PROFILING THE IMPACT OF TINNITUS THROUGH THE ICF CLASSIFICATION

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CERTIFICATE

This is to certify that this dissertation entitled **"Profiling the Impact of Tinnitus through the ICF Classification"** is a bonafide work submitted in part of fulfilment for the degree of Master of Science (Audiology) of the student with Registration Number P01II21S0050. This has been carried out under the guidance of the faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysuru,

September, 2023

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CERTIFICATE

This is to certify that this dissertation entitled **"Profiling the Impact of Tinnitus through the ICF Classification"** is the bonafide work submitted asa part of fulfilment for the degree of Master of Science (Audiology) of the student Registration Number: P01IIS0050. This has been carried out under my supervision and guidance. It has also been certified that this dissertation has not been submitted earlier to any other university for the award of any other Diploma or Degree.

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DECLARATION

This is to certify that this Master's dissertation entitled **"Profiling the Impact of Tinnitus through the ICF Classification"** is the result of my own study under the guidance of Dr. Prashanth Prabhu P (Guide), Assistant Professor in Audiology, Department of Audiology, All India Institute of Speech and Hearing, Mysuru, and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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ABSTRACT

The pathophysiology of tinnitus is complex and multifactorial, involving both auditory and non-auditory systems. People with bothersome tinnitus can report various associated problems, highlighting the diverse nature of the condition. By systematically profiling the auditory and non-auditory manifestations of tinnitus, clinicians and researchers can gain a more comprehensive understanding of the condition and develop effective strategies for evaluation and management. This study aimed to profile the overall impact of tinnitus and correlate it with conventional auditory measures using the International Classification of Functioning, Disability, and Health (ICF) framework. The study highlights the use of open-ended questions in gathering helpful information about the impact of tinnitus and the importance of considering a comprehensive approach for the assessment and management of tinnitus. The study sample included 117 individuals diagnosed with tinnitus. A Problem Question (PQ) and a Life Effects Question (LEQ) were used to gather participant data. The study had 433 responses related to the Problem Questionnaire (PQ) and 158 responses to the Life Effects Questionnaire (LEQ). The study's findings revealed that the most affected domains differed between the PQ and LEQ. In the PQ, the most affected domain was activity limitation, indicating difficulties executing specific activities.On the other hand, in the LEQ, the most affected domain was body function, which refers to the physiological and psychological functions of the body. There was a significant difference in the total number of responses between PQ and LEQ. No significant correlations were found between the International Classification of Functioning, Disability and Health (ICF)-based responses and audiological measures such as Pure Tone Audiometry (PTA) and Speech Identification Scores (SIS). However, a strong correlation was observed between the Problem Questionnaire (PQ), Life Effects Questionnaire (LEQ), and Tinnitus Handicap Inventory (THI) scores. These findings highlight the need to profile the heterogeneity of tinnitus using internationally established tools like the ICF.

Keywords: Tinnitus, International Classification of Functioning, Disability and Health (ICF), Open-ended Questions, Problem Question (PQ), Life effect Question (LEQ), Activity Limitation and Participation restriction, Body function

CHAPTER 1

INTRODUCTION

Tinnitus is derived from the Latin verb tinnire (which means to ring). Tinnitus is the term used to describe the conscious perception of sound within one's ear, even when no external stimulation is present (Atik, 2014). The sensation of tinnitus can either be subjective, which means it is only perceived by the person experiencing it, or less frequently objective, where an outside observer can also hear the sound (Han et al., 2009). The condition is often accompanied by physiological and psychological complications, including depression, anxiety, and insomnia (Langguth, 2011).Most people with tinnitus do not have severe tinnitus; however, tinnitus affects daily life for a portion of the population (estimated at 2–10% of the general population) (Oosterloo et al., 2021).

Regarding perception, tinnitus has been described as buzzing, roaring, ringing, hissing, and sizzling, which may persist continuously or be intermittent (Baguley et al., 2013). Tinnitus is classified as subjective and objective tinnitus (Møller, 2003). An internal sound only heard by the patient is referred to as subjective tinnitus, whereas the term "objective tinnitus" refers to tinnitus that is audible to both the patient and the examiner (Lan et al., 2002).

Tinnitus is closely related to hearing loss in most cases but can also occur without hearing loss (Savastano, 2008). Several otological diseases can cause tinnitus, including ototoxicity, noise-induced hearing loss (NIHL), Meniere's disease, and presbycusis. The two most common types of hearing loss associated with tinnitus are

NIHL and presbycusis. Tinnitus can also develop due to emotional factors and stress (Hinton et al., 2006). The generation of tinnitus can often involve multiple factors, meaning that a combination of changes in the way sound and physical sensations are perceived, along with abnormal activity in certain parts of the brain due to factors such as physical damage, lack of blood flow, or emotional factors, may contribute to the development of tinnitus. This may be particularly true for tinnitus following a head injury (Kreuzer et al., 2012). Additionally, the factors that contribute to the development of tinnitus may not be the same as those that are responsible for its long-term existence, as evidenced by the fact that while many individuals experience temporary tinnitus following exposure to loud noises, only a small percentage of them develop persistent tinnitus (Ortmann et al., 2011).

It is unclear mainly that 80% of those with persistent tinnitus seek little to no treatment, seeking effects from their tinnitus, whereas around 20% showed clinically significant symptoms (Jastreboff, 2011). The impact of tinnitus on quality of life varies greatly from person to person, and tinnitus may be more likely to be experienced by a person as a "distressing" condition depending on their personality traits (Henry & Wilson, 2002). The primary effect of tinnitus is sleep deprivation, cognitive impairment, emotional distress, and hearing impairment (Dobie, 2003). About half of the people with tinnitus complain of sleep disturbances (Erlandsson & Hallberg, 2000). As a result of chronic sleep deprivation caused by tinnitus may lead to difficulty in concentration (effects on cognition) as well as feelings of frustration and anger (effects on emotion). Tinnitus can further impair one's ability to interact normally with others, leading to chronic stress, which can possess such negative effects as the inability to eat, drive, or do any kind of chores.

Many people who suffer from tinnitus claim that it manifested out of nowhere, and that experiencing it is a whole new experience. This new sound may be unexpected and originates from within our head, drawing our attention. When tinnitus evokes fears of major medical conditions or psychological disorders, it may be considered a threat.

1.1 Need for the study

It is evident that the overall quality of life of an individual with tinnitus is affected (Rocha et al., 2017). Tinnitus has been quantified using a variety of scales and inventories, but most of them focus primarily on its emotional and psychological effects. It has been recognized for years that tinnitus has adverse effects that need to be measured uniformly and reliably. This objective justifies the creation of a universally valid questionnaire to evaluate various tinnitus drawbacks. The ICF framework provides a culture-neutral language to examine the consequences of health conditions and is easy to compare across populations.

The International Classification of Functioning, Disabilities, and Health (ICF) is a comprehensive framework developed by the World Health Organization to aid in conceptualizing the effects of health problems and disability. It describes the overall impact of any condition on an individual's general and emotional health status. A total of 1500 are included in ICF, which is divided into the following components: body structures (*s*), body functions (*b*), activities and participation (*d*), environmental factors (*e*), and personal factors (*pf*) (Üstün et al., 2003).The utility of this tool in addressing the overall impact of auditory disorders such as hearing impairment (Helvik et al., 2006), including single-sided deafness (Durisala et al., 2016), tinnitus (Manchaiah et al., 2018), Meniere's disease (Levo et al., 2019), as well as vestibular disorders such

as Benign Paroxysmal Positional Vertigo and Vestibular Migraine (Mueller et al., 2012), has been documented in the literature. Only two studies have previously used the International Classification of Functioning, Disability, and Health (ICF) framework to analyze the effects of tinnitus (Manchaiah et al., 2018, 2022).

Given the scanty literature dealing with the overall perceptual profiling of tinnitus in everyday situations and the ever-increasing need to understand the same, the current study aims to utilize ICF to shed light on individuals' hardships tinnitus experience daily, which are otherwise ignored mainly in auditory tests. The study's objectives are to explore the overall effects of the tinnitus problem on body function, activity limitation, environmental function, and personality domains of ICF Classification. The current study examines the problems and life effects experienced by people with tinnitus in the Indian population. This present study attempts to evaluate the use of ICF classification in determining the problems experienced by individuals with tinnitus. It will also be attempted to correlate these findings with various audiological features of individuals with tinnitus.

1.2 Aim of the study

The current study aims to profile the key problems and life effects experienced by individuals with tinnitus.

1.3 Objectives of the Study

- To use ICF categorization to determine tinnitus's consequences and life effects, focusing on the areas of body function, body structures, activities, involvement, contextual variables, environmental factors, and personal factors.

- To identify which domain-Body structure (s), Body function, Activity restriction and Participation restriction, Environmental variables, and Personal factors have the most challenges and consequences on people with tinnitus.
- To correlate the pure tone average, speech identification, and THI scores with ICF categories.

CHAPTER 2

REVIEW OF LITERATURE

2.1 Definition of Tinnitus

Tinnitus refers to the experience of hearing sounds that are not caused by external acoustic or mechanical stimuli in the ear but instead arise from neural activity in the nervous system (Jastreboff, 1990). According to Levin and Oron's (2015) definition, tinnitus is the perception of sound without any corresponding external sound (Levine & Oron, 2015). The definition of tinnitus provided by ANSI in 1969 states that tinnitus is the experience of hearing sounds without any external auditory stimulation. Tinnitus may manifest in different ways, including as a loud or soft sound, with high or low pitch, and may occur suddenly or gradually. Additionally, tinnitus may affect one ear (unilateral) or both ears (bilateral) (Baguley et al., 2013).

To evaluate tinnitus, a detailed case history and different subjective and objective assessments are done to determine the condition's potential cause, intensity, and classification. The information gathered through these evaluations is useful in choosing suitable treatment options and recording the predicted outcomes of the treatment (Cima et al., 2019).

2.2 Quality of life in individuals with tinnitus

Studies of tinnitus prevalence report that 0.5-1% of respondents have significant difficulties leading a normal existence due to tinnitus (Erlandsson & Hallberg, 2000). The concept of quality of life refers to much more than health issues.

Individuals are evaluated based on their ability to function professionally and socially (Gopinath et al., 2010). Quality of life can also be influenced by the person's innate mental and physical ability to cope with the situation (Kennedy et al., 2004). It differs from person to person rather than being consistent. A rehabilitation process increasingly includes recognizing the influence of a disease or condition because the severity of the disease or condition does not always align with how it is perceived (Kennedy et al., 2004).

Quality of life measures may be used for a variety of purposes. This clinical tool helps evaluate requirements and determine the most suitable therapy. Choosing the right quality-of-life measure can help identify areas that need rehabilitation. Moreover, it allows for assessing rehabilitation effectiveness, particularly in specific therapeutic areas. It can also be used as a research instrument to investigate the factors influencing tinnitus. Quality-of-life measures function as social or health policy tools quantifying a condition's societal, work-related, and health implications (Guyatt et al., 1993). This type of measure enables a broad understanding of the quality-of-life effects.

Numerous outcome measures provide helpful general health profile scales for assessing various facets of quality of life. One such measure is Tinnitus Handicap Inventory (Newman et al., 1996)

2.2.1 Tinnitus Handicap Inventory

The most commonly used validated questionnaire to measure the severity of tinnitus is the Tinnitus Handicap Inventory (THI) (Newman et al., 1996). The Tinnitus

Handicap Inventory (THI) is a self-administered assessment tool created by the British Association of Otolaryngologists, Head and Neck Surgeons. It aims to measure the extent of the limitations and negative effects on daily life caused by tinnitus by assigning a numerical value to these experiences. Newman, Jacobson, and Spitzer developed a preliminary version of the THI questionnaire in 1996, a revised version of the original 50-item questionnaire. This new version was referred to as a beta version and was subsequently published. Despite the existence of earlier scales and questionnaires for measuring tinnitus, the THI is widely regarded as one of the most effective tools for this purpose. This is due to its comprehensive nature and its development following the earlier scales, allowing it to improve upon its limitations.

The THI consists of 25 questions that are divided into three categories, or subscales. These include the functional subscale, which has 12 questions; the emotional subscale, which has eight questions; and the catastrophic response subscale, which has five questions. Each of these subscales aims to assess different aspects of the impact of tinnitus on an individual's life, such as physical functioning, psychological distress, and feelings of desperation or loss of control (Newman et al., 1996). The THI questionnaire's 25 items are answered on a scale where a "yes" response is given 4 points, a "sometimes" response is given 2 points, and a "no" response is given 0 points. The total score is between 0 to 100, with scores falling into one of five categories: non-handicapped (0-16), mild handicapped (18-36), moderate handicapped (38-56), severe handicapped (58-76), and catastrophic handicapped (78-100). These categories are based on the total score and indicate the severity of the individual's tinnitus.

The main focus of the study, which aimed to investigate how the five major personality traits, namely 'Neuroticism,' 'Extraversion,' 'Openness,' 'Agreeableness,' and 'Conscientiousness,' influence the scores obtained on two commonly used questionnaires, the tinnitus handicap inventory (THI) and the tinnitus questionnaire (TQ), that assess the severity of tinnitus-related complaints. The study aimed to explore whether there is a correlation between individuals' personality traits and their self-reported experiences of tinnitus.

In summary, the THI is a concise and straightforward self-report questionnaire that evaluates the level of impairment an individual experiences due to their tinnitus across various areas of their life. It is simple to administer and can be used to measure the impact of tinnitus on different domains. The THI questionnaire is frequently utilized to identify patients who need intervention for their tinnitus. Its widespread use makes it a valuable tool in selecting patients who require immediate attention for their tinnitus.

2.3 The International Classification of Functioning, Disabilities, and Health (ICF)

The ICF is a system for organizing and depicting information about functioning and disability, providing a consistent language and framework for defining and assessing health and disability. The main objective of the ICF classification is to offer a standardized language and structure for depicting health and health-related conditions. The ICF is a member of a group of international classifications developed by the World Health Organization (WHO) for use in various areas of health. The World Health Organization (World Health Organization., 2001) developed the International Classification of Impairment, Disability, and Handicaps (ICIDH) to categorize and

explain disabilities. The WHO's group of international classifications offers a structure for coding diverse health-related data, such as diagnosis, functioning, disability, and reasons for healthcare visits. It also employs a uniform and standardized language for communication about health and healthcare across various fields and sciences worldwide.

The ICF is a multipurpose classification system intended to be helpful in a variety of disciplines and sectors (World Health Organization., 2001), with specific objectives that can be summarised as follows:

- To establish a scientific foundation for comprehending and studying health and health-related conditions, outcomes, and factors.
- To create a shared vocabulary for categorizing health and health-related conditions to improve communication between different users; this includes healthcare professionals, researchers, policymakers, and the public, including individuals with disabilities.
- To enable information comparisons across countries, healthcare fields, services, and periods.
- To provide a structured coding system for health information systems.

ICF is beneficial due to its various applications, including

- As a statistical instrument for gathering and registering data, such as in population studies, surveys, or management information systems.
- It is utilized as a research instrument to assess results, quality of life, or environmental factors.

- As a clinical aid tool as evaluating needs, aligning treatments with specific conditions, assessing vocational abilities, rehabilitation, and measuring outcomes.
- As an educational resource, design curriculums, raise awareness, and undertake social action.

The ICF has a wide range of practical uses, including but not limited to social security, assessment in managed healthcare, and local, national, and international population surveys.

The ICF is also advantageous in studying healthcare systems, both in terms of assessing their effectiveness and developing policies.

2.4 Model of ICF

As an interactive and evolutionary process, it presents several different approaches to categorizing functioning and disability. The ICF model offers the fundamental components for individuals interested in developing models and exploring various aspects of the functioning and disability process. In other words, it provides a basis or framework for those who want to create their models. The model suggests that the various factors or components involved in the functioning and disability process are not directly linked in a cause-and-effect manner (Stucki, 2008). Figure 2.1 presents a comprehensive approach to classifying functionality and impairment. The approach is characterized as multifaceted, meaning that it considers various factors and perspectives.

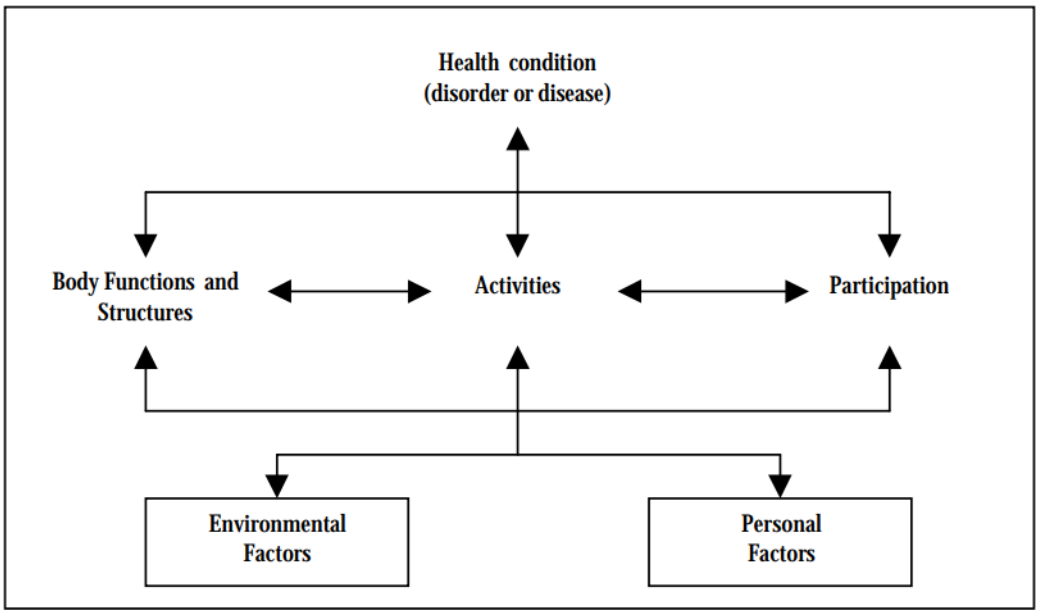

Figure 2.1: *Interactions between different elements of ICF (World Health Organisation, 2001)*

The associations among the different elements of the ICF model are distinct and cannot always be anticipated in a straightforward, one-to-one manner. Interaction is not one-way but goes in both directions, highlighting the complex and dynamic nature of the functioning and disability process. Each component of the health experience is significant and contributes to a comprehensive understanding of the functioning and disability process.

2.4.1 Activities and Participation

Activity is determined as an individual's performance of a specific task or action. Activity limitations refer to the challenges or obstacles an individual may face in carrying out activities. These limitations could be due to various factors such as

health conditions, environmental barriers, or personal factors. Participation refers to the active involvement of a person in a particular context, which could be a social, occupational, or community setting. Participation restrictions refer to the difficulties an individual may encounter in engaging or being involved in various life situations. There are two types of qualifiers, namely, the performance qualifier and the capacity qualifier. The performance qualifier pertains to an individual's current environment and describes what that person can do. The term "capacity qualifier" refers to the capability of an individual to carry out a particular task or activity (World Health Organization., 2001).

2.4.2 Body functions and body structures

Body functions are the various bodily functions performed by the body's different systems, which may also include psychological functions. Body structures refer to the physical structures or components of the human body, such as bones, muscles, and organs. The body structures are essential for carrying out different bodily functions and activities. Impairments refer to a major deviation or loss in the functioning or structure of the body.

2.4.3 Contextual factors

According to the International Classification of Functioning, Disability, and Health (ICF), contextual factors have two characteristics that can affect the well-being of an individual with a medical condition: environmental and personal factors. The primary distinction between these two elements is their respective positions in relation to the person, where environmental factors are perceived as factors outside of the

individual. On the other hand, personal factors are considered internal factors, in opposition to environmental factors, which are viewed as external to the individual. Personal factors are those specific aspects of an individual's life and experiences that are distinct to them and unrelated to their overall health or health condition. These variables could comprise factors such as gender, race, age, pre-existing health conditions, physical fitness, lifestyle, daily routines, childhood experiences, and coping mechanisms (World Health Organization., 2001). Environmental factors pertain to the surroundings, including the physical, social, and attitudinal environment in which people reside and carry out their daily activities (World Health Organization., 2001). Environmental factors are evaluated as facilitators or hindrances/barriers to an individual's performance in a given situation, as they are acknowledged to have positive or negative control over the individual's functioning. The impacts of environmental factors on individuals with health conditions are diverse and intricate, and further research is anticipated to contribute to a better comprehension of this interplay. There is a possibility that a second classification for these factors could help understand their influence.

2.5 Classification according to ICF

ICF divides health conditions into two main categories: (i) functioning and disability and (ii) contextual factors. The classification of ICF into its two main categories is illustrated in Figure 2.2, where they are divided into more specific components. These components include body functions, body structures, activities and participation, environmental factors, and personal factors (Cerniauskaite et al., 2011a). Body function encompasses the physiological performance of bodily systems, such as

the ability to detect sound. On the other hand, body structures include the body's physical components, such as the ear and heart. Activities refer to an individual's ability to carry out a task or action and participate in various activities. Environmental factors consist of the physical and social surroundings in which people live, including family support and relationships. Additionally, personal factors are linked to the inherent characteristics of an individual that are not related to their health condition, such as age and gender.

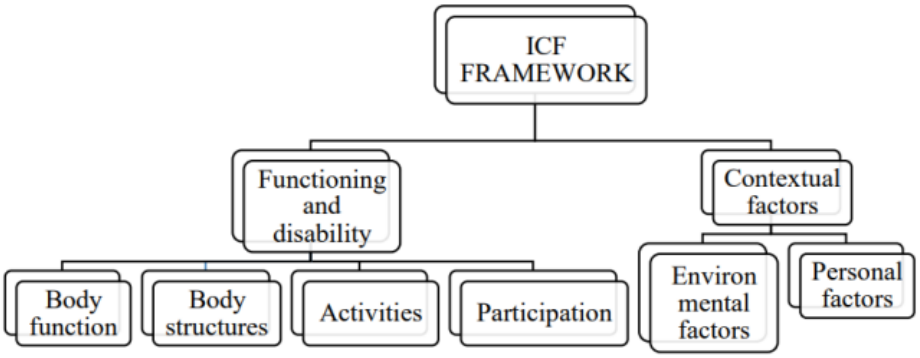

Figure 2.2: *The ICF framework and its various categories/components*

2.6. ICF Core Sets

The WHO initiated the ICF core sets project to simplify the utilization of ICF in clinical environments and research settings (Stucki & Grimby, 2004). The ICF model contains around 1,500 categories, so its application in clinical practice and research can be challenging. To address this difficulty, ICF Core Sets were developed as a solution. ICF Core Sets have been created to provide a systematic and thorough

description of functioning that can be used for various purposes and in different settings, including clinical practice and research. These Core Sets are a selection of ICF categories taken from the complete classification, tailored to specific health conditions, condition groups, and settings. An ICF Core Set can be a basic benchmark for evaluating and recording an individual's functioning and health in clinical research and comprehensive, single or multi-disciplinary clinical consultations when utilized in these settings. Numerous core sets are available for various conditions. These core sets come in two forms: comprehensive core sets encompassing all ICF categories related to a specific area and brief core sets, which are a more condensed version of the comprehensive core sets (Selb et al., 2014). From the inception of the ICF Core Sets project until 2017, a total of 35 core sets were developed for various health conditions, circumstances, situations, and generic core sets (Selb et al., 2014). In 2008, the ICF core sets project was launched to focus on adults with hearing loss (Granberg et al., 2014). Various outcome measures have been identified to target the researcher's perspective in the context of other core set projects. These measures include standard provider-reported or third-party-reported measures, nonstandard measures such as single questions (Escorpizo et al., 2011), clinical measures such as joint pain or joint swelling, and technical measures such as X-rays (Zochling et al., 2006).

To conclude, the advantages of using the ICF framework go beyond its ability to assess the health of a population. ICF allows the identification of environmental factors that affect participation in areas such as housing, education, or transportation, which may be determinants of health (Cerniauskaite et al., 2011b). Incorporating ICF in evaluating noise-induced hearing loss is more effective than using the traditional audiological test battery alone.

2.7 ICF in Tinnitus

Several research studies in the speech and hearing domain have utilized the ICF classification system. A study investigated the correlation between tinnitus and the difficulties and impact on quality of life among a group of volunteers participating in tinnitus research in the United Kingdom (Manchaiah et al., 2018). Using open-ended questions, the study examined the difficulties and impacts on daily life reported by 240 volunteers participating in tinnitus research. The study utilized the ICF classification system to categorize and analyze the responses provided by the research volunteers. Using the ICF classification system demonstrates that tinnitus has diverse effects on different aspects of a person's life. Additionally, the study's employment of an open-ended questioning approach highlights the significant value of gathering comprehensive information on the impact of tinnitus. By categorizing the responses according to the ICF classification system, it became evident that tinnitus affects bodily functions, activity limitations, and participation restrictions. The study's outcomes indicate that tinnitus's impact on individuals is heterogeneous and varies greatly.

Another study conducted in the United States utilized the International Classification of Functioning, Disability, and Health (ICF) framework to identify the primary issues and impacts on quality of life that were reported by individuals suffering from tinnitus (Manchaiah et al., 2022). The researchers linked the responses to open-ended questions to the International Classification of Functioning, Disability, and Health (ICF) classification. Furthermore, the study involved comparing the number of answers to questions related to problems and life effects and investigating

the potential relationship between the number of open-ended question responses and variables related to tinnitus. In this study, the areas of activities and participation were observed to be the most frequently impacted compared to bodily functions

CHAPTER 3

METHODS

3.1 Research design

A cross-sectional survey design was the data collection method carried out for the study. The data was collected through a qualitative interview process followed by comparing their audiological test results. Individuals with tinnitus who reported to the institute and underwent Audiological testing at the Department of Audiology were involved in the study.

3.2 Participants

The study involved 117 individuals diagnosed with tinnitus aged 18-70 with an average age of 39.7 (SD=12.58). The study included one hundred and seventeen participants, of whom 56 were male and 61 were female.

3.3 Informed consent and ethical consideration

The participants were provided with informed consent, which included an explanation of the purpose of the study and its importance in a concise manner. The study ensured that the participants remained anonymous throughout the research. The patient's willingness to participate in the study did not influence the standard audiological assessment or any other evaluations conducted on them. The study followed the ethical standards for bio-behavioural research, as outlined by (Venkatesan, 2009) and established by the institutional review board.

3.4 Study Selection

To select participants for the study, the following specific inclusion and exclusion criteria were taken into consideration :

3.4.1 Inclusion Criteria

- Individuals diagnosed with tinnitus between the age range of 18-70 years.
- For at least three months, individuals with subjective, unilateral, or bilateral continuous tinnitus were considered.
- The hearing loss of the individuals ranged from Normal hearing sensitivity to severe hearing loss

3.4.2 Exclusion Criteria

Individuals suffering from other co-morbidities, such as hyperacusis and misophonia, were excluded.

3.5 Procedure

The google forms were sent to all the participants, direct/telephonic interviews were done, and they were asked to answer all the questions. They were informed about the complete procedure and approximate time before conducting the study,

The study was carried out in three stages.

3.5.1 Phase I: The information was gathered via an online/offline survey about (a) demographical characteristics (such as age, gender, and work status), (b) tinnitus-related variables (such as duration of tinnitus, type of tinnitus, the onset of tinnitus),

(c) standardized questionnaires (Tinnitus Handicap Inventory) (Newman et al., 1996) and (d) open-ended questions. The section included questions to identify whether the individual has Hyperacusis and Misophonia. Khalfa Hyperacusis Questionnaire and the Amsterdam Misophonia Scale Revised (AMISOS-R) were used as a tool to identify individuals who exhibit the symptoms of Hyperacusis and Misophonia, respectively.

The THI is composed of 25 individual questions, each of which offers three possible responses: "yes" (score-4), "sometimes" (score-2), and "no" (score 0). A minimum of 0The total score can range from 0 to 100. The greater the score, the more severe the impact of tinnitus on a person's functioning.

The two open-ended questions administered were a Problem question (PQ) and a Life effects Question (LEQ), which are questions based on the previous studies related to hearing loss and tinnitus (Barcham& Stephens, 1980; Stephens et al., 2001).

The two open-ended questions focus on difficulties associated with tinnitus and its effects on everyday life. The questions asked were:

- **Problem question (PQ):** 'Make a list of difficulties you have due to your tinnitus. Write down as many as you can think of.
- **Life effects question (LEQ):** Make a list of the effects of tinnitus on your life. Write down as many as you can think of.

These questions were translated into Kannada by three native Kannada speakers. A translation agreed upon by two-thirds of native speakers was considered for use in the study. A reverse translation of these questions was performed to find out

if there were any translation errors. The finalized questions were loaded onto the Google form or asked verbally or in a written form.

Only participants who were willing to answer the questions participated in the study. The questions were asked through direct interviews, and gave responses for each question. These responses were recorded and given to native Kannada speakers for translation.

The participants were requested to respond in their favoured mode, in writing, voice recording, or typed text. Participants were contacted through mobile phones and informed about the study; only those who desired to participate were included in the study. They were given two options: either answer these questions via a link to the Google form or by using a mobile phone to answer these questions. Later, using native Kannada speakers, the mobile conversations were documented and transcribed verbatim. Whenever the participants could not understand the conversation over the phone, the caregiver was contacted for assistance.

3.5.2 Phase II: International Classification of Functioning Disability and Health (ICF) coding*:*

The responses were classified into domains utilizing the International Classification of Functioning, Disability and Health (ICF) which represents a comprehensive context for understanding disability, health, and functioning. ICF divides information into two main categories: (i) functioning and disability and (ii) contextual factors. The two main parts are segmented into smaller components: body function, body structures, activities and participation, and environmental and personal

factors (Schneidert et al., 2003). The body function encompasses the physiological operation of bodily systems, such as the ability to perceive sound.

The 'seven-step linking procedure' was used as an analytical method to connect all the data to the ICF framework (Hsieh & Shannon, 2005). The seven steps are (1) meaningful unit identification, (2) defining the significant concept(s), (3) underlying meaning interpretation, (4) determining the linking unit(s), (5) appropriate ICF category derivation, (6) documenting the linking rule applied, and (7) verifying the representativeness of the ICF categories chosen. The initial analysis stage involves identifying words that carry important meanings and can be considered essential elements. These words were counted and studied to identify significant patterns and ideas. The concept is interpreted to obtain its underlying meaning. Linking units are determined based on the underlying meaning. Units of this kind are used across responses based on similar concepts and patterns. The unit is categorized based on the domains outlined in the ICF framework through a process of coding.

The codes were classified into different categories by the International Classification of Functioning, Disability, and Health (ICF), including body functions, activity limitation and participation restrictions, environmental and personal factors. The transcribed responses were provided to three coders to improve the coding process reliability. Responses were counted for PQ and LEQ, as well as for total responses (PQ + LEQ). If there was any discrepancy in the coding, it was discussed among the coders, and a final consensus was obtained. Reliability analysis for these three coders' coded responses was carried out using IBM Statistical Package Social Sciences(SPSS) version 25.0 (IBM Corp. Released 2017).

3.5.3 Phase III: A retrospective collection of auditory effects from clinical records.

The audiological information was analyzed retrospectively by examining the relevant case files located in the Department of Clinical Services (DCS) at AIISH Mysore. Clients enrolled and reported to AIISH with tinnitus (as mentioned in case files) were considered. The test results in pure tone audiometry, speech audiometry (speech identification scores), and Tinnitus Handicap Index scores were noted and entered in google sheets.

Hearing sensitivity is assessed behaviorally using pure-tone audiometry. The softest sound that an individual can hear at least 50% of the time is indicated by pure-tone thresholds. An essential tool in assessing hearing loss is speech audiometry. The speech identification score (SIS) was determined by presenting a list of unknown single-syllable words at +40 dBHL above the speech recognition threshold. SIS is determined by the number of correct words out of the number of presented words. Tinnitus Handicap Inventory is a self-report measure of perceived tinnitus handicap severity. It consists of 25 items. Using the THI total score, one can determine the severity of the tinnitus handicap from 0 to 100, where a higher score indicates more tinnitus handicap severity.

3.6 Quantitative Data Analyses

The statistical analysis was performed using IBM SPSS version 20.0 and Graph Pad Prism 9. Descriptive statistics were analysed, including mean and standard deviation (SD). The total count of responses for PQ and LEQ questions was attained.

The normality check was done using Shapiro-Wilk's test. After determining the result of the normality test, the Wilcoxon signed-rank test was performed to assess whether there was a statistically significant difference in the number of responses. The effect size was calculated using the formula $r = (Z/\sqrt{N})$ whenever the results were statistically significant. "Z" represents the Z score obtained from the Wilcoxon signed-rank test, and "N" is the total number of observations. Spearman's rho correlation coefficient was tested to establish the relationship between the questions mentioned in PQ and LEQ with the audiological variables. Statistical significance was determined at a two-tailed level of $p < 0.05$ for all analyses.

CHAPTER 4

RESULTS

This study aimed to profile the problems and life effects experienced by individuals with tinnitus. One hundred seventeen individuals diagnosed with tinnitus were asked two open-ended questions, and their responses were collected through direct interviews. The participants' responses were transcribed verbatim, and three coders gave ICF codes to the responses respective to the keywords. The audiological data of all the participants were collected from their case files. Inferential and descriptive statistics were computed using SPSS (version 20.0). The Shapiro-Wilk's test was performed to check the normality of the data, and the data were found to be non-normally distributed (p<0.05). Therefore, non-parametric inferential statistics were used for additional analysis. The following sections explain the study's findings:

4.1 Impact of tinnitus across different domains of ICF

4.2 Quantification of problem and life effects of individuals with tinnitus

4.3 Correlation between PQ, LEQ responses, audiological variables (PTA, SIS) and THI Scores

4.1 Impact of tinnitus across different domains of ICF

The problem effects of Tinnitus patients were reported more frequently than life effects. Within the Problem effects, the Activity limitation and Participation domain had the highest frequency of responses. A total of 361 responses were obtained within the domain of Activity Limitation and Participation. Of the 361 responses within the Activity limitations and Participation restrictions domain, 221 were

obtained from the Problem Questionnaire (PQ), while the remaining 140 came from the Life Effect Questionnaire (LEQ). The most commonly occurring group was "Recreation and leisure" (d920), with a frequency count of 70 responses. The category that occurred the second highest frequency count was "Sleep function." Similarly, the Body function domain has the second-highest number of responses, with a total count of 241 responses. Additional categories which appeared more frequently include "Attention function" (b240), "Thinking" (d163), "Focusing attention" (d160), "Aural pressure" (b2405), "Reading" (d166), "Carrying out daily routine" (d230), "Watching" (d110).

A total of 19 responses was obtained from Environmental factors, with the highest number of responses being from the "Sound Intensity" (e2500) category. In addition to these domains, there were unclassifiable or non-codable factors. The frequency response of domains such as Body function, Activity limitation and Participation Restriction, and Environmental Factors with their respective codes are given in Table 4.1 to Table 4.3

Table 4.1

Frequency Counts of All the Responses Under the Domain of Activity Limitationand Participation Restrictions

Function	*Codes*	*PQ* *n=221*	*LEQ* *n=140*	*Total* *n=361*
Carrying out daily routine	d230	22	1	23
Reading	d166	24	0	24
Doing housework	d640	11	0	11
Driving	d475	18	0	18
Listening	d115	11	0	11
Focusing attention	d160	29	0	29
Writing	d170	1	0	1
Using telecommunication devices	d3600	5	0	5
Handling stress and other psychological demands	d240	5	0	5
Shopping	d6200	3	17	20
Thinking	d163	33	0	33
Recreation and leisure	d920	1	69	70
Communicating with—receiving—spoken messages	d310	1	1	2
Acquiring, keeping and terminating a job	d845	3	8	11

Speaking	d330	10	8	18
Watching	d110	23	0	23
Conversation	d350	9	1	10
Walking	d450	1	0	1
Undertaking multiple tasks	d220	1	0	1
Conversing with many people	d3504	3	1	4
Moving around outside the home and other buildings	d4602	1	0	1
Making decisions	d177	4	0	4
Using transportation	d470	1	0	1
Carrying out multiple tasks	d2200	1	0	1
Sports	d9201	0	2	2
Informal relationships with friends	d7500	0	4	4
Socializing	d9205	0	7	7
Family relationships	d760	0	3	3
Community life	d910	0	9	9
Informal social relationships	d750	0	2	2
Ceremonies	d9102	0	3	3
Arts and Culture	d9202	0	1	1
Full-time employment	d8502	0	3	3

Table 4.2

Frequency Counts of All the Responses Under the Domain of Impairments ofBody Functions

Definition	*Codes*	*PQ* *n=236*	*LEQ* *n=5*	*Total* *n=241*
Attention function	b240	34	0	34
Sensations associated with hearing and vestibular function	b140	1	0	1
Emotional functions	b152	21	0	21
Pain in head and neck	b28010	18	0	18
Range of emotion	b1522	1	0	1
Sleep function	b134	47	0	47
Amount of sleep	b1340	5	0	5
Aural pressure	b2405	28	0	28
Vestibular function of balance	b2351	10	0	10
Memory functions	b144	2	0	2
Energy and drive functions	b1300	12	0	12
Hearing functions	b230	14	0	14
Nausea associated with dizziness or vertigo	b2403	3	0	3
Dizziness	b2401	7	0	7

Auditory perception	b1560	1	0	1
Speech discrimination	b2304	2	0	2
Sustaining attention	b1400	4	4	8
Sensation of falling	b2402	1	0	1
Irritation in the ear	b2404	2	0	2
Confidence	b1266	2	0	2
Sensation of pain	b280	19	0	19
Regurgitation and vomiting	b5106	2	0	2
Extraversion	b1260	0	1	1

Table 4.3

Frequency Counts of All the Responses Under the Domain of Environmental Factors

Definition	*Codes*	*PQ n=0*	*LEQ n=19*	*Total n=19*
Sound	e250	0	2	2
Sound Intensity	e2500	0	10	10
Products and technology for communication	e125	0	1	1
General products and technology for communication	e1250	0	1	1

General products and technology for personal use in daily living	e1150	0	2	2
Individual attitudes of friends	e240	0	1	1
Products and technology for culture, recreation and sport	e140	0	2	2

Among the issues frequently mentioned, the majority fell under the Activity limitation and Participation Restrictions category. In total, there were 221 responses related to PQ and 140 responses related to LEQ.

4.2 Quantification of problem and life effects of individuals with tinnitus

591 responses (PQ: 433 responses and LEQ: 158 responses) were obtained from 117 adults with tinnitus using two open-ended questions.

The total number of responses varied from 1 to 14. Most participants gave 1 to 5 relevant answers for PQ, with 14 being the highest number of responses and 1 to 2 appropriate responses for LEQ, with 5 being the highest number of responses.

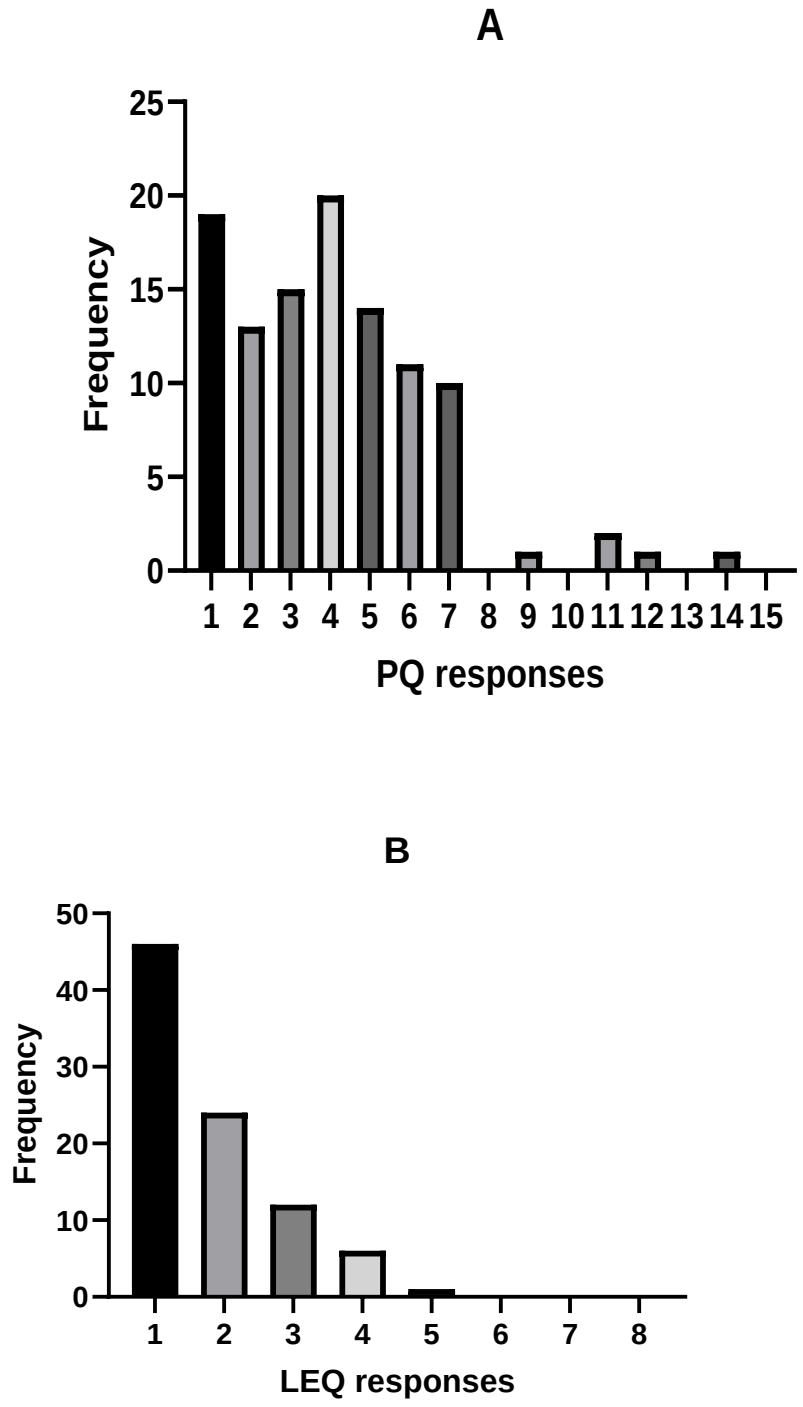

Figure 4.1

The bar graph depicting the comparison of the number of problems listed in (A) PQ and (B) LEQ

For PQ and LEQ, each participant's average responses were 3.70(±2.66) and 1.35 (±1.15), respectively. There was a significant difference in the total number of responses between PQ and LEQ, as shown in Table 4.4

Table 4. 4

Number of Responses in Each of the ICF Domains Listed in the Two Questions

	PQ Mean (±one SD)	*LEQ Mean (±one SD)*	*Wilcoxon (Z)*	*Sig. (p)*	*Effect Size r=(Z/√N)*
Overall Responses	3.70 (±2.66)	1.35 (±1.15)	-8.352	<0.05	0.77

Note. SD= Standard Deviation

4.3 Correlation between PQ, LEQ responses, audiological variables (PTA, SIS), and THI Scores:

The Spearman's rho correlation was carried out to examine the relationship between PQ, LEQ, audiological variables (PTA, SIS), and THI Scores. Table 4.5 depicts the correlation among PQ, LEQ, audiological variables, and THI scores.

Table 4.5

Correlation Among the Number of Responses to the Problem and Life Effects Question, Audiological Variables and THI scores

		THI scores	*PTA of Right ear*	*PTA of Left ear*	*SIS of Right ear*	*SIS of Left ear*
PQ	Spearman's rho correlation	0.760	0.177	0.097	-0.196	-0.023
	Significance	0.00	0.057	0.296	0.034	0.806
LEQ	Spearman's rho correlation	0.747	0.160	0.200	-0.165	-0.085
		0.00	0.085	0.031	0.075	0.362

Note. PTA= Pure Tone Average, SIS= Speech Identification score, THI= Tinnitus Handicap Inventory

The results showed a strong correlation between the number of PQ and LEQ responses with THI scores and a weak correlation among audiological variables. No statistically significant correlation ($p>0.05$) was found between the PQ and LEQ responses and Audiological variables like PTA and SIS.

In summary, the study outcomes highlighted the following findings.

1. The activity limitation participation restriction domain has the highest reported responses.
2. The responses obtained for PQ and LEQ differ significantly.
3. There is no connection between the PQ and LEQ responses and the audiological parameters such as PTA and SIS. There is a strong correlation between the number of responses to the Problem question (PQ) and Life Effect question (LEQ) and the scores obtained from the Tinnitus Handicap Inventory (THI).

CHAPTER 5

DISCUSSION

This study investigated the problems and life effects of 117 individuals diagnosed with tinnitus using open-ended questioning. In total, responses were coded using ICF. Most of the answers for PQ and LEQ ranged from 2 to 3 meaningful responses. This shows that tinnitus notably impacts various domains of an individual's life. Additionally, it demonstrates how beneficial it is to use an open-ended approach to understand how tinnitus influences particular people. This is because open-ended questions enable individuals to express their ideas and emotions in their own words, which might provide valuable insights into their experiences. The study's results exhibited a very strong correlation between the overall number of responses obtained for the two open-ended questions. There was a weak correlation between the audiological variables (PTA and SIS) and the total number of PQ and LEQ responses obtained, which indicates that there can be other factors that are responsible for tinnitus.

In the present study, various audiological parameters considered for the correlation analysis were the pure tone average, speech identification scores in both ears, and PQ and LEQ responses. The participants in the study had different levels of hearing ability, ranging from normal hearing to profound hearing loss. The results from the Spearman correlation analysis indicate a weak relationship or association between the audiological measures and the participants' responses to open-ended questions and a very strong relationship between THI scores and PQ and LEQ responses.

When comparing the responses obtained for the open-ended questions shows that the Problem question (PQ) received the highest number of responses, and the difference was found to be statistically significant. Out of 621 responses, nearly 73% of the overall responses, which is 457 responses, were categorized under the Problem question. Tinnitus clearly impacts the daily life of individuals. In a research study carried out by (Manchaiah et al., 2022), the results were in line with previous observations. Specifically, the study found that participants provided a notably greater number of responses when answering the Problem Question (PQ) compared to their responses to the Life Effects Question (LEQ). The severity of tinnitus and its co-morbidities show how significantly the participants were affected by their tinnitus. The findings suggest that both open-ended and standardized outcome measures can provide insights into the consequences of tinnitus.

Taking into account responses in each of the ICF classification domains, the most frequent responses from the participants were related to Activity Limitation and Participation Restriction. Over half of the responses were reported from this domain. Activity Limitation and Participation restriction are the domains in ICF that describe difficulties an individual may have in executing activities and problems they may experience in involvement in life situations. Activity Limitation and Participation Restrictions have more impact on "Recreation and leisure" (d920). Restrictions on participation in various leisure activities can lead to emotional unease, including stress, frustration, despair, and conflict. This was followed by "Focusing attention" (d160), "Reading" (d166), "Carrying out daily routine" (d230), and "Watching" (d110). "Shopping" (d6200) and "Driving" (d475) difficulties were also reported by the Tinnitus individuals. These findings aligned with existing research examining

tinnitus's consequences using the multidimensional perspective (Manchaiah et al., 2022). This study concluded that Activity Limitations and Participation Restrictions were most commonly affected when compared to body function. In addition, tinnitus has been found to impact body functions such as attention function (b140), sleep functions (b134), temperament and personality function (b126) and hearing function (b230). Participants also mentioned factors that they found noteworthy, including the "Sound intensity" (e2500), "Sound" (for communication e250), and general communication products and technology (e1250).

For the correlation analysis, pure tone averages and speech identification scores in both ears and PQ and LEQ responses were considered. In this study, pure tone averages varied from Normal hearing to Profound Hearing Loss among participants. Along with audiological parameters, the correlation between PQ and LEQ with THI scores was also done. The results of the study showed a strong correlation between the number of responses to the Problem Question (PQ) and Life Effects Question (LEQ) with the Tinnitus Handicap Inventory (THI) scores and a weak correlation between audiological parameters. Some studies has correlated the number of problems listed in PQ and LEQ with tinnitus severity, gender and age (Manchaiah et al., 2018) . The study's results indicated correlation for the number of responses were positive for tinnitus severity and gender and a negative correlation for age. No studies have correlated between number of responses with audiological variables.

CHAPTER 6

SUMMARY AND CONCLUSIONS

Tinnitus is the term used to describe the conscious perception of sound within one's ear, even when no external stimulation is present (Atik, 2014). It is unclear mainly that 80% of those with persistent tinnitus seek little to no treatment, seeking effects from their tinnitus, whereas around 20% showed clinically significant symptoms (Jastreboff, 2011). A cross-sectional survey design was the data collection method carried out for the study. The data was collected through a qualitative interview process followed by comparing their audiological test results. The study involved 117 individuals diagnosed with tinnitus aged 18-70 with an average age of 39.7 (SD=12.58). The two open-ended questions, a Problem question (PQ) and a Life effects Question (LEQ), were administered along with the Tinnitus Handicap Inventory. The responses were classified into domains utilizing the International Classification of Functioning, Disability, and Health (ICF). The responses were coded using seven' seven-step linking procedure'. The codes were classified into different categories of the International Classification of Functioning, Disability and Health (ICF), including body functions, activity limitation and participation restrictions, and environmental and personal factors.

The study investigated the challenges and impacts on individuals, with tinnitus, examining the difficulties and consequences they face in their lives. The total number of responses for the Personal Question (PQ) and Life Effects Question (LEQ) showed a significant difference. Out of 621 responses, nearly 73% of the overall responses, which is 457, were categorized under the Problem question. It is evident that activity

limitations and participation restrictions are critical domains related to disability and health, where it has more impact on "Recreation and leisure." These domains refer to the difficulties an individual experiences in performing tasks and engaging in social roles. In the next domain, Impairments of Body Functions, " Sleep function " (b134) caused the most significant concern. The most frequently occurring responses related to environmental factors in the context of tinnitus were "Sound Intensity" (e2500) and "General products and technology for personal use in daily living" (e1150).

The results showed a strong correlation between the number of PQ and LEQ responses with THI scores and a weak correlation among audiological variables such as Pure Tone Average and Speech Identification Scores. This indicates that tinnitus has other confounding factors associated with it. Open-ended questions were instrumental in obtaining necessary information with diverse concerns. Open-ended questions are free-form survey questions that allow respondents to answer in an open-text format based on their complete knowledge, feelings, and understanding. Thus, future audiological evaluation methods for tinnitus may benefit from focusing on the following critical areas besides the audiological test battery.

6.1 Implications of the Study

Understanding the challenges faced by individuals with tinnitus using a biopsychosocial approach can provide valuable insights, particularly for clinicians and family members. Clinicians should focus on every aspect of a person affected by a particular problem or condition when conducting assessments. This approach is the biopsychosocial assessment, which considers biological, psychological, and social factors that could impact a client's health. Based on the findings of the present study,

it is evident that individuals with Tinnitus experience issues in multiple domains rather than just one (e.g., Activity limitation and participation restriction -Recreation and leisure, Sleep function, Focusing attention, Reading, carrying out a daily routine, attention function, aural pressure, environmental factors- Sound Intensity). A more elaborate questionnaire can be developed and validated, considering all the domains specific to the problems that individuals with tinnitus report as a response to these open-ended questionnaires. Clinicians and researchers must consider the key outcome domains to be measured when performing clinical trials. The selection of appropriate outcomes or domains is crucial when designing clinical trials to compare directly the effects of different interventions in ways that minimise bias.

The study will aid in a comprehensive understanding of the impact of tinnitus. ICF helps to study the impact of health conditions from a newer perspective. ICF-based analysis of tinnitus has not only revealed a more comprehensive picture of impairment, functioning, and disability but has also defined these terms in a universally understood manner. Additionally, open-ended questions can be added to structured questionnaires to help tinnitus sufferers provide more detailed information about themselves. Along with the conventional auditory test battery, this questionnaire can be used to identify domain-specific deficits, which can help Audiologists come up with effective rehabilitation strategies and counselling

6.2 Strengths and Limitations of the Study

The incorporation of open-ended questions is a major strength of the present study. Open-ended questions have the benefit of covering more topics than structured ones, providing a more comprehensive understanding of the impact of tinnitus on individuals. The study used a simplified content analysis approach to link concepts to

ICF categories following established linking rules. The findings suggest that open-ended questions can provide valuable insights into the impact of tinnitus on individuals and should be incorporated into future studies. Additionally, subjects were given multiple options to submit their responses, which resulted in much more refined responses. The present study's approach, which incorporated open-ended questions and ICF coding, was relevant and yielded many responses. ICF is an internationally recognized classification system that provides high reliability in coding responses.

Tinnitus has been studied using ICF guidelines to understand its psychosocial impact; however, its small sample size limits its generalizations. By including more participants in future studies, this shortcoming might be addressed. In this present study, the number of PQ and LEQ responses has been correlated with audiological variables such as PTA and SIS. In future studies, another audiological variable can also be incorporated, such as intensity matching, Pitch matching, etc.

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