VALIDITY AND RELIABILITY OF TINNITUS HEARING SURVEY (THS) QUESTIONNAIRE IN MALAY VERSION

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VALIDITY AND RELIABILITY OF TINNITUS HEARING SURVEY (THS) QUESTIONNAIRE IN MALAY VERSION

by

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Thesis submitted in fulfillment of the requirements
for the degree of Bachelor of Health Sciences
(Honours) Audiology

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CERTIFICATION

This is to certify that the dissertation entitled "Validity and Reliability of Tinnitus Hearing Survey (THS) Questionnaire in Malay Version" is the project work done by AINA FATIHAH BINTI AHMAD from October 2024 until July 2025 .We have thoroughly reviewed this dissertation, and we believe it meets the accepted criteria of academic presentation and is totally appropriate, in scope and quality, as the dissertation to be submitted in partial fulfillment for the degree of Bachelor of Health Sciences (Honours) (Audiology).

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DECLARATION

I, with this, affirm that the work was completed by myself, that all of the results are the result of my research, and that any ideas or quotations from others' work are properly acknowledged in accordance with the discipline's normal referencing norms. I further certify that it has not been submitted as a whole previously or concurrently for any other degrees at any school. I allow Universiti Sains Malaysia permission to use the dissertation for teaching, research, and promotional purposes.

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LIST OF ABBREVIATIONS

THS	Tinnitus Hearing Survey
THS-T	Tinnitus Hearing Survey (Tinnitus)
THS-H	Tinnitus Hearing Survey (Hearing)
THS-ST	Tinnitus Hearing Survey (Sound Tolerance)
TMJ	temporomandibular joint
OHCs	Outer hair cell
IHCs	inner hair cells
SFRs	spontaneous firing rates
DCN	dorsal cochlear nucleus
SOAEs	spontaneous otoacoustic emissions
OAEs	Otoacoustic emissions
NMDA	N Methyl Dextro Aspartic Acid
CBT	Cognitive Behavioural Therapy
TRT	Tinnitus Retraining Therapy
THI	Tinnitus Handicap Inventory
TFI	Tinnitus Functional Index
TRQ	Tinnitus Reaction Questionnaire
THQ	Tinnitus Handicap Questionnaire (THQ)
TQ	Tinnitus Questionnaire
BEST	Borang Evaluasi Soal selidik Tinnitus
FM	frequency modulation

BCHA	bone-conduction hearing aids
BAHA	bone-anchored hearing aids
CROS	contralateral routing of signal
BiCROS	bilateral contralateral routing of signal
PROMs	patient-reported outcome measures
HHIE/HHIA	Hearing Handicap Inventory for the Elderly/Adults
HHQ	Hearing Handicap Questionnaire
HPI	Hearing Performance Inventory
PTM	progressive tinnitus management
CVR	Content Validity Ratio
CVI	Content Validity Index
R-CVI	Relevance Content Validity Index
I-CVI	Item-level Content Validity Index
USM	Universiti Sains Malaysia
HPUSM	Hospital Pakar Universiti Sains Malaysia
BM DASS-21	Malay version of the Depression Anxiety Stress Scales
ICC	Intraclass Correlation Coefficient
JEPeM	Jawatankuasa Etika Penyelidikan (Manusia) of USM
NRS	Numeratic Rating Scale

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KESAHAN DAN KEBOLEHPERCAYAAN SOAL SELIDIK TINJAUAN PENDENGARAN TINNITUS DALAM VERSI BAHASA MELAYU

ABSTRAK

Kajian ini bertujuan untuk menganalisis kesahan dan kebolehpercayaan Soal Selidik Tinjauan Pendengaran Tinnitus *(THS)* dalam Versi Bahasa Melayu dalam kalangan individu dewasa yang mengalami tinnitus. Seramai 42 individu dengan tinnitus telah direkrut dari Klinik Audiologi di Pusat Pengajian Sains Kesihatan, Universiti Sains Malaysia (USM), Hospital Pakar Universiti Sains Malaysia (HPUSM), dan Pusat Pengajian Sains Kesihatan, USM dari Januari 2025 hingga Jun 2025. Purata umur peserta adalah 31.41 tahun, dengan julat umur antara 17 hingga 65 tahun. Soal selidik ini mengandungi 10 item dan terdiri daripada tiga subskala yang berbeza iaitu Tinnitus (THS-T), Pendengaran (THS-H), dan Toleransi Bunyi (THS-ST). Setiap soalan dinilai menggunakan skala Likert 5 mata, bermula daripada "tidak, bukan satu masalah" hingga "ya, masalah yang sangat besar". Kebolehpercayaan dalaman dinilai menggunakan pekali alpha Cronbach, manakala kebolehpercayaan luaran ditentukan melalui analisis *Intraclass Correlation Coefficient* (ICC) dan ujian *Wilcoxon Signed-Rank*. Sementara itu, kesahan konvergen dinilai menggunakan analisis korelasi Spearman bagi meneliti hubungan antara bahagian THS-T dan soal selidik Borang Evaluasi Soal Selidik Tinnitus (BEST). Kesahan diskriminan juga dinilai melalui analisis korelasi Spearman dengan mengukur hubungan antara bahagian THS-T dan THS-H dalam soal selidik THS. Kedua-dua bahagian THS-T dan THS-H menunjukkan kebolehpercayaan dalaman yang baik, dengan nilai alpha Cronbach masing-masing sebanyak 0.921 dan 0.916. Kebolehpercayaan luaran untuk bahagian THS-T menunjukkan tahap persetujuan yang sederhana hingga baik, dengan nilai ICC antara 0.549 hingga 0.619. Sebaliknya, bahagian THS-H menunjukkan tahap persetujuan yang baik, dengan nilai ICC antara 0.664 hingga 0.791. Ujian *Wilcoxon Signed-Rank* juga menunjukkan tiada perbezaan yang signifikan ($p > 0.05$) dalam kebolehpercayaan uji semula bagi bahagian THS-T dan THS-H, yang menunjukkan respons yang konsisten antara sesi pertama dan kedua. Sementara itu, kesahan konvergen bahagian THS-T menunjukkan hubungan yang sangat tinggi ($\rho = 0.728$) dengan soal selidik BEST. Kesahan diskriminan pula menunjukkan korelasi sederhana ($\rho = 0.675$) antara bahagian THS-T dan THS-H. Kesimpulannya, penyesuaian soal selidik THS ke dalam Bahasa Melayu menunjukkan kebolehpercayaan dan kesahan yang memberangsangkan sebagai alat penilaian keterukan tinnitus

dalam kalangan populasi berbahasa Melayu. Dapatan kajian ini menyokong sifat psikometrik soal selidik yang kukuh, sekali gus mengesahkan kegunaannya dalam konteks klinikal dan penyelidikan untuk memahami dan mengurus tinnitus dalam kalangan masyarakat di Malaysia.

VALIDITY AND RELIABILITY OF TINNITUS HEARING SURVEY (THS) QUESTIONNAIRE IN MALAY VERSION

ABSTRACT

The study aimed to analyze the validity and reliability of the Tinnitus Hearing Survey (THS) questionnaire in Malay version among adult individuals with tinnitus. A total of 42 individuals with tinnitus from the Audiology Clinic in the School of Health Sciences, Universiti Sains Malaysia (USM), Hospital Pakar Universiti Sains Malaysia (HPUSM), and School of Health Sciences, USM were recruited from January 2025 until June 2025. The participants' mean age was 31.41 years, aged 17 to 65 years old. The questionnaire consisted of 10 items and comprised three distinct subscales which were Tinnitus (THS-T), Hearing (THS-H), and Sound Tolerance (THS-ST). Each question was rated on a 5-point Likert scale, ranging from " no, not a problem" to "yes, very big problem". Internal reliability was assessed using Cronbach's alpha, while external reliability (test-retest reliability) was determined through Intraclass Correlation Coefficient (ICC) analysis and Wilcoxon Signed-Rank test. Meanwhile, convergent validity was evaluated using Spearman correlation analysis to examine the association between the THS-T section and the Borang Evaluasi Soal Selidik (BEST) questionnaire. Discriminant validity was also assessed through Spearman correlation analysis by measuring the relationship between the THS-T and THS-H sections of the THS questionnaire. Both the THS-T and THS-H sections demonstrated good internal reliability, with Cronbach's alpha values of 0.921 and 0.916, respectively. The external reliability for the THS-T section showed a fair to good level of agreement, with ICC values ranging from 0.549 to 0.619. In comparison, the THS-H section demonstrated a good level of agreement, with ICC values ranging from 0.664 to 0.791. The Wilcoxon Signed-Rank test also showed no significant difference ($p > 0.05$) in the test-retest reliability for THS-T and THS-H sections, showing reliable responses for first and second sessions. Meanwhile, the convergent validity of THS-T section showed very high relationship ($\rho = 0.728$) with BEST questionnaire. The discriminant validity showed moderate correlation ($\rho = 0.675$) between THS-T and THS-H sections. In conclusion, the adaptation of the THS into Malay demonstrated promising reliability and validity as an assessment tool for tinnitus severity among Malay-speaking populations. The study's findings supported the questionnaire's robust psychometric properties, affirming its utility in clinical and research settings aimed at understanding and managing tinnitus in the Malaysian context.

CHAPTER 1

INTRODUCTION

1.1 Background of Study

The word "tinnitus," which means "to ring", comes from the Latin verb "tinnire." It refers to the conscious experience of an auditory sense when there is no accompanying outward stimulation (Neurol, 2009). Tinnitus is not a disease itself, but rather a symptom of several underlying conditions. Based on data collected by Jarach et al. (2022), tinnitus affects around 14% of the world's population, with more than 2% suffering from severe forms. Tinnitus affects both sexes equally, and its prevalence rises with age (Jarach et al., 2022).

Tinnitus distress, annoyance, and severity are critical outcomes, as they are common factors among individuals with tinnitus and significantly affect their general quality of life (National Guideline Centre (UK), 2020). Tinnitus annoyance is linked to a wide range of psychological, cognitive, demographic, and health-related variables. According to a meta-analysis, higher levels of anxiety and depression are connected with increased tinnitus discomfort (Trevis et al., 2018). Tinnitus discomfort is linked to cognitive challenges, as it disrupts "executive attention," the ability to concentrate on specific tasks (Clarke et al., 2020). Meanwhile, demographic factors like age and sex, along with hearing-related issues such as hearing loss and health conditions like vertigo and temporomandibular joint (TMJ) disorders, have been found to be associated with tinnitus annoyance (Hoekstra et al., 2014).

Tinnitus severity can be assessed objectively through a pure tone audiogram, which measures hearing thresholds, while subjectively, it can be evaluated using a questionnaire that captures the individual's personal experience and perception of the tinnitus. However, tinnitus is challenging to measure objectively because it is primarily a subjective phenomenon. Objective measures, such as pitch or loudness, only weakly correlate with the impact of tinnitus on various aspects of life (Henry & Meikle, 2000). Additionally, the severity and impact of tinnitus often vary from person to person. For this reason, self-reported measures are widely used in clinical practice to evaluate the severity of tinnitus. These assessments often rely on well-established questionnaires, such as the Tinnitus Questionnaire (TQ), Tinnitus Handicap Inventory (THI), Tinnitus Reaction Questionnaire (TRQ), and Tinnitus Handicap Questionnaire (THQ).

To be effectively applied in clinical settings, these questionnaires must exhibit strong validity and reliability. Validity refers to their ability to accurately measure what they are designed to assess, while reliability ensures they consistently produce dependable results, including strong internal consistency across their items. A well-designed questionnaire minimizes the burden on patients and clinicians, facilitates accurate symptom evaluation, management planning and supports better diagnosis.

Moreover, individuals who complained of tinnitus often attribute their hearing difficulties to the tinnitus itself (Dobie & Robert, 2004). In such cases, a portion or even all of their reported "tinnitus distress" may actually stem from communication challenges caused by hearing loss. Therefore, it is crucial to distinguish between tinnitus-related issues, hearing difficulties, or a combination of both, as the intervention strategies for these conditions vary. A precise assessment such as questionnaire helps clinicians decide whether to focus on managing tinnitus, treating hearing loss, or both**.** This is because some tinnitus treatments fail to address hearing issues, which may be the primary cause of a patient's discomfort.

Aside from that, hyperacusis might be associated with tinnitus. Tinnitus and hyperacusis appear to be completely distinct, yet in clinical terms, they are inseparable. Nearly half of tinnitus sufferers have some degree of hyperacusis, while the majority of hyperacusis sufferers have tinnitus (Anari et al., 1999). Individuals with hyperacusis are unable to tolerate ordinary loud noises and may even report painful responses to them.

Thus, the Tinnitus and Hearing Survey (THS) is a specialized questionnaire designed to assess the impact of hearing loss, tinnitus, and sound intolerance in a rapid manner. Its primary purpose is to assist clinicians in tailoring proper interventions based on the patient's primary concern whether it is hearing loss, tinnitus, or a combination of both. The questionnaire comprises three distinct subscales such as Hearing (THS-H), Tinnitus (THS-T), and Sound Tolerance (THS-ST) and this questionnaire provides a comprehensive evaluation of the patient's condition (Davidson et al., 2023). This approach helps determine whether a patient would benefit more from management focusing on tinnitus-related discomfort, hearing loss rehabilitation, or a combination of both treatments.

1.2 Problem Statement

Tinnitus is frequently associated with comorbidities, particularly in the auditory domain, the most prevalent of which are hearing loss (affecting 80% of older persons) and hyperacusis (occurring in 7%-70% of cases) (D. M. Baguley & Hoare, 2018; Gibrin et al., 2013). According to Sanchez et al. (2005), 85-96% of individuals with tinnitus had some degree of hearing loss. The combined challenges of tinnitus and hearing loss can have a substantial impact on a patient's daily life. One study even found that as hearing loss worsens, the impact of tinnitus tends to intensify, suggesting a strong link between the severity of hearing impairment and the distress caused by tinnitus (Mazurek et al., 2010).

A significant challenge in providing effective management for the patients with tinnitus lies in the overlap between tinnitus and hearing difficulties. These conditions are often closely interconnected, making it hard to pinpoint the primary source of a patient's discomfort. The most challenging aspect of addressing patient complaints is determining how much of their distress is directly caused by tinnitus versus an underlying, unrecognized hearing issue. For example, when patients visit an audiology clinic with complaints of both tinnitus and hearing difficulties, it can be difficult to assess which condition has a greater impact on their quality of life. Thus, it is worth noting that there is still no standardized approach to determine whether patients with tinnitus should receive management for hearing loss, tinnitus, or a combination of both. To address this complexity, the THS questionnaire is specifically designed to help identify the patient's primary complaint and guide the selection of the most appropriate management.

It has been reported that the THS questionnaire demonstrated good psychometric properties in terms of validity and reliability in Polish version (Raj-Koziak et al., 2018). Moreover, THS questionnaire was culturally adapted in Brazilian Portuguese since it demonstrated strong validity and reliability (Scheffer & Mondelli, 2021). However, the psychometric properties of the THS questionnaire in Malay version, including its validity and reliability, have not yet been established. Besides that, this research is a continuation of a previous study to assess the validity and reliability of THS questionnaire in Malay version. THS questionnaire is adapted and translated from an existing questionnaire, the content validity for the questionnaire has been done by the previous study however, other assessments still need to be conducted to ensure that THS questionnaire in Malay version is valid and reliable. These assessments are critical to ensure that the questionnaire

consistently and properly assesses what it is designed to measure. The primary goal of this research is to assess the construct validity, as well as the internal and external reliability, for the Malay version of the THS questionnaire, ensuring its quality and effectiveness as an assessment tool for clinical application.

1.3 Research Objectives

1.3.1 General Objective

To determine the validity and reliability of Tinnitus Hearing Survey (THS) in Malay version among adult individuals with tinnitus.

1.3.2 Specific Objectives

a) To assess the internal reliability of the Malay version of the THS among individuals with tinnitus.
b) To determine the external reliability of the Malay version of the THS among individuals with tinnitus.
c) To evaluate the construct validity of the Malay version of the THS among individuals with tinnitus.

1.4 Research Questions

a) Does THS questionnaire in Malay version has good psychometric properties?
b) What is the internal and external reliability of the THS questionnaire in Malay version?
c) What is the construct validity of the THS questionnaire in Malay version?

CHAPTER 2

LITERATURE REVIEW

2.1 Nature of Tinnitus

Tinnitus sufferers often describe hearing a range of intrusive sounds such as buzzing, hissing, clicking, or whistling, and the condition may be intermittent or continuous. Many report tinnitus sounds resembling the buzzing of cicadas, the chirping of crickets, the rushing of wind, dripping water, grinding metal, escaping steam, humming fluorescent lights, or running engines (Han et al., 2009). These perceptions are thought to stem from abnormal neural activity at the subcortical level of the auditory pathway (Dobie & Robert, 2004; Jastreboff & Hazell, 2004). While some patients may feel the sounds originate externally, tinnitus can be localized in one or both ears or be perceived centrally within the head (D. Baguley et al., 2013).

Moreover, the perception of tinnitus is believed to be tied to patterns stored in the auditory memory. These patterns are processed through the limbic system, where they become associated with emotional responses (Jastreboff & azell, 1993). Hence, the perceived sound is often unrelated to the type or degree of any accompanying hearing impairment. Most sufferers report their tinnitus as having a pitch above 3 kHz (Tyler Richard S, 2006). However, majority of patients who experience both tinnitus and hearing loss noting that the frequency of the tinnitus aligns with the frequency and severity of their hearing loss. Notably, these patients often describe that the intensity of the tinnitus is typically less than 10 decibels above the patient's hearing threshold at the corresponding frequency (Dobie & Robert, 2004).

2.1.1 Category of Tinnitus

Tinnitus is classified into two groups, objective and subjective (Neurol, 2009). Firstly, objective tinnitus is the production of sound near the ear that can be heard by the examiner using the stethoscope (Han et al., 2009). Objective tinnitus typically results from turbulent blood flow or involuntary muscle contractions in the soft palate or middle ear, creating audible sounds that both the patient and the clinician can detect. Secondly, subjective tinnitus is the perception of sound in the absence of an acoustic stimulus and can only be heard by the patient (Han et al., 2009). It is more prevalent and can be associated with practically any ear disease. Tinnitus is commonly used by physicians to refer to subjective tinnitus, while somatosound refers to objective

tinnitus (Dobie & Robert, 2004).

In addition, tinnitus can be classified as either pulsatile or nonpulsatile. Noise exposure and age-related hearing loss are frequently associated with nonpulsatile tinnitus (Levine & Oron, 2015). Unilateral non-pulsatile tinnitus can be caused by neurological conditions such as multiple sclerosis, cerebellopontine-angle tumours, and brainstem infarction (Crummer & Hassan, 2004). In contrast, depending on the origin and degree, pulsatile tinnitus can be synchronous or asynchronous (Chari & Limb, 2018). One of the main causes of synchronous pulsatile tinnitus is intracranial hypertension (Wall, 2010). Asynchronous pulsatile tinnitus can be caused mechanically by middle-ear myoclonus, eustachian tube contraction, or palate muscular spasm (Park et al., 2013). Besides that, tinnitus can also be characterised as acute or chronic based on length of symptoms. Acute tinnitus is temporary and lasts up to 3 months, but chronic tinnitus lasts longer than 3 months (Wallhäusser-Franke et al., 2017).

2.2 : Mechanism of Tinnitus

2.2.1 : Discordant Damage of Hair Cells

The discordant theory proposes that tinnitus is caused by a mismatch between the functioning of injured outer hair cells (OHCs) and undamaged inner hair cells (IHCs) in the cochlea (Han et al., 2009). The IHCs are the major receptors for sound transduction, meanwhile OHCs play an important role in sound perception by actively vibrating their cell bodies via a mechanism known as electromotility, which effectively increases sound sensitivity before it reaches the inner ear. When exposed to loud noises or ototoxic chemicals, the OHCs in the cochlea's basal turn are first damaged, reducing their capacity to amplify sound. IHCs, which are more resistant to such damage, stay functioning for a while, but chronic exposure eventually harms them as well (Jastreboff & azell, 1993). This imbalance between the two types of hair cells causes a "discord" in the auditory system, which may result in the sense of phantom sounds, or tinnitus (Chung & Lee, 2016).

2.2.2 : Increased In Neural Synchrony

The general mechanism begins when the central auditory system receives less neuronal information due to noise-induced hearing loss. Consequently, even in the absence of a physical auditory stimulation, the central auditory system experiences an increase in spontaneous firing rate