

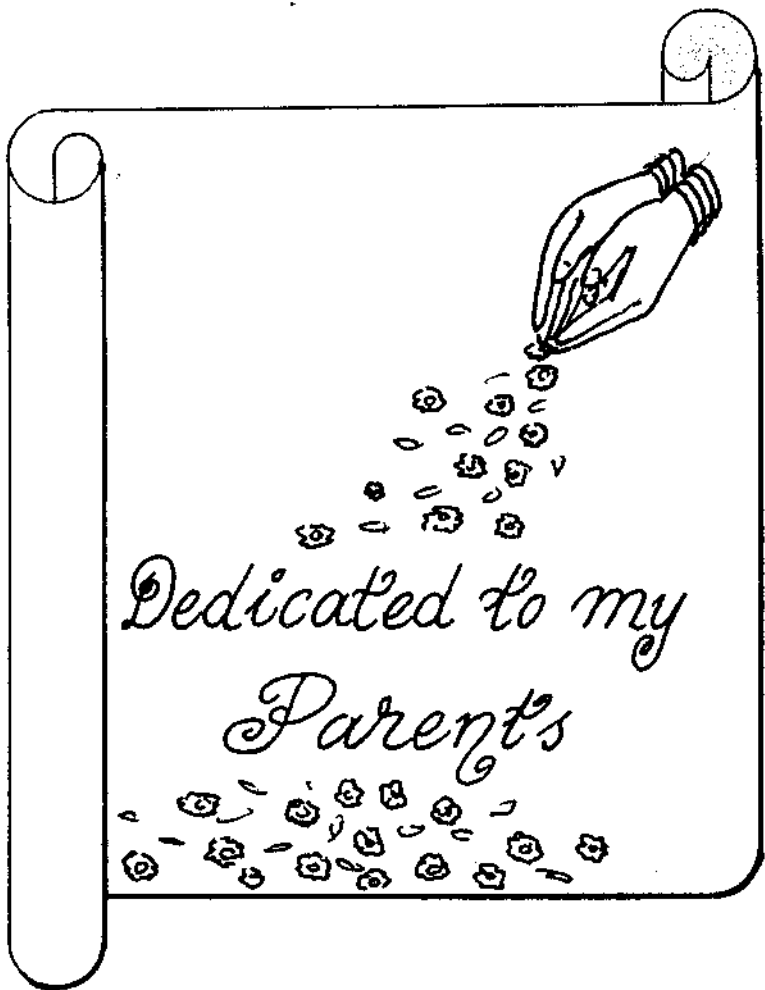
**A SELF-REPORT TINNITUS HANDICAP  
QUESTIONNAIRE (SR-THQ)**

**Register No.M0107**

An Independent Project submitted in part fulfillment for the  
first year **M.Sc, (Speech and Hearing)**  
University of Mysore, Mysore.

All India Institute of Speech and Hearing  
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Mysore

**MAY 2002**

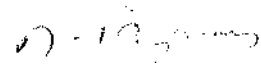


*Dedicated to my  
Parents*

## CERTIFICATE

This is to certify that the Independent Project entitled : "**A Self-report Tinnitus Handicap Questionnaire (SR-THQ)**" is the bonafide work in part fulfillment for the degree of Master of Science (Speech and Hearing) of the student with Register No.M0107.

Mysore  
May 2002

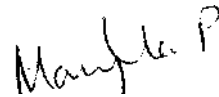


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## **CERTIFICATE**

This is to certify that this Independent Project entitled : "A Self-report Tinnitus Handicap Questionnaire (SR-THQ)" has been prepared under my supervision and guidance. It is also certified that this has not been submitted earlier in any other University for the award of any Diploma or Degree.



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Mysore  
May 2002

## DECLARATION

I hereby declare that this Independent Project entitled "A Self-report Tinnitus Handicap Questionnaire (SR-THQ)" is the result of my own study under the guidance of *Mrs.Manjula, P.*, Lecturer in Audiology, Department of Audiology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier at any other University for the award of any Diploma or Degree.

Mysore  
May 2002.

**Reg. No.M0107**

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*My sincere and heartfelt and gratitude Mrs. Manjula, for all her patience and guidance which finally helped me to complete my Independent Project.*

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*Dear Appa and Amma, no words to express my gratitude to both of you, you always being showering your love, affection and blessings on me. What more to say than remembering how much you've been a part of my sorrows, tears and my pain during all those dark nights and bright things. "I am, what I am, right-now just because of you".*

*"All my gratitude at your feet".*

*Dear brothers, Raju and Pachi, I am so proud to be your sis, all those moments of my childhood are memorable because of you've always been my friends than my brothers. What I only wish for you both is that you always fulfill your dreams and always make us feel proud of you.*

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## TABLE OF CONTENTS

|                        | Page No. |
|------------------------|----------|
| INTRODUCTION           | 1 - 4    |
| REVIEW OF LITERATURE   | 5 - 32   |
| METHOD                 | 33-41    |
| RESULTS AND DISCUSSION | 42 - 56  |
| SUMMARY AND CONCLUSION | 57-61    |
| REFERENCES             | 62 - 65  |
| APPENDIX               |          |



## INTRODUCTION

"Imagine the thunder of a jet taking off, with a roaring echo that never fades, or the sound of hundreds of telephones ringing all at once, in a small room. Imagine the constant noisy out burst of a construction crew's jackhammer - one that doesn't stop at the end of the day - or the never ending buzzing sound of a sound of a bee in your head. Imagine putting in your head between the two whistling kettles and walking around with them all day, every day, with no option of putting them down or turning them off.

"A tremendous fear that is what I remember, I was terribly afraid that it would become permanent".

"I was paralyzed with terror. . . . I knew that something terrible had happened to me" were such descriptions by the people who experienced tinnitus.

It is quite natural that we hear the sounds from outside through our own ears, but, what happens when you hear an unwanted sound from inside within you either in your ears or in your head ? This is

what we are referring to as 'Tinnitus'. McFadden (1982) (cited in Axelsson, A., 1995) suggested that "Tinnitus is the conscious expression of a sound that originates in an involuntary manner in the head of the owner, or may appear to him to do so". It is often referred to as, ringing in the ears. It can also take the form of hissing, roaring, whistling, chirping or clicking. Tinnitus may be triggered or originate from within the auditory system or from para-auditory structures, and it may be a pointer to underlying pathological conditions. Tinnitus has been characterized as the perception of internal noise, mainly originating within the head, in the absence of external acoustic stimuli (Hallam, Rnchman and HinchclifTe, 1984, cited in Axelsson, A., 1995). A clear definition of what one means by tinnitus is needed to allow uniform comparisons to be made, whether for descriptive or intervention purposes.

Tinnitus is a common and often debilitating condition. In the USA, a general population survey indicated that 32% of the population had some form of tinnitus (National Centre for Health Statistics, 1967, 1980; cited in Axelsson, A., and Ringdahl, A., 1989).

There is considerable variation in tinnitus expression, its etiology and its effect on patients' lives. Tinnitus can have many

different causes but it should be mentioned that the causes of tinnitus, and in particular severe tinnitus, in most cases is unknown. One of the common known causes of tinnitus is noise exposure and others include aging, drugs, wax, accidents, otosclerosis, etc.

### **NEED FOR THE STUDY**

Tinnitus can impair the quality of life of individuals and their family, leading to social and psychological complications. Tyler and Baker (1983) listed the problems, by at least 15% of the members of a tinnitus self-help group, as problems (a) getting to sleep (b) persistence of tinnitus (c) understanding speech (d) depression (e) annoyance (f) confusion and (g) dependence on drugs.

Hence, to understand the difficulties experienced by tinnitus sufferers, various disorder-specific self-report measures are emerging as useful clinical tools in audiology for three reasons. Firstly, they help substantiate patient's auditory and balance complaints not readily apparent by audiometric and vestibulometric testing. Secondly, self-report tinnitus handicap measures are gaining recognition as tools for quantifying the impact of tinnitus in everyday

life. Thirdly, they are also time and cost-effective (Newman, Jacobson and Spitzer, 1996).

### **AIM OF THE STUDY**

In light of the afore mentioned reasons, the present investigation was undertaken,

1. To develop a self-report tinnitus handicap questionnaire (SR-THQ) with the following characteristics -
  - (i) It should be brief so that it can be used in a busy clinical practice.
  - (ii) It should be easy to administer and interpret,
  - (iii) It should be broad in scope, reflecting the impact of tinnitus on everyday function,
  - (iv) It should be psychometrically robust with adequate reliability and validity.

An attempt has also been made -

2. To study the relationship between subjective measurements of tinnitus using tinnitus pitch and tinnitus loudness matching procedures with that of the developed self-report handicap questionnaire.

## REVIEW OF LITERATURE

"I think it is hopeless to have tinnitus. That's all, I must learn to accept it. If I could choose, I would like them to cut that piece off, but there is nothing that is physiologically wrong, they say" were such descriptions by the people who experienced tinnitus.

Human life demands the capacity of the individual to select and sort out valuable information from the endless input of non-relevant stimuli from the surrounding environment. One example of such stimuli is the undesired, environments noise that seems to increase in the modern world in an uncontrolled way - one such internal noise of aversive nature is considered to be tinnitus.

Tinnitus has been characterized as the perception of internal noises, mainly originating involuntarily within the head, in the absence of external acoustic stimuli (Hallam, Rachman and Hinchcliffe, 1984; cited in Erlandsson, S.I., Hallberg, L.R.M., and Axelsson, A., 1992). A clear definition of what we mean by tinnitus is needed to allow uniform comparisons condition to be made, whether for descriptive or intervention purposes. McFadden (1982) (cited in

Axelsson, A., and Ringdahl, A, 1989) defined tinnitus as the conscious expression of a sound that originates in an involuntary manner in the head of the owner, or may appear to him to do so. Tinnitus is a noise perceived by the patient when there is no external acoustic stimulus (Vernon, 1995; cited in Axelsson, A., 1995).

Tinnitus is a symptom not a disease. Because, it may be caused by a number of different disorders in the ear or in the auditory nervous system, to try to describe the pathophysiology of tinnitus in all its manifestations may seem fruitless. However, certain restricted forms of subjective tinnitus may be explained on the basis of current knowledge about the function of the ear and the auditory nervous system.

There is considerable variation in the tinnitus expression, its etiology and its effect on patients' lives. Tinnitus may be triggered or originate from within the auditory system or from para-auditory structures, and it may be a pointer to underlying pathological conditions. It can impair the quality of life of individuals and their family, leading to social and psychological complications.

In the United States, as many as 40 million people perceive tinnitus of some type. That is, tinnitus affects about 17% of the general population. Many more persons experience a normal phenomenon, spontaneous transient tinnitus, which lasts only a few seconds. An estimated 7 to 10 million suffer from severe, annoying, or troublesome tinnitus symptoms and the quality of life is seriously disturbed (Coles, 1984 cited in Axelsson, A., and Ringdahl, A., 1989); Axelsson and Ringdahl, 1989). Males and females are afflicted in equal proportions. Although tinnitus is most prevalent between the ages of 40 and 70 years, it also affects children, perhaps more than is commonly appreciated. Patients often associate the onset of tinnitus to some specific event, such as exposure to high intensity sound, a significant medical problem, or a stressful experience. Tinnitus is typically categorized as either subjective or objective tinnitus (Deweese and Saunders, 1973).

### ***Subjective Tinnitus***

Subjective tinnitus may arise from a disturbance of the external ear, tympanic membrane, ossicles, cochlea, eighth nerve, brainstem, or cortex. The character of the tinnitus does not aid in

determining the site of the disturbance. However, certain conditions are known to give rise to one type of tinnitus more often than another.

Cerumen in the external canal perforation of the tympanic membrane, or fluid in the middle ear may cause subjective tinnitus. This type of tinnitus most often causes a muffling of other sounds and a change in the patient's voice. Sometimes, in its course otosclerosis is almost always accompanied by tinnitus, which may last for months or years and then disappear as the disease progresses. There may be ringing, roaring, or whistling sounds. Several sounds may occur together. It does not fluctuate widely. Inflammation of the middle ear may be accompanied by tinnitus that is often pulsating in character. The tinnitus subsides with the inflammation.

In presbycusis and after acoustic trauma, tinnitus is usually high pitched and ringing in character. In these conditions, pitch of the tinnitus is usually near the frequency where the hearing loss is greatest.

Certain drugs cause tinnitus. Such tinnitus is usually high pitched and may discontinue after the drug has been stopped. Such drugs could be quinines, salicylates, streptomycin,



dihydrostreptomycin, neomycin, kanamycin and similar chemically related drugs may cause both tinnitus and hearing loss.

Vascular changes in the central nervous system associated with arteriosclerosis and hypertension commonly cause a high-pitched tinnitus. Anemia and low blood pressure may produce a variable tinnitus of mild intensity. Unilateral tinnitus is one of the triad of symptoms characterizing Meniere's disease. The characteristic sound is low pitched and although continuous, fluctuates in intensity. Some patients hear certain vascular sounds that are interpreted as tinnitus. Perhaps, head noise would be a better term for these sounds during venous congestion or when plaques are present in the carotid arterial supply, pulsating or "swishing"<sup>1</sup> tinnitus synchronous with the heart beat may be heard. Vascular tinnitus is usually low pitched.

Tumors of the posterior fossa, particularly in the cerebellopontine angle, produce tinnitus early in their course. Continuous high-pitched or low-pitched tinnitus maybe the first symptom of an acousricneuroma and may precede loss of hearing or disturbance of equilibrium. Syphilis of the central nervous system may produce tinnitus, usually high pitched and continuous.

Some types of tinnitus are neurogenic or functional in origin. They have no characteristic sound. When a person hears organized sounds (such as voice or music) when no sound is present, he is said to have auditory hallucinations. Auditory hallucinations may occur in psychotic patients.

Certain muscular sounds in the head and neck may be heard by the patient and disturb him. Chewing, stretching the neck, tight closing of the eyes, or tight clenching of the jaws produce sounds that any of us can hear.

### *Objective Tinnitus*

Objective tinnitus is nothing but the patient's tinnitus that can be heard by the examiner. Audible tinnitus should be suspected when tinnitus is blowing in character and coincides with respiration; when it is pulsating, biphasic, and rough in character; or when there is rapid succession of clicking sounds. A blowing tinnitus, which coincides with respiration, usually indicates an abnormally patent Eustachian tube. Most such instances of tinnitus are of short duration.

Rarely, a patient will have tinnitus characterized by a series of sharp, regular clicks heard for several seconds or several minutes at a time. This type of tinnitus is almost always intermittent. The cause for this is not definitely known.

An audible tinnitus that is pulsating and synchronous with the heartbeat almost always indicates an arteriovenous aneurysm somewhere in the head or neck. Rarely a carotid bruit is audible. The most common site of arteriovenous aneurysm causing audible tinnitus are intracranial or are vessels immediately in front of the ear (anterior auricular artery).

Estimates of the incidence of tinnitus severity is likely to lead to medical consultation range from two percent to seven percent of the adult population (Office of Population Censuses and Survey's, 1981 cited in Axelsson, A., and Ringdahl, A., 1989; Smith and Coles, 1987; cited in Axelsson, A., and Ringdahl, A., 1989). Reports on age- and-gender-based differences in the prevalence of tinnitus are inconsistent in the literature. In general, there seems to be a decrease in gender differences of tinnitus in later life (Axelsson and Ringdahl, 1989). Reed (1960) reported that the prevalence of tinnitus was approximately equal between the genders up to the age of 70 years.

Coles (1984) (cited in Axelsson, A., and Ringdahl, A., 1989) found a small, but significant trend for a prevalence of tinnitus in females and suggested that tinnitus is commoner in women, most likely balanced by the greater noise exposure of men. The prevalence of tinnitus was greater in females below the age of 40 years, and the reverse was true for women over 40 years.

## **LOCALIZATION OF TINNITUS**

Left-sided localization of tinnitus is commoner than right-sided in clinical populations, according to Taylor-Walsh (1984) (cited in Axelsson, A., 1995). In a general population reporting tinnitus, the difference is found to be less pronounced. In a British population survey (Coles, et al., 1981; cited in Axelsson, A., 1995) left-sided localization was somewhat more prevalent than right-sided. Erlandsson, Hallberg and Axelsson (1992) noticed that patients with considerable low levels of mood more often had tinnitus located to the left ear. The right hemisphere is dominant regarding emotional experiences, and qualitative differences in the capacity of integrating and discriminating sensory input were mentioned by the authors as some of the causes of the commoner left-sided localization of tinnitus.

## **PSYCHOLOGICAL PROFILES OF PATIENTS WITH TINNITUS**

Tinnitus is a multifaceted phenomenon, resulting in a myriad of complaints from sleep disturbances to problems in concentration (Tyler and Baker, 1983). A factor analytic approach has demonstrated sub-classifications within a range of tinnitus complaints (Jakes, Hallam, Chambers and Hinchcliffe, 1985).

Tinnitus is a problem that causes much psychological disturbance in a patient's daily routine. A patient's disturbance from tinnitus may vary from mild irritation to suicidal distress. Patients report disturbances in sleep, feelings of depression, stress and excessive anxiety. Tinnitus can impair the quality of life of individuals and their family, leading to psychological complications. A number of studies using factor analytical descriptions of complaints have indicated factors such as emotional and cognitive distress, sleep disturbances, auditory perceptual difficulties, social consequences of tinnitus, perceived negative attitudes, intrusiveness, inability to ignore and to maintain concentration (Jakes, Hallam, Chambers and Hinchcliffe, 1985; Hallam, Jakes and Hinchcliffe, 1988; cited in Erlandsson, S.I. 2000); Kuk, Tyler, Russel and Jordan, 1990; Sweetow and Levy. 1990; Henry, Bowen and Haralambous, 1991;

cited in Erlandson 2000; Halford and Anderson, 1991; Hiller and Goebel, 1992; cited in Erlandsson, S.I. 2000; Erlandsson, Hallberg and Axelsson, 1992).

Cognitive distortions and emotional distress, found in subjects with severe tinnitus, imply that there are similarities between cognitive, emotional aspects of depression and tinnitus. Cognitive disturbances of individuals who are depressed are described and identified as problems in concentration, attention, sleep, learning and implicit memory (Eysenck and Mogg, 1992; cited in Erlandsson, S.I. 2000). Difficulties in attention and impaired information processing might lead to a form of sensory deprivation. Attention to the tinnitus brings about distress if it is thought to be associated with something threatening (tumor) or if it interferes with important activities (listening to conversation, sleep, concentration, etc.).

Severe form of tinnitus is generally known to develop a deeper form of depression. Johnston and Walker (1996) (cited in Erlandsson, S.I. 2000) highlighted the importance of tracing signs and symptoms of depression and suicidality in geriatrics. Among risk factors identified, patients who had a history of depression and alcohol abuse were found to have impaired ability to communicate,

interactable tinnitus and feelings of helplessness. A review of follow-up studies showed that lifetime incidence of suicide among depressed patients is 15 percent (Guze and Robins, 1970 cited in Erlandsson, S.I. 2000).

According to Selye (1976) (cited in Erlandsson, S.I. 2000) the constant pressure from the varying states of stress and distress in modern life can cause the patient to be constantly mobilized for action. This mobilization produces various physical disorders like tinnitus. Tinnitus is considered a stressful experience (House, 1985; cited in Erlandsson, S.I. 2000). Some patients' histories include stress as the precipitating factor in the onset of tinnitus. For patients who begin to hear head noise, stress is said to be generated about the meaning of the noise.

Sleep disturbance is a frequent complaint of tinnitus sufferers, indeed some patients regarded it as an integral element of the experience of tinnitus (McKenna, 2000; cited in Tyler, R.S. 2000). Disturbance of sleep is reported by approximately one-half of individuals complaining of tinnitus (Tyler and Baker, 1983; Jakes, Hallam and Hinchcliffe, 1985, cited in Tyler, R.S., 2000; Axelsson and Ringdahl, 1989). Subjects with tinnitus in comparison with a

nontinnitus, hearing-impaired control group were found by Harrop-Griffith (1987) (cited in Tyler, R.S. 2000) to report significantly more difficulties with sleep. Erlandsson, Hallberg and Axelsson (1992) found that sleep disturbances had larger deviation than other variables included in a tinnitus severity questionnaire, which indicates a tinnitus distress profile that is heterogenous. Dineen-Wagner, Lorian and Shipley (1983) (cited in Tyler, R.S. 2000) reported that sleep disturbances is linked to old age per se, and in some patients it is also linked to tinnitus because the prevalence of tinnitus increases with age.

## **ASSESSMENT OF TINNITUS**

In the literature, assessments of tinnitus for the evaluation of treatment effects have mainly focused on the loudness and the severity of the complaints, its intrusiveness and the negative impact of tinnitus on the psychological well-being of the individual.

For certain individuals their tinnitus is a major handicap; for others a trivial concern. Tinnitus like pain is a subjective state and trying to objectively assess the severity is problematic. Audiological techniques to match subjective loudness to a machine produced noise



may offer little help, in **that** sound intensity matches can bear little correspondence to subjective complaint (Meikle and Taylor-Walsh, 1984).

Such a seemingly intangible dimension may provide problems in classification for the clinician and researcher alike. In practice, a clinician makes a global evaluation of severity, the validity of which will depend upon their knowledge of tinnitus, and the time available for examination. The researcher has tended to use individual questions relating to loudness or tolerance, with a line to mark or a set of alternative responses to choose from. Basing assessments on single questions can be unreliable; and the patient is likely to find difficulty in expressing their tinnitus in absolute terms to a specialist as they have no other tinnitus with which to compare it but their own.

Hall and Haynes (2001) focus the discussion on the consultation and associated diagnostic audiologic assessment. The patient may first present to the otolaryngologist upon referral from another physician, to the audiologist for an audiologic assessment specifically for a tinnitus consultation. In-depth history is obtained, including presence of hearing loss, onset of hearing loss, and history of vertigo, characteristics of tinnitus including pulsatile or non-

pulsatile, constant or intermittent and severity are important to document. A history of occupational or recreational noise exposure is documented.

Audiologists may first encounter the tinnitus patient in a scheduled formal tinnitus consultation. The consultation with a health care professional, and a diagnostic audiologic and tinnitus assessment are among the recommendations that follow a detailed medical and audiologic history.

Hall and Haynes (2001) suggest the following audiologic assessment for patients with tinnitus.

*Audiologic test battery*

- \* Pure tone audiometry for octave frequencies from 250 to 10,000 Hz, and inter-octave frequencies of 1500, 3000 and 6000 Hz.
- \* Word recognition performance at the patient's most comfortable level (MCL)
- \* Immittance measurements (tympanometry) but acoustic reflex thresholds only with caution.

- \* Distortion Product Otoacoustic Emissions (DPOAEs) to assess outer hair cell integrity and function.

## **TINNITUS ASSESSMENT**

Apart from the regular audiologic evaluation, Hall and Haynes (2001) suggest the following for the assessment of tinnitus.

- \* Pitch match for most bothersome tinnitus using pure tone or narrowband noise signals from 125 to 10,000 Hz presented at 5 to 10 dB above audiometric threshold. Tinnitus pitch match is performed for each ear although, it is rarely an exact indication of tinnitus frequency.
- \* Loudness match to estimate the perceived loudness of the tinnitus, beginning below threshold at the estimated pitch of the tinnitus. The signal is increased in 2 dB steps until the patient states that the external signal is at an equivalent level to their tinnitus. This procedure is performed for each ear, and for each tinnitus sound identified by the patient.
- \* Minimum masking level to determine the effects of a masking noise on the perception of tinnitus (e.g. whether it becomes louder or softer, or can be masked). While noise is first presented at a level below the patient's threshold, and then

increased in 5 dB steps. Patient reports any change in Hearing level in the tinnitus ear.

- \* Loudness discomfort level (LDL) to determine tolerance for sound measured with pure tones and live-voice speech signals.

Hall and Haynes (2001) reviewed data for a total of over 236 patients evaluated in a medical centre. There were substantially more males than females. The age range was from 21 to 84 years. Hearing loss especially in the high frequency region, was clearly characteristic of the group, although a small proportion of the patients had hearing sensitivity within normal limits for all audiometric frequencies. In selected patients, high frequency audiometry confirmed abnormal thresholds above 8000 Hz, usually coinciding with the perceived tinnitus pitch.

Majority of the patients described their tinnitus as singing, high toned or cricket sound. Most patients noted tinnitus either in both ears or in their head. Among those describing unilateral tinnitus, slightly more noted the left ear than the right ear. The modal frequency matched to tinnitus for the group, was in a high frequency region from 2000 to 8000 Hz. Importantly, tinnitus loudness was on

an average less than 10 dB above the audiometric threshold for both ears (Hall and Haynes, 2001).

The evaluation of a tinnitus complaint should include the standard elements of any medical evaluation with close attention to the circumstances surrounding the onset of the tinnitus, including any association with new medications, psychosocial stress, a concurrent medical illness, other auditory, vestibular or neurological complaints or head, neck or dental disorder. Exacerbating and remitting factors should be sought including diurnal variations in the tinnitus. According to Hall and Haynes (2001), the most important features of the tinnitus percept that must be ascertained are -

- 1) Its quality, particularly whether or not it is pulsatile.
- 2) Its location, whether it is heard in one ear or not,
- 3) Its variability, whether it is intermittent or constant, and
- 4) Its pitch, whether it is predominantly low or high frequency in character.

There has been an increasing interest among health care providers in quantifying the handicapping consequences of a disease state. That is, clinicians are interested not only in the direct effects of a particular condition (eg., pain, severity) but also the impact this

condition, as a symptom, has on the patient's general well-being. In addition, measurement scales have ranged from general quality-of-life scales to disorder-specific scales (Newman, Jacobson and Spitzer, 1996).

Disorder-specific self-report measures are emerging as useful clinical tools in audiology and otology for two reasons. Firstly, they help substantiate patients auditory and balance complaints not readily apparent by audiometric and vestibulometric testing. Secondly, self-perceived handicap scales serve as functional outcome measures when used in a pre-treatment and post-treatment paradigm, with reduction in self-perceived handicap as the desired positive outcome. In this connection, self-report measures have been used to document benefit derived, following the provision of hearing aids (Cox and Gihmore, 1990; cited in Newman, C.W., Jacobson, G.P., and Spitzer, J.B. 1996), counselling based aural rehabilitation and balance retraining and vestibular rehabilitation (Newman and Jacobson, 1993; cited in Newman, C.W., Jacobson, G.P., and Spitzer, J.B. 1996).

In the past decade, the psychological aspects of tinnitus have received increasing attention. However, further investigation is

warranted of the range of problems that patients associated with their tinnitus. The severity of tinnitus remains difficult to determine because of measurement problems, tinnitus handicap which may be better understood through the investigation of complaints related to tinnitus. The term handicap has been used here following the World Health Organization (1980) (cited in Erlandsson, S.I., Hallberg, L.R.M., and Axelsson, A., 1992) definition, implying the effects of the condition on the life of the individual.

In addition to hearing and balance measures, self-report tinnitus handicap methods are gaining recognition as tools for quantifying the impact of tinnitus on everyday life. Although, a number of tinnitus scales are available, they measure a limited number of constructs and use rating methods or scales that are confusing to certain patients, or are difficult to score and interpret. For example, no internal consistency and reliability data were reported for the Tinnitus Handicap/Support Questionnaire (Erlandsson, Hallberg and Axelsson, 1992), Tinnitus Effects Questionnaire (Hallam, Jakes and Hinchcliffe, 1988), and the Tinnitus Severity Questionnaire (Coles, Lutman, Axelsson and Hazel, 1992; cited in Newman, C.W., Jacobson, G.P., and Spitzer, J.B. 1996). Although, the Tinnitus Handicap Questionnaires (Kuk. Tyler. Russel

and Jordan, 1990) is broad in scope and focusses on the social, emotional and behavioral effects of tinnitus (factor 1), tinnitus and hearing (factor 2) and the patient's outlook on tinnitus (factor 3). The psychometric adequacy of factor 3, as an independent measure is questionable. Furthermore, the response method (choosing a number between 0 and 100 that corresponds with subjective strength of belief) is unwieldy or esoteric to some patients (Streiner and Norman, 1994; cited in Newman, C.W., Jacobson, G.P., and Spitzer, J.B. 1996).

Most recently, the Tinnitus Reaction Questionnaire (Wilson, Henry, Bowen and Haralambous, 1991; cited in Newman, C.W., Jacobson, G.P., and Spitzer, J.B. 1996) was developed, having good internal consistency reliability and test-retest-reliability. The major weakness associated with the latter scale is that it focus solely on the psychological construct of distress (Wilson, Henry, Bowen and Haralambous, 1991; cited in Newman, C.W., Jacobson, G.P., and Spitzer, J.B. 1996).

In a questionnaire investigation of an average sample of the population in England (Institute of Hearing Research, 1981; cited in Tyler, R.S., and Baker, L.J., 1983), approximately 17% stated that they had tinnitus. About 2% claimed that it was severe and 0.5% that



it seriously disturbed their way of life. An attempt to analyze the difficulties experienced by tinnitus sufferers has been made by Tyler and Baker (1983). These authors asked a number of members of a tinnitus self-help association to list difficulties that they attributed to their tinnitus. In these patients a large number of subjective symptoms were reported.

Lindberg, Lyttkens, Melin and Scott (1984) investigated 1091 patients using a questionnaire, 59% of them claimed that they were troubled by tinnitus. Among patients with both subjective hearing loss and tinnitus, 23% stated that tinnitus was the greater problem and 38% that their tinnitus and hearing loss were equally troublesome. Stress symptoms such as headache and sleep disturbances were correlated to tinnitus.

Jakes, Hallam, Chambers and Hinchcliffe (1985) conducted a factor-analytical study of various self-rated complaints about tinnitus, audiometric measurements of tinnitus intensity and neuro-otological symptoms. They described two main factors obtained out of the eleven original factors; the 'intrusiveness of tinnitus' related to the sensory qualities of the tinnitus and the 'distress due to tinnitus' as affective dimensions. Recently, Kuk, Tyler, Russel and Jordan

(1990) performed a psychometric study of a tinnitus handicap questionnaire which included 27 items in a reliable and valid version of the test. The questionnaire is judged to be useful for the comparison of a patient's tinnitus handicap with the norms, for the identification of special areas of handicap and for evaluation of the effect of treatment programmes.

The relationship between audiological, psychological and psychosomatic factors (self-assessment of vertigo and headache and the perceived severity of tinnitus) was investigated by Erlandsson, Hallberg and Axelsson (1990) in a clinical population of 163 subjects. Audiological descriptives comprised pure tone average (dB HL), etiology of hearing loss, duration of tinnitus and tinnitus localization. Perceived severity of tinnitus was assessed with a questionnaire focusing on impact of tinnitus on aspects of quality of life, concentration and sleep. A 28 items handicap and support questionnaire was used and factor analyzed, resulting in three factors : perceived attitudes, social support and disability or handicap. Tinnitus severity was significantly related to perceived attitudes. The influence of social support on tinnitus severity did not seem to be crucial. The results showed that significantly more women than men complained about vertigo. Unilateral tinnitus localization was also

more prevalent in females. The subjects with multiple tinnitus localizations were older and had significantly more sleep disturbances than subjects with tinnitus localized to the ears only. In accordance with previously reported observations, the frequency of headaches was strongly correlated with the severity of tinnitus.

The objective assessment of the severity of a subjective state like tinnitus is problematic, since sound-intensity matching may not correspond to subjective complaints (Meikle and Taylor-Walsh, 1984). That is why subjective questionnaires are necessary for a full understanding of the patients problems and the severity of tinnitus complaints. Therefore, in recent years several questionnaires have been developed to measure tinnitus complaints regarding its assumed multi-dimensionality (Erlandsson, 1992). A few shorter questionnaires focus on a more global one-dimensional assessment of tinnitus severity (Hiller, et al. 1994), one of which is the Subjective Tinnitus Severity Scale (STSS) developed by Halford and Anderson (1991). This questionnaire was developed to test whether it was justified to measure tinnitus severity as a unitary concept. This scale measures tinnitus severity according to the degree to which tinnitus is intensive, prominent and distressing (Halford and Anderson, 1991) Halford and Anderson (1991) have carried out research into the

psychometric qualities of the STSS, such as reliability, validity and its relationship with questionnaires measuring anxiety and depression.

Examining the relationship between the STSS scores and audiometric loudness-matching techniques revealed a significant correlation of the scale with the tinnitus loudness. At the tinnitus frequency it was the threshold and loudness match that correlated with the STSS ( $r_2=0.39$ ,  $p<0.05$  and  $r_2=0.41$ ,  $p<0.05$ , respectively), while the tinnitus sensation level did not (Haiford and Anderson, 1991). In line with prior studies (Reich and Johnson, 1984; (cited in Erlandsson, S.I., 2000); Stephens and Hallam, 1985, (cited in Erlandsson, S.I., 2000) they found that tinnitus patients showed increased psychopathology.

The authors argued that the STSS proved its usefulness as a simple, reliable and valid method. Since, the clinical sample was small, extensive clinical data on different populations were recommended by the authors.

A scale explicitly bringing out the multi-dimensionality of tinnitus, bears a better clinical application. One of them is the Tinnitus Questionnaire (TQ) produced by Hallam, Jakes and

Hinchcliffe (1980) (cited in Erlandsson, S.I., 2000) which contains a broader spectrum on tinnitus related complaints. This scale contains six factors, reflecting the multifaceted nature of chronic tinnitus, derived from both factor analysis and clinical evidence (Hiller and Goebel, 1992; cited in Erlandsson, S.I., 2000; Hiller, et al. 1994; cited in Erlandsson, S.I., 2000).

The tinnitus effects questionnaires (sometimes called simply the tinnitus questionnaire) was developed by Hallam, Jakes and Hinchcliffe (1988) (cited in Erlandsson, S.T., 2000) ; Hallam (1996) (cited in Erlandsson, S.T., 2000) studied the severity as a measure of dimensions of complaints about tinnitus. It consisted of 52 items with five subscales including sleep disturbance, emotional distress, auditory perceptual difficulties, intrusiveness and somatic complaints. The respondents were asked to indicate their agreement by aiding to one of the three response alternatives - "true", "partly true" or "not true". Evidence of good psychometric properties was presented, including high internal consistency for each of the subscales. Cronbach's alpha was found to be 0.91, indicating very good internal consistency. The test-retest correlation was 0.91 indicating very good stability over time.

Similarly, the Tinnitus Cognitions Questionnaire is a self-report scale designed by Wilson and Henry (1998) (cited in Erlandsson, S.I., 2000) to assess the kinds of cognitive abilities in which people report that they engage, in relation to their tinnitus. This questionnaire consisted of 26 items of which 13 items were negative thoughts and the remaining 13 items were positive thoughts each rated on a five point rating scale. The Tinnitus Cognitions Questionnaire is considered as a useful measure of the reported cognitive responses to tinnitus.

Newman, Jacobson and Spitzer (1996) administered the 45 item alpha version of the Tinnitus Handicap Inventory (THI) to 84 patients reporting tinnitus as their primary complaint or secondary to hearing loss. The alpha THI consisted of 45 items derived empirically from case histories of patients with tinnitus. In addition, some of the items were adapted from existing hearing handicap scales (Ventry and Weinstein, 1982; cited in Newman, C.W., Jacobson, G.P., and Spitzer, J.B., 1996), dizziness scales like dizziness handicap inventory by Jacobson and Newman (1990) (cited in Newman, C.W., Jacobson, G.P., and Spitzer, J.B., 1996) and from symptom categories described by Tyler and Baker (1983). In the second investigation of the same study, 66 subjects (37 men and 29 women), also reporting

tinnitus, completed the 25 item beta version of Tinnitus handicap inventory (THI) with the items grouped into functional, emotional and catastrophic subscales. Convergent validity was assessed using another measure of perceived tinnitus handicap i.e., the Tinnitus Handicap Questionnaire developed by Kuk, Tyler, Russel and Jordan (1990). Construct validity was assessed using symptom rating scales and perceived tinnitus pitch and loudness judgements. The total scale yielded excellent internal consistency reliability. No significant age or gender effects were seen. Weak correlations were observed between the THI and pitch and loudness judgements. Significant correlations were found between the THI and the symptom rating scales.

Sanchez and Stephens (1997) investigated difficulties associated with tinnitus in a large sample of patients using an open-ended problem questionnaire. 473 patients referred to the Tinnitus Clinic of the Welsh Hearing Institute completed the Tinnitus Problem Questionnaire (Tyler and Baker, 1983). Responses of only 436 patients were taken, 224 women and 212 men, whose average age was 57.1 years. Thirty most common difficulties attributed to tinnitus were described. There was broad agreement between the problems reported in this clinic based study and those reported by a self-help

group sample (Tyler and Baker, 1983). Analysis of these responses into groups based on psychological (30.1%), hearing (223.5%), health (20.7%), sleep (14.6%) and situational (11.1%) difficulties highlights the need for recognition of the global consequences of tinnitus to many patients and for a broadly based tinnitus management.



## **METHOD**

The aim of the present study was to develop a self-report tinnitus handicap questionnaire (SR-THQ). The present study was carried out in the following two stages -

Stage-I : The development of the self-report tinnitus handicap questionnaire (SR-THQ) was undertaken.

### ***MATERIAL DEVELOPMENT***

The items for the development of questionnaire were derived from case histories of patients with tinnitus. In addition some of the items were adapted from symptom categories described by Tyler and Baker (1983) and also from existing questionnaires like the tinnitus handicap inventory (Newman, Jacobson, and Spitzer, 1996) and the tinnitus history (developed by Oregon Hearing Research Centre, 2000). The self-report tinnitus handicap questionnaire (SR-THQ) thus, developed from the above literature consisted of 25 questions.

The questions in the SR-THQ were grouped under three subscales,

- (i) Functional subscale with 17 questions
- (ii) Emotional subscale with 6 questions
- (iii) Catastrophic subscale with 2 questions

Scoring : Each 'yes' response = 4 points

Each 'sometimes' response = 2 points

Each 'no' response = 0 points

In addition, three subjective rating scales were also included in the self-reporting tinnitus handicap questionnaire. They are

- (1) Subjective tinnitus pitch rating (TPR) scale.

The subjects were instructed to indicate the pitch of their tinnitus on a scale of 1 to 10, i.e., '1' being very low pitched and '10' being very high pitched.

- (2) Subjective tinnitus loudness rating (TLR) scale.

The subjects were instructed to indicate the loudness of their tinnitus on a scale of 1 to 10, i.e. '1' being very soft and '10' being very loud.

### (3) Subjective tinnitus severity rating (TSR) scale

The subjects were instructed to indicate the overall severity of their tinnitus based on the pitch, loudness and duration of their tinnitus i.e. '1' being less severe and '10' being highly severe.

This was initially administered on ten subjects with a complaint of tinnitus as primary complaint or secondary to hearing loss, as a part of the pilot study. Based on their responses, the questions were modified accordingly. (See Appendix for the Self-report tinnitus handicap questionnaire).

**Stage-II** : The relationship between the subjective measurements of tinnitus pitch and loudness measures with the self-report tinnitus handicap questionnaire (SR-THQ) was investigated.

## **SUBJECTS**

Forty subjects (28 males and 12 females) in the age range of 20-60 years participated in the study.

### *Selection Criteria*

All subjects who reported of tinnitus at the time of audiologic examination either as their primary complaint or secondary to hearing loss were selected for the study.

### **INSTRUMENTATION/MATERIAL**

1. The developed self-report tinnitus handicap questionnaire was administered on the selected subjects.
2. A calibrated diagnostic audiometer (Madsen Orbiter-922) was used for the evaluation of tinnitus and for audiometric evaluation.
3. A calibrated immittance meter GSI-33 Middle ear analyzer was used for the evaluation of middle ear function.

### **TEST ENVIRONMENT**

The test was carried out in an acoustically sound treated, air-conditioned two-room situation with noise within permissible limits (re. ANSI-1991; cited in Wilber, 1994). The self-report tinnitus

handicap questionnaire (SR-THQ) was administered in an acoustically sound treated single room situation.

## **PROCEDURE**

The aim of the present study was to develop a self-report tinnitus handicap questionnaire that will be brief, easy to administer and interpret and thus, provide direction for opting an appropriate management procedure.

The following steps were adopted to carry out the study -

- I. Administration of the self-report tinnitus handicap questionnaire
- II. Evaluation of tinnitus
  - Otoscopic examination
  - Audiometric evaluation
  - Immittance evaluation
  - Assessment of tinnitus

**(I) ADMINISTRATION OF THE SELF-REPORT TINNITUS HANDICAP QUESTIONNAIRE**

The handicap questionnaire was administered on forty patients who reported of tinnitus in the age range of 20-60 years.

**Scoring** : Scoring of self-report Tinnitus Handicap Questionnaire developed was identical to Tinnitus Handicap Inventory (developed by Newman, Jacobson and Spitzer, 1996). That is, each 'yes' response was awarded four points, each 'sometimes' responses was awarded two points and 'no' response was awarded zero point.

**(II) EVALUATION OF TINNITUS**

- 1) *Otological examination* - Initial otological examination was done by an otologist to rule out contraindications for carrying out audiological evaluation.
- 2) *Audiometric evaluation* - A detailed audiometric evaluation was carried out including -
  - Pure tone audiometry (Pure tone thresholds)
  - Speech audiometry (Speech reception thresholds and Speech recognition scores)

Evaluation of Uncomfortable loudness level (UCL) for speech.

**3) *Immittance evaluation***

Immittance evaluation was done which included -

Tympanometry

Reflexometry (including Acoustic Reflex Thresholds and

Reflex Decay Test)

**4) *Assessment of Tinnitus***

Assessment of patient's predominant tinnitus (i.e., if a patient had multiple tinnitus or tinnitus in both the ears, that tinnitus which was heard predominantly was referred to as predominant tinnitus) was done after administration of the self-report tinnitus handicap questionnaire which included -

- (i) Quality judgement of tinnitus
- (ii) Assessment of tinnitus pitch
- (iii) Assessment of tinnitus loudness

*(i) Quality judgement of tinnitus*

Pure tones, narrow band noise and wide band noise were presented, in that order, to the contralateral ear (in unilateral subjects of tinnitus and in bilateral subjects the ear opposite to that ear with the predominant tinnitus) as reported by the patient were presented. The patient was asked to indicate which his/her tinnitus was most like.

*(ii) Assessment of tinnitus pitch*

Tinnitus pitch was determined by presenting signal ipsilaterally at 1000 Hz and in octave steps above this, until an approximate pitch was obtained. The most predominant tinnitus pitch was assessed using a two alternate forced choice method. The stimulus was selected as pure tone or narrow band noise depending on the history or description of his tinnitus. The stimulus was presented 10 dB above the subjects' pure tone threshold. A comparison of low-pitch with that of a sound of a drum and a high-pitch with that of a bell were given as illustrations. In order to familiarize, the subjects, with low-pitch and high-pitch, the subjects were made to hear a low-frequency signal and a high-frequency signal respectively. Later,



they were asked to give a best match of their tinnitus. The subjects were instructed to indicate, when they perceived pitch of the signal presented, to be equal or closest to their tinnitus pitch.

*(iii) Assessment of tinnitus loudness*

Once the pitch was determined, the loudness of the predominant tinnitus was determined using tinnitus loudness matching wherein the subjects were asked to give a best possible match for the loudness of their tinnitus pitch matched frequency. The loudness thus obtained was converted to dB SL (reference threshold). The subjects were instructed to indicate when they perceived the loudness of the signal presented to be equal to the perceived loudness of their tinnitus.

## RESULTS AND DISCUSSION

The data thus obtained after administration of the self-report handicap questionnaire (SR-THQ) and the evaluation of tinnitus were statistically analyzed in two categories :

I : To see if the self-report tinnitus handicap questionnaire is psychometrically robust, demonstrating adequate reliability and validity.

II : Statistical analysis was also done, In order to study the relationship between subjective measurements of tinnitus using tinnitus pitch and tinnitus loudness matching procedures with that of the self-report tinnitus handicap questionnaire developed.

Forty subjects (28 males and 12 females) in the age range of 20-60 years, who reported of tinnitus as their primary complaint or secondary to hearing loss, participated in the study.

Table-1: Items comprising the self-report tinnitus handicap questionnaire with associated endorsement rates and item total correlations

| si.<br>No. | Items   | Endorsement rates<br>(in %) |               |    | Item-<br>total<br>corre-<br>lation |
|------------|---|-----------------------------|---------------|----|------------------------------------|
|            |   | Yes                         | Some<br>times | No |                                    |
| 1.         | Do you complaint tinnitus as a significant problem for you? # | 35                          | 35            | 30 | 0.621                              |
| 2.         | Do you hear your tinnitus/sounds all the time? #              | 60                          | 25            | 15 | 0.266                              |
| 3.         | Have you noticed changes in the loudness of your tinnitus? #  | 65                          | 25            | 15 | 0.35                               |
| 4.         | Do you feel that you can no longer cope with your tinnitus? • | 50                          | 15            | 35 | 0.366                              |
| 5.         | Does tinnitus cause you trouble getting to sleep? #           | 15                          | 20            | 65 | 0.553                              |
| 6.         | Does tinnitus cause you trouble staying asleep? #             | 0                           | 10            | 90 | 0.085                              |
| 7.         | Do you feel your tinnitus is annoying? *                      | 25                          | 40            | 35 | 0.450                              |
| 8.         | Does tinnitus place stress on you? *                          | 15                          | 25            | 60 | 0.675                              |
| 9.         | Does tinnitus make you uncomfortable to be in quiet? #        | 35                          | 55            | 10 | 0.652                              |
| 10.        | Does tinnitus make you feel difficult to concentrate? #       | 40                          | 35            | 25 | 0.502                              |

|     |   |    |    |    |        |
|-----|---|----|----|----|--------|
| 11. | Does tinnitus make you feel harder to interact pleasantly with others? #                        | 10 | 15 | 75 | 0.647  |
| 12. | Does tinnitus make you feel depressed? *  | 70 | 20 | 10 | 0.605  |
| 13. | Does your tinnitus interfere with your job or household responsibilities? #                     | 15 | 10 | 75 | 0.686  |
| 14. | Do you feel, as though you cannot escape tinnitus?•   | 60 | 25 | 15 | 0.670  |
| 15. | Because of your tinnitus do you feel frustrated? *  | 20 | 60 | 20 | 0.601  |
| 16. | Do you find it difficult to focus your attention away from your tinnitus and on other things? # | 15 | 60 | 25 | 0.657  |
| 17. | Does tinnitus make you feel irritable? *  | 10 | 20 | 70 | 0.739  |
| 18. | Does tinnitus make you feel tired or ill?#  | 10 | 15 | 75 | 0.627  |
| 19. | Does tinnitus make you feel anxious? *  | 15 | 30 | 55 | 0.715  |
| 20. | Does tinnitus make you find it difficult to relax? #  | 20 | 15 | 65 | 0.759  |
| 21. | Does tinnitus cause you headache? #   | 60 | 30 | 10 | 0.583  |
| 22. | Do you have difficulty in understanding in speech when you have tinnitus #                      | 25 | 25 | 50 | 0.659  |
| 23. | Do you have difficulty in understanding speech in noisy surroundings? #                         | 55 | 20 | 25 | 0.542  |
| 24. | Do you experience pain or plugging in the ear? #  | 20 | 20 | 60 | -0.112 |

|     |   |    |    |    |        |
|-----|---|----|----|----|--------|
| 25. | Had any medication caused you to experience changes in your tinnitus? # | 25 | 10 | 65 | -0.070 |
|-----|---|----|----|----|--------|

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# - represents items in the functional subscale

\* - represents items in the emotional subscale

A - represents items in the catastrophic subscale

Table-1 displays the items comprising the final version of the self-report tinnitus handicap questionnaire with associated endorsement rates and item-total correlations. Item-total correlations ranged from - 0.112 to 0.759. Items with the highest correlations were considered most representative of the total score of the questionnaire developed. Accordingly, item 20 ("Does tinnitus make you feel difficult to relax?") is most representative of the questionnaire. In the lowest range of -0.112 of the item 24 ("Do you experience pain or plugging in the ear?") was considered least representative of the total items related to tinnitus.

Table-2 : Mean and standard deviation (SD) of total scale, functional sub-scale, emotional sub-scale and catastrophic sub-scale in the self-report tinnitus handicap questionnaire(SR-THQ)

|              | Mean  | SD    |
|--------------|-------|-------|
| Total scale  | 44.30 | 19.44 |
| Functional   | 26.55 | 11.26 |
| Emotional    | 12.55 | 6.77  |
| Catastrophic | 5.2   | 2.78  |

Table-2 displays the mean, standard deviation and range of scores obtained on the self-report tinnitus handicap questionnaire (SR-THQ). The large standard deviations associated with the self-report tinnitus handicap questionnaire shows that the reactions to tinnitus are varied among individuals. In addition, the observed wide range of scores demonstrated that the sample was heterogeneous with respect to self-perceived tinnitus handicap.

#### ***INTERNAL CONSISTENCY RELIABILITY***

Cronbach's alpha reliability estimates were calculated to determine the internal consistency reliability of the final version of the self-report tinnitus handicap questionnaire. A Cronbach's alpha of 0.93 was obtained for the 25 item self-report tinnitus handicap questionnaire, indicating excellent internal consistency reliability. As shown in Table-1, the item-total correlations ranged from -0.112 to 0.759. Certain questions with low-item correlation were retained because of their high content validity. For example item 6 ("Does tinnitus cause you trouble getting to sleep?"), item 3 ("Have you noticed changes in the loudness of your tinnitus?"), item 23 ("Do you have difficulty in understanding speech in noisy surroundings?").

The internal consistency reliability for each subscale was analyzed separately. Cronbach's alpha was 0.86 for items constituting the functional subscale (item total correlations ranging from -0.112 to 0.759). Cronbach's alpha was 0.87 for the emotional subscale (item total correlations ranging from 0.450 to 0.715). Cronbach's alpha was 0.68 for the catastrophic subscale (item-total correlations ranging from 0.366 to 0.670). Cronbach's alpha, as expected, was lower for the catastrophic subscale ( $\alpha = 0.68$ ) because of the smaller number of items constituting this dimension. However, it was decided to retain the latter subscale because of its potential use for identifying the most handicapped individuals requiring more aggressive treatment. That is, affirmative responses to specific items on the catastrophic subscale was considered to represent the most severe reactions to the tinnitus sensation (e.g., loss of control, unable to cope), alerting the clinician that the patient may require referral to other professionals. These items were retained again for another reason that, it was found to represent the most severe reactions to the tinnitus sensation (e.g., unable to cope, unable to ignore), according to a study conducted by Tyler & Baker (1983) to analyze the difficulties experienced by patients with tinnitus, In addition, the items constituting the catastrophic subscale may represent those areas most amenable to treatment and may produce the

most dramatic effects if changes are observed. Items with the highest correlations within each subscale were considered most representative of the total subscale score.

Table-3: Pearson product moment correlation among the self-report tinnitus handicap questionnaire.

|              | Total   | Functional | Emotional | Catastrophic |
|--------------|---------|------------|-----------|--------------|
| Total scale  | 1.000   | **         | **        | **           |
| Functional   | 0.965** | 1.000      | **        | **           |
| Emotional    | 0.960   | 0.870**    | 1.000     | **           |
| Catastrophic | 0.739** | 0.577**    | 0.752**   | 1.000        |

•  $p < 0.05$ . \*\* $p < 0.01$

Table-3 summarizes the Pearson's co-efficient of correlation among the total self-report tinnitus handicap questionnaire score and subscale scores. The results revealed moderate to strong correlations ranging from  $r=0.577$  ( $p < 0.01$ ) to  $r=0.965$  ( $p < 0.01$ ). Items with the highest correlation of  $r=0.965$  of the functional subscale was considered most representative of the subscales in the self-report tinnitus handicap questionnaire. This goes in accordance with the study conducted by Newman, Jacobson and Spitzer (1996) who developed the Tinnitus Handicap Inventory, where in the functional subscale was considered the most representative of the Tinnitus



Handicap Inventory with the highest correlation of  $r=0.92$ . Thus, suggesting that the tinnitus severity is most hampering the patient's quality of life functionally (e. g, difficult to relax, interference with job or house hold responsibilities). Similarly, items with the highest correlations within each subscale are most representative of the total sub-scale score. Accordingly, item 20 (i.e. "Does tinnitus make you feel difficult to relax?") with an item- total correlation of  $r =0.759$  and item 13 (i.e. "Does your tinnitus interfere with your job or household responsibilities?") with an item-total correlation of  $r=0.686$  were most representative of the functional subscale. In the emotional subscale item 19 (i.e. "Does tinnitus make you feel anxious?") and item 8 (i.e. "Does tinnitus place stress on you?") were the most representative of the emotional subscale with item-total correlation of  $r=0.715$  and  $r=0.675$  respectively. Similarly, item M (i.e., "Do you feel as though you cannot escape tinnitus?") is the most representative of the catastrophic subscale with an item-total correlation of  $r=0.670$ .

*CONSTRUCT VALIDITY*

Table-4: Correlation co-efficient among self-report tinnitus handicap questionnaire (Total, functional, emotional, and catastrophic subscale) and tinnitus loudness rating (TLR) tinnitus pitch rating (TPR), duration and tinnitus severity rating (TSR)

\*\* $p < 0.01$ , \* $p < 0.05$

Table-4 summarizes the correlations among scores on the self-report tinnitus handicap questionnaire and the subjective tinnitus loudness rating, tinnitus pitch rating and overall tinnitus severity ratings. Low correlation was observed between the total score and tinnitus pitch rating ( $r=0.135$ ). Correlation was observed to be significant between both total score and tinnitus loudness rating ( $r=0.383$ ,  $p < 0.05$ ) and between the total score and duration ( $r=0.324$   $p < 0.05$ ). This finding supported the finding that by Kuk, Tylet, Russel and Jordan (1990) who conducted a survey of patients on a number of

tinnitus handicap questions. They found a moderately high correlation between the total handicap score and perceived tinnitus loudness rating ( $r = 0.57, p < 0.01$ ).

Amongst the three subscales, correlations were found to be significant between the emotional sub-scale and tinnitus loudness rating ( $r=0.461, p < 0.01$ ) and between the catastrophic subscale and tinnitus loudness rating ( $r=0.407, p < 0.01$ ). Low correlations were observed between the three subscales and the tinnitus pitch ratings.

Correlation was found to be significant between the total self-report tinnitus handicap questionnaire scores and the tinnitus severity rating ( $r=0.462, p < 0.01$ ). Correlations were found to be significant between emotional subscale and tinnitus severity rating (TSR) ( $r=0.476, p < 0.01$ ). Correlation was also observed to be significant between catastrophic subscale and tinnitus severity rating ( $r=0.498, p < 0.01$ ). Similarly, correlation was found to be significant between functional subscale and tinnitus severity rating ( $r=0.388, p < 0.05$ ). Amongst the three subscales, the catastrophic subscale indicated high correlations with the tinnitus severity rating ( $r=0.498$ ) than the emotional ( $r=0.476$ ) and functional subscale ( $r=0.388$ ).

Correlation was found to be significant between the total score and duration ( $r=0.375$ ,  $p<0.05$ ). Correlation between the three subscales and duration was found to be significant i.e., correlation between functional subscale and duration was 0.345 ( $p<0.05$ ), correlation between emotional subscale and duration was 0.362 ( $p<0.05$ ) and correlation between catastrophic subscale and duration was 0.341( $p<0.05$ ).

Table-5 : Correlation co-efficient among the self-report tinnitus handicap questionnaire (Total scale, functional, emotional and catastrophic sub-scale) and tinnitus pitch match (TPM) and tinnitus loudness match (TLM).

|              | Correlation | TPM   | TLM     |
|--------------|-------------|-------|---------|
| Total        | r           | 0.172 | 0.567** |
| Functional   | r           | 0.190 | 0.700** |
| Emotional    | r           | 0.150 | 0.663** |
| Catastrophic | r           | 0.187 | 0.667** |

\*\* $p<0.01$

Table-5, displays the correlation co-efficient among the self-report tinnitus handicap questionnaire score (SR-THQ) score and tinnitus pitch matching and tinnitus loudness matching. Low correlation was found between the total self-report tinnitus handicap questionnaire score and tinnitus pitch matching. Thus, indicating that

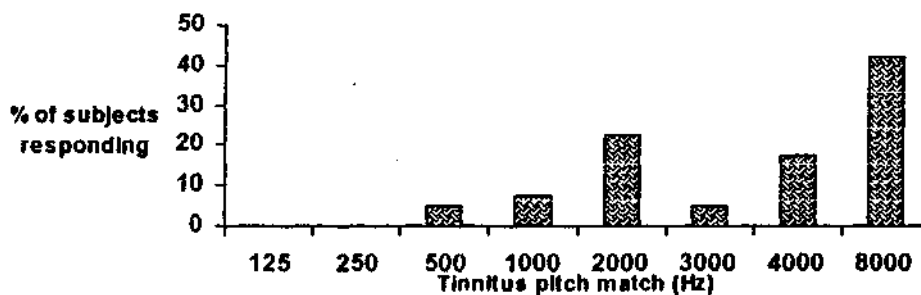
the severity of tinnitus is independent of the pitch as matched by the subjects during evaluation. Similarly low correlation was found between the three subscales of self-report tinnitus handicap questionnaire (i.e., Functional subscale, emotional subscale and catastrophic subscale) and the tinnitus pitch as matched by the subjects.

Correlation was found to be significant between the total self-report tinnitus handicap questionnaire score and tinnitus loudness as matched by the subjects ( $r=0.667$ ,  $p<0.01$ ) indicating that the severity of tinnitus is dependent on the perceived loudness of tinnitus. Correlation was also found significant between the three subscales and the tinnitus loudness as matched by the subjects during evaluation of tinnitus. Amongst the three subscales the correlation was found to be high between emotional subscale and tinnitus loudness ( $r= 0.007$ ,  $p< 0.01$ ). The correlation co-efficient of functional subscale and emotional subscale were,  $r- 0.567$  ( $p< 0.01$ ) and  $r— 0.663$  ( $p< 0.01$ ) respectively.

Thus, from the above results it could be inferred that the severity of tinnitus is independent of the pitch of tinnitus whereas it is highly dependent on the loudness of tinnitus. These findings are supported by the findings of Kuk, Tyler, Russel and Jordan (1989) who

also report of a relationship between tinnitus loudness and overall tinnitus handicap and found a moderately high correlation between the total handicap score and the perceived tinnitus loudness ( $r= 0.57$ ,  $p> 0.01$ ).

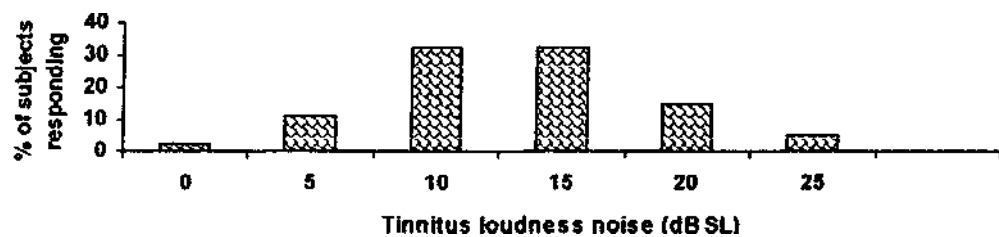
**Graph-1: Percentage of subjects responding for tinnitus pitch match**



Graph-1, shows the percentage of subjects matching the pitch of their tinnitus after the evaluation of tinnitus. It is clear that a high percentage of patients matched their tinnitus pitch at 8000Hz (42.5%), followed by 22.5% who matched at 2000Hz and 17.5% of them matched at 4000Hz. Thus, it can be observed that in most patients the tinnitus pitch is matched to a high frequency signal. This goes in accordance with a study done by Reed (1960) who noted that the most common frequency matched is about 3000 Hz. Also, Meikle (1995) reported that 33% matched their tinnitus to a tone between 3,500 Hz and 6,499 Hz. Hall and Haynes (2001) reported that the modal

frequency matched to tinnitus for a group of 236 patients, was in a high frequency region from 2000 to 8000 Hz.

**Graph-2: Percentage of subject responding for tinnitus loudness match**



Graph-2, shows the percentage of subjects matching the loudness of tinnitus after the evaluation of tinnitus. From the above it can be observed that high percentage of subjects (32.5%) have matched their loudness at 10 dBSL and 15 dBSL. Vernon (1977) has commented that the level of a pure tone equated in loudness to tinnitus was often less than 10 dB sensation level, even when the patients complained that their tinnitus was very loud. Similarly, Matsushira and Yamashita (1996) measured tinnitus loudness and the average loudness match was 13.5 dBSL. Tinnitus loudness was on an average less than 10 dB above the audiometric threshold for both ears as reported by Hall and Haynacs (2001).

## **RE-ORDERING OF HIE QUESTIONS IN THE SELF-REPORT TINNITUS HANDICAP QUESTIONNAIRE**

The questions in the self-report were later re-ordered based on the graded severity of tinnitus from more general to specific questions regarding their tinnitus. (See Appendix-1 for the self-report tinnitus handicap questionnaire).

### **IMPLICATIONS**

The self-report tinnitus handicap questionnaire (SR-TIIQ),

- 1) Will facilitate an audiologist to get a clearer picture of the problem of patients with tinnitus and to elicit information from the patients about different aspects of tinnitus.
- 2) Will help a professional to decide which factor (pitch, loudness or the duration of tinnitus) is contributing to the severity of the tinnitus.
- 3) Most importantly and most explicitly the self-report tinnitus handicap questionnaire and the assessment of tinnitus will aid a professional to opt for an appropriate management of tinnitus right from counseling and referral for selecting an appropriate management strategy.
- 4) A software programme can be created on the developed self-report tinnitus handicap questionnaire so that the patients with tinnitus can themselves score and grade the severity of their problem.



## SUMMARY AND CONCLUSION

Tinnitus is a seemingly intangible dimension and various attempts have been made to understand it on a more specific basis either by trying to measure it objectively or investigating it more subjectively.

There are several reasons for measuring tinnitus. However, it is important to have a clear rationale regarding why they are applied in specific situations. There are several good procedures for evaluating tinnitus. One of the outstanding characteristics of these measurements is the diverse responses that are observed across patients. This makes these measurements particularly important for routine clinical applications and clinical trials.

During the past few years, there has been a growing interest among health care providers to assess patient's functional status using self-report measures (Lansky, Butler and Waller, 1992; cited in Newman, C.W., Jacobson, G.P. and Spitzer, J.B., 1996). That is, clinicians are interested not only in the direct effects of a particular condition but also the impact this condition or symptom has on the patient's well being. Hence, various disorder-specific self-report

measures are emerging as useful clinical tools which serve as functional outcome measures when used in a pre-treatment and post-treatment paradigm, with reduction in self-perceived handicap as the desired positive outcome.

In light, of the afore mentioned reasons, the present study was undertaken to develop a self-report tinnitus handicap questionnaire (SR-THQ). The present study also attempted, to study the relationship between subjective measurements of tinnitus loudness and tinnitus pitch with that of the scores obtained on the developed self-report tinnitus handicap questionnaire (SR-THQ).

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The study was carried out in two stages-

- 2) Development of self-report tinnitus handicap questionnaire (SR-THQ).

To study the relationship between the subjective measurements of tinnitus pitch and tinnitus loudness measures with the self-report tinnitus handicap questionnaire (SR-THQ).

In the stage (1), the self-report tinnitus handicap questionnaire with three subscales-the functional subscale, the emotional subscale and the catastrophic subscale was developed. These subscales probe

into the functional, emotional and catastrophic reactions to tinnitus. In a busy clinical practice environment, a self-report measure must be brief, have a simple response format and be easy to score and interpret. The self-report tinnitus handicap questionnaire (SR-THQ) meets each of these practical considerations. Furthermore, although some well established scales evaluate physical, emotional and social consequences of tinnitus, the self-report tinnitus handicap questionnaire (SR-THQ) response categories reflect a novel alternative analysis of reactions.

The results of stage (II) demonstrated that the SR-THQ has good internal consistency reliability for the total scale ( $\alpha=0.93$ ) and is adequate for the functional ( $\alpha=0.86$ ) and emotional ( $\alpha=0.87$ ) subscales. The alpha co-efficient was lower for the catastrophic subscale ( $\alpha=0.68$ ) because of the smaller number of items constituting this dimension. However, the latter subscale is retained because of its potential use for identifying the most handicapped individuals requiring more aggressive treatment. In addition, the items constituting the catastrophic subscale may represent those areas amenable to treatment and may produce the most dramatic effects if changes are observed.

To summarize the findings, there was significant, high correlation between the functional subscale (amongst the three subscales) and the total score of self-report tinnitus handicap questionnaire (SR-THQ). There was moderately high correlation between the total score of self-report tinnitus handicap questionnaire (SR-THQ) and duration suggesting the reaction or severity of tinnitus due to the subjective loudness and also the duration that the tinnitus is present. However, a low correlation was found between the total score of self-report tinnitus handicap questionnaire (SR-TIIQ) and tinnitus pitch rating. Thus, suggesting the dependency of the severity of tinnitus with the subjective pitch.

Overall a high Cronbach's alpha reliability ( $\alpha=0.93$ ) was obtained for the total self-report tinnitus questionnaire (SR-THQ), indicating excellent internal consistency reliability and adequate internal consistency reliability for the functional ( $\alpha=0.86$ ) and emotional ( $\alpha=0.87$ ) subscales.

In conclusion, a self-report tinnitus handicap questionnaire (SR-THQ) was developed that is brief, and can be used in a busy clinical practice, easy to administer and interpret, that

is broad in scope, reflecting the impact of tinnitus on everyday function and is psychometrically robust, demonstrating adequate reliability and validity and assesses the domains of functional remedial by a variety of medical and rehabilitative approaches. Most importantly the self-report tinnitus handicap questionnaire (SR-THQ) would be helpful in selecting those patients with tinnitus most in need of intervention and proper referral is also possible based on the self-report tinnitus handicap questionnaire (SR-THQ).

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## APPENDIX

**A SELF-REPORT TINNITUS HANDICAP QUESTIONNAIRE  
(SR-THQ)**

Name : Education:  
 Age/Sex: Occupation:  
 Phone No./E-mail/Fax: Referred from:  
 Contact address:

appropriate.

| Sl. No. | Questions   | Yes | Some times | No |
|---------|---|-----|------------|----|
| 1.      | Do you complaint tinnitus as a significant problem for you?               |     |            |    |
| 2.      | Do you hear your tinnitus/sounds all the time?                            |     |            |    |
| 3.      | Have you noticed changes in the loudness of your tinnitus?                |     |            |    |
| 4.      | Do you feel that you can no longer cope with your tinnitus?               |     |            |    |
| 5.      | Does tinnitus make you free difficult to relax?                           |     |            |    |
| 6.      | Does tinnitus make you feel irritable?                                    |     |            |    |
| 7.      | Does tinnitus make you feel anxious?                                      |     |            |    |
| 8.      | Does your tinnitus interfere with your job or household responsibilities? |     |            |    |
| 9.      | Does tinnitus place stress on you?  |     |            |    |
| 10.     | Do you feel, as though you cannot escape tinnitus?                        |     |            |    |
| 11.     | Do you have difficulty in understanding speech when you have tinnitus?    |     |            |    |

| Sl. No. | Questions   | Yes | Some times | No |
|---------|---|-----|------------|----|
| 12.     | Do you find it difficult to focus your attention away from your tinnitus and on other things? |     |            |    |
| 13.     | Does tinnitus make you uncomfortable to be in quiet?  |     |            |    |
| 14.     | Does tinnitus make you feel harder to interact pleasantly with others?                        |     |            |    |
| 15.     | Does tinnitus make you feel tired or ill?   |     |            |    |
| 16.     | Does tinnitus make you feel depressed?  |     |            |    |
| 17.     | Because of your tinnitus do you feel frustrated?  |     |            |    |
| 18.     | Does tinnitus cause you headache?   |     |            |    |
| 19.     | Does tinnitus cause you trouble getting to sleep?   |     |            |    |
| 20.     | Do you have difficulty in understanding speech in noisy surroundings?                         |     |            |    |
| 21.     | Does tinnitus make you feel difficult to concentrate?   |     |            |    |
| 22.     | Do you feel your tinnitus is annoying?  |     |            |    |
| 23.     | Does tinnitus cause you trouble staying asleep?   |     |            |    |
| 24.     | Had any medication caused you to experience changes in your tinnitus?                         |     |            |    |
| 25.     | Do you experience pain or plugging in the ear?  |     |            |    |