus. Westin et al., based on the items of the Chronic Pain Acceptance Questionnaire (CPAQ) and the Acceptance and Action Questionnaire (AAQ) developed the TAQ and reported a Cronbach's alpha of 0.89 for the overall questionnaire. It has 12 items measuring two domains of activity engagement (9 items) and tinnitus suppression (3 items) [20]. Activity engagement has been shown to be a significant predictor of quality of life, tinnitus annoyance, and depression. The tinnitus suppression factor assesses the effort to control thoughts and feelings related to tinnitus, which is an indicator of experiential avoidance. These two factors are used because acceptance is indirectly measured based on the patient's effort to avoid or control tinnitus and their ability to pursue life activities despite having tinnitus. The TAQ has a total score ranged from 0 to 72, with higher scores indicating higher levels of acceptance. In the tinnitus suppression subscale, a lower score indicates a more suppression because the items have reversed scoring [11, 20].

The current study aimed to translate and culturally adapt this questionnaire into Persian culture and then assess its validity and reliability in patients with chronic tinnitus. Moreover, the correlation between the scores of TAQ and the psychoacoustic evaluations including tinnitus loudness matching, tinnitus pitch matching, and MML were determined.

## Methods

After obtaining permission from the developer of the main version, the TAQ was translated into Persian by two experienced translators based on the protocol of the international quality of life assessment [21]. Then, each translated version was carefully reviewed and finally an initial draft of the Persian version was prepared. This draft along with a form to assess the quality and clarity of the translation as well as the cultural adaptation was given to 10 audiologists. They were asked to evaluate the translation for each item using a 5-point Likert scale from 1 (completely disagree) to 5 (completely agree). According to their comments, the initial draft was revised. Then, it was back translated into English by two other translators. After reviewing them, the final English version was sent to the developer for comparison with the original version. After approval, the Persian version was prepared and given to 15 patients with subjective tinnitus. They were asked to give their opinion on the clarity and quality of the translation. Eventually, the final Persian version was prepared.

In this study, participants were 85 patients with non-pulsatile chronic subjective tinnitus aged 20–50 years referred to the Amir Alam Hospital in Tehran. After taking a history and confirming the entry criteria (having tinnitus for at least 6 months, having Persian language skills, and no history of neurological and psychological problems), they were asked to complete the Persian version of the TAQ (P-TAQ). Their initial evaluation outcomes including otoscopy, tympanometry, and pure tone audiometry (at a frequency of 250–8000 Hz) were also recorded. Before completing the questionnaire, informed consent was obtained from each person.

To measure tinnitus pitch matching using the two-alternative forced-choice (2AFC) method, two sounds were presented to the patient's ear contralaterally (compared to the ear with tinnitus or the ear with louder tinnitus) and the patient was asked to identify which sound was most similar to their tinnitus. To measure tinnitus loudness matching, the stimulus was presented to the patient's ear contralaterally (compared to the ear that has a tinnitus or the ear with louder tinnitus) at 10 dB HL lower than the individual's hearing threshold, which increased by 1 dB in each step to determine the hearing threshold. The intensity was increased in 1 dB steps until the loudness of the presented sound was equal to the loudness of tinnitus. To measure the MML, a narrow band noise stimulus at the frequency of the tinnitus spectrum (based on the tinnitus pitch) was presented to the patient's ear ipsilaterally, started from levels below the hearing threshold and increased in 1 dB steps until the patient could not hear their tinnitus in the stimulated ear [22].

In this study, we employed the Persian version of the THI [23] and the Hospital Anxiety and Depression Scale (HADS) [24] to determine the criterion validity of the P-TAQ. To assess its reliability, 30 patients with chronic tinnitus who participated in the first stage, were randomly selected to complete it again two weeks later. Moreover, the correlation between the total score of the P-TAQ and psychoacoustic parameters was investigated. Cronbach's alpha coefficient was used to determine internal consistency and the Intraclass Correlation Coefficient (ICC) was used to determine the test-retest reliability. Additionally, Spearman's test was utilized to investigate the correlation between the total P-TAQ score and the quantitative variables. All statistical analysis was performed in SPSS v.16.

## Results

The demographic characteristics and findings of this study are shown in Table 1. The mean age of the participants was  $43.42 \pm 7.49$  years, and the average duration of tinnitus in participants was  $3.58 \pm 5.22$  years. In addition, the mean Pure Tone Average (PTA) at a frequency over 500–4000 Hz was  $27.84 \pm 16.73$  in the left ear and  $29.34 \pm 19.24$  in the right ear.

Based on the opinions of 10 audiologists, the P-TAQ had acceptable face validity. The content validity ratio was in a range of 0.8–1, which is a high value. The content validity index value for the questionnaire was 0.95. Cronbach's alpha coefficient was 0.921 for the overall scale, indicating an excellent internal consistency. Cronbach's alpha coefficient for the subscales of activity engagement and tinnitus suppression were 0.917 and 0.808, respectively. The ICC values for the overall scale and subscales of activity engagement and tinnitus suppression were obtained as 0.994, 0.975 and 0.949, respectively, indicating excellent test-retest reliability.

Based on Spearman's correlation test results, there was a positive and significant correlation between the scores of the two P-TAQ subscales ( $r=0.779$ ,  $p<0.001$ ). However, the correlation was not very strong. In addition, there was a significant positive correlation between the P-TAQ total score and the scores of activity engagement ( $r=0.961$ ,  $p<0.001$ ) and tinnitus suppression ( $r=0.910$ ,  $p<0.001$ ). Tables 2 and 3 present descriptive values for the items, total score, and subscale scores of the P-TAQ in patients.

Spearman's correlation test results showed a strong and significant correlation between the total score of the P-TAQ with the total score of THI ( $r=-0.788$ ,  $p<0.001$ ) and the scores of anxiety ( $r=-0.623$ ,  $p<0.001$ ) and depression ( $r=-0.728$ ,  $p<0.001$ ) subscales in the HADS.

Spearman's correlation test results showed no significant correlation between the total score of the P-TAQ and the factors of age ( $r=0.061$ ,  $p=0.582$ ) and duration of tinnitus ( $r=0.091$ ,  $p=0.406$ ), but there was a weak significant negative correlation between the P-TAQ total score and the mean PTA of both ears ( $r=-0.223$ ,  $p=0.040$ ). The total P-TAQ score had a negative and significant correlation with the subjective tinnitus loudness ( $r=-0.322$ ,  $p=0.003$ ), but it had no significant correlation with the tinnitus pitch ( $r=0.045$ ,  $p=0.680$ ) and MML ( $r=0.117$ ,  $p=0.288$ ).

## Discussion

The Persian version of the TAQ had good face validity in terms of the quality and clarity of the translation and the cultural adaptation. In this study, the mean total score of the P-TAQ was  $53.5\pm 13$ , which is higher compared to previous studies [12, 25, 26]. The high internal consistency of the P-TAQ was confirmed with high Cronbach's alpha values for both overall scale and the subscales of activity engagement and tinnitus suppression. In Westin et al.'s study, Cronbach's alpha values for the overall scale and subscales of TAQ were 0.89, 0.91, and 0.7, respectively [20]. In the study by Weise et al., Cronbach's alpha values were 0.86 for the overall scale and 0.91 and 0.68 for the subscales of activity engagement and tinnitus suppression, respectively [11]. In the study by Takabatake et al., the Cronbach's alpha coefficient was 0.88 for the overall scale [27]. In all these studies, high internal consistency was reported which is consistent with our findings. According to our findings, the ICC values for the overall scale and subscales of the P-TAQ were high. Therefore, the P-TAQ has a high test-retest reliability.

Moreover, our findings showed a significant positive correlation between the scores of activity engagement and tinnitus suppression in the P-TAQ. However, this correlation was not very strong; therefore, it can be argued that while the two subscales are distinguishable, they are still related. A strong and significant correlation was observed between the total score of the P-TAQ and the total score of the THI and the scores of HADS subscales, indicating that this questionnaire has good criterion validity. Depression may affect the correlation between tinnitus sound and annoyance. Also, the relationship between the tinnitus loudness and annoyance may be mediated by anxiety [28]. In the study by Weise et al., it was shown that the activity engagement subscale of the TAQ and the anxiety subscale of the HADS partially mediated the relationship between the perceived tinnitus loudness and annoyance [11]. On the other hand, studies have demonstrated that acceptance is closely related to experiential avoidance, which can exacerbate anxiety and annoyance caused by tinnitus [25, 29]. In the present study, in line with recent studies, it was shown that acceptance has a strong and inverse correlation with anxiety and depression symptoms. Increased levels of anxiety can lead to increased tinnitus annoyance, which may lead to lower acceptance of tinnitus in patients.

According to our study, the mean PTA of both ears and the total score of the P-TAQ had a weak but significant correlation with each other. Hearing impairment is often associated with tinnitus; however, the relationship between hearing impairment and the severity and annoyance of tinnitus is still unclear. According to recent studies, the lateralization of tinnitus, hyperacusis, and hearing damage are among the factors that may increase the severity and annoyance of tinnitus [26, 30-32]. These conditions may lead to higher loudness and more annoying tinnitus, which in turn reduces the tinnitus acceptance. Our findings also showed that the duration of tinnitus did not have any significant correlation with the total score of the P-TAQ, which is consistent with Westin et al.'s study [20].

There was a weak correlation between the subjective loudness of tinnitus and the total score of the P-TAQ. In recent studies, the tinnitus loudness has been shown to be significantly related to the severity of tinnitus, and there is a negative correlation between acceptance of tinnitus and its severity. Moreover, it has been shown that acceptance of tinnitus can act as a mediator between the subjective loudness of tinnitus and its annoyance [16, 17]. However, the relationship between the tinnitus loudness and annoyance remains unclear. According to the

present study, the tinnitus annoyance and low acceptance in patients may be related to the tinnitus loudness, but from a clinical perspective, the tinnitus acceptance cannot be adequately explained by psychoacoustic parameters such as tinnitus loudness. In our study, the MML and tinnitus pitch had no significant relationship with the P-TAQ score.

## Conclusion

The P-TAQ has acceptable validity and reliability; therefore, it can be used in clinical settings and research for assessing tinnitus acceptance in Persian-speaking patients with chronic tinnitus.

## Ethical Considerations

### Compliance with ethical guidelines

The study was confirmed by Ethical Committee of Tehran University of Medical Sciences (Code No. IR.TUMS.AMIRALAM.REC.1402.027).

### Funding

This research did not receive any grant from funding agencies in the public, commercial or non-profit sectors.

### Authors' contributions

NN: Study design, data collection, interpretation of the results; SF: Supervisor, study design, interpretation of the results; FF: Supervisor, study design, interpretation of the results; EF: Statistical analysis.

### Conflict of interest

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

### Acknowledgments

This study is extracted from the MSc. Thesis at the Department of Audiology, the Tehran University of Medical Sciences, Tehran, Iran. The authors would like to sincerely thank all those who participated in this study.

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Table 1. Demographic data of patients

Characteristics	Mean(SD)	N(%)
Age in years, mean(SD)	43.42(7.49)	
<b>Gender</b>		
Male		30(35.3)
Female		55(64.7)
<b>Tinnitus laterality</b>		
Right ear		27(31.8)
Left ear		30(35.3)
Both ears		28(32.9)
<b>Tinnitus quality</b>		
Narrow-band noise		60(70.6)
Tonal		25(29.4)
<b>Hearing impairment</b>		
None		33(38.8)
Hearing loss		52(61.2)
Subjective tinnitus loudness, mean(SD)	3.02(1.47)	
Pitch of tinnitus, mean(SD)	3191.17(1826.82)	
Minimum masking level, mean(SD)	12.91(8.99)	

Table 2. Range, mean, standard deviation, and median scores of the Persian version of the tinnitus acceptance questionnaire items in patients with chronic tinnitus

Item	Range	Mean(SD)	Median
Q1	0–6	5.62(0.88)	6.00
Q2	0–6	5.22(1.36)	6.00
Q3	0–6	5.29(1.01)	6.00
Q4	0–6	2.98(1.95)	3.00
Q5	0–6	5.52(0.83)	6.00
Q6	0–6	5.56(0.85)	6.00
Q7	0–6	2.42(1.86)	3.00
Q8	0–6	4.78(1.44)	5.00
Q9	0–6	4.85(1.48)	5.00
Q10	0–6	4.71(1.53)	5.00
Q11	0–6	3.85(1.93)	4.00
Q12	0–6	2.67(1.93)	3.00

Q; question

Items 2, 4, 7, 8, 9, 10, 11 and 12 are reversed items

Table 3. Range, mean, standard deviation, and median of the Persian version of the tinnitus acceptance questionnaire total score and its subscale scores in patients with chronic tinnitus

<b>Subscale</b>	<b>Range</b>	<b>Mean(SD)</b>	<b>Median</b>
<b>Activity engagement</b>	0–54	44.20(9.10)	47.00
<b>Tinnitus suppression</b>	0–18	9.20(4.90)	9.00
<b>Total</b>	0–72	53.50(13.00)	56.00

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