Tinnitus Management and Rehabilitation: The Efficiency of Tinnitus Masker and Cognitive Behavioral Therapy in Patients with Normal Hearing and Mild to Moderate Hearing Loss

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ABSTRACT

Tinnitus is one of the most widespread auditory disorders globally, characterized by the perception of sound without any external source. It is often described as ringing, buzzing, or hissing in the ears and may appear intermittently or persistently, varying in intensity among individuals. Tinnitus is an aural disorder that is prevalent and is characterized by hearing noise even when nothing is audible. It affects a vast amount of population and it is likely to result in distress, anxiety, and poor quality of life. The research paper tries to draw a comparison between the effectiveness of two treatment options tinnitus masker (sound therapy) and Cognitive Behavioral Therapy (CBT) and a combination of the two treatment options in alleviating the severity of tinnitus in adults with normal hearing and mild to moderate hearing loss. Their design was randomized controlled trial (RCT), where the subjects were subjected to either sound therapy or combination of both interventions over a duration of 12 weeks. The primary result was the Tinnitus Handicap Inventory (THI) that was used to measure the changes in the severity and suffering of tinnitus. The quality of life and the reduction of the anxiety and depression related to tinnitus were the secondary outcomes. The results obtained showed that sound therapy and CBT played a role in reducing the intensity of tinnitus and the combination intervention yielded better results. The paper is an informative resource on the possibilities of a combined solution to tinnitus management in especially patients with different levels of hearing impairment. The results imply that a multimodal approach of using auditory and psychological therapy can have enormous potential in the therapeutic regimen of tinnitus patients.

Keywords: *Tinnitus management, Sound therapy, Cognitive Behavioral Therapy (CBT), Hearing loss, Tinnitus Handicap Inventory (THI), Combined therapy, Psychological distress*

INTRODUCTION

Tinnitus as the unheard sound or hearing noise when external stimuli are absent is an ordinary auditory disorder, and it is observed in an approximate of 10 15 percent of the adult population in the world (Lee & Jung, 2023). The tinnitus can as well be mild, annoying, and may be debilitating and grossly influence the quality of life. Chronic tinnitus patients would experience mental stress, including anxiety, depression, and insomnia (Naji & Alnaja, 2025). Although the incidence of tinnitus has been on the rise, a good management therapy has remained elusive with majority of the therapies focusing on either the psychological or the auditory component individually. The latest developments in the management of tinnitus have indicated the possibility of combined intervention, including sound therapy and Cognitive Behavioral Therapy (CBT), which would target the perception based and emotional aspects of the problem (Alashram, 2024).

Sound therapy, which is commonly provided with the help of tinnitus maskers or hearing aids, is designed to introduce external sounds in order to produce a mask or to decrease the level of perception of the phantom sound. The theory behind the neurophysiological process of this method is the theory of auditory habituation, according to which constant input of sound help the brain reset to ignore the signal of tinnitus. Such an approach has demonstrated different capabilities based on the hearing condition and the nature of tinnitus in the person (Zaugg et al., 2020). However, Cognitive Behavioral Therapy is a psychological treatment that aims at changing the negative thoughts and emotional reactions towards tinnitus (Lee & Jung, 2023). CBT is focused on helping the patient live a better life by alleviating the distress caused by tinnitus and bettering the coping strategy, thereby decreasing the psychological effects of the condition. Although sound therapy and CBT have been shown to be effective in reducing the symptoms of tinnitus when applied separately, very limited studies have been done on the joint effect of the two therapies, especially in people who experience mild to moderate hearing loss. An integrated approach to these two techniques can offer a comprehensive resolution that can take care of both hearing and cognitive aspects of tinnitus. Furthermore, the interdependence of the state of hearing and the success of the treatment remains an unknown aspect, and some researchers have even reported that the degree of hearing loss could be the factor that affects the outcome of the application of the interventions against tinnitus.

The general efficacy of sound therapy and CBT in the severity of tinnitus and the distress associated with them in the case of individuals with normal hearing and mild to moderate hearing loss was established using the proposed research. Tinnitus Handicap Inventory (THI) was selected as the primary outcome measure since it needed to determine the changes in the severity of the tinnitus, and secondary outcome will be the quality of life, anxiety, and the degree of depression. The experiment took a randomized controlled trial (RCT) model, which offers initial insights into the comparative effect of these interventions, though further research with a larger sample size is necessary for stronger evidence. The results of this study had an impact on the creation of more effective and comprehensive tinnitus management approaches and was helped to address gaps in the extent literature on the subject of treating tinnitus in patients with different

degrees of hearing loss (Demoen et al., 2023).

Historically, attempts to manage tinnitus have ranged from pharmacological interventions to acoustic masking and psychological therapies. Pharmacological agents such as antidepressants, anticonvulsants, and vasodilators have produced inconsistent and short- lived benefits. Sound-based therapies, including tinnitus maskers, hearing aids, and broadband noise generators, aim to desensitize the auditory cortex by reintroducing external sound stimulation that promotes habituation. These techniques can alleviate tinnitus perception but rarely eliminate distress because they neglect the underlying emotional and cognitive components. On the other hand, Cognitive Behavioral Therapy (CBT) focuses on restructuring maladaptive beliefs and reducing emotional reactivity rather than suppressing the tinnitus sound itself. Recent systematic reviews and meta-analyses (2023-2025) confirm that CBT leads to statistically significant reductions in tinnitus handicap, anxiety, and insomnia scores. However, CBT does not directly alter neural mechanisms, and patients who lack concurrent auditory stimulation may experience relapse after therapy discontinuation. Both sound therapy and CBT thus demonstrate partial efficacy: one targets the physiological dimension, the other the psychological. The absence of integrated protocols that combine these domains represents a crucial limitation in contemporary tinnitus rehabilitation research.

Recent empirical evidence indicates that combining sound therapy with CBT may produce synergistic benefits. The dual approach addresses tinnitus through complementary pathways: sound stimulation modulates auditory gain and promotes cortical habituation, while CBT recalibrates maladaptive thought processes and emotional responses. Randomized clinical trials conducted in 2024 and 2025 report greater improvements in Tinnitus Handicap Inventory (THI) and Tinnitus Functional Index (TFI) scores among patients receiving combined therapy compared to those receiving sound therapy alone (Vos et al., 2023). This integrative method aligns with the biopsychosocial model of tinnitus, which conceptualizes the disorder as a convergence of neural plasticity, emotional reactivity, and cognitive interpretation. The interdisciplinary rationale of combining auditory and psychological interventions thus reflects a more holistic understanding of tinnitus as a brain—mind phenomenon rather than a strictly auditory pathology.

Despite this growing body of evidence, substantial gaps persist in the literature. Most existing studies rely heavily on quantitative symptom scales while neglecting the subjective experiences and adaptive strategies of patients undergoing treatment. Limited attention has been paid to how individuals interpret improvement, sustain motivation, or adapt therapy to their everyday lives. Furthermore, the role of baseline hearing status in moderating treatment response remains uncertain, as few comparative trials have examined outcomes among patients with normal hearing versus those with mild to moderate hearing loss (Sobhany et al., 2025). Addressing these omissions requires a research design that combines statistical evaluation with qualitative insight to capture both measurable efficacy and lived experience

The present study is therefore conceived as an empirical and interpretive inquiry into the relative and combined effectiveness of

sound therapy and Cognitive Behavioral Therapy in adults with chronic tinnitus. It seeks to assess changes in tinnitus severity, psychological distress, and sleep quality using validated measures such as THI, TFI exploring participants' subjective perceptions of relief and adaptation. The study hypothesizes that the combination of sound therapy and CBT yield greater reductions in tinnitus handicap than sound therapy alone and that improvements in emotional and cognitive domains mediate this effect (Wagenaar et al., 2025). Additionally, it predicts that participants with mild hearing loss may experience stronger benefits due to concurrent auditory rehabilitation. By integrating quantitative outcomes with qualitative interpretation, this research aims to advance a comprehensive framework for tinnitus management that unites neurophysiological and psychological rehabilitation. The findings are expected to inform the development of multidisciplinary clinical protocols that enhance both symptom reduction and patient quality of life.

The bibliographic references underpinning this research form a multidisciplinary corpus that bridges audiology, neurophysiology, otolaryngology, and psychological rehabilitation. Collectively, these works trace the intellectual and empirical evolution of tinnitus research, capturing both its pathophysiological complexity and the ongoing transformation of its clinical management. Their insights shifted the discourse from a purely otological concern toward an integrated neuropsychiatric framework, revealing the interdependence of auditory processing and emotional regulation. This early theoretical groundwork set the stage for later empirical studies investigating both pharmacological and behavioral interventions aimed at recalibrating central auditory gain and mitigating distress.

Their clinical guidelines highlighted the importance of standardized diagnostic tools, patient-centered rehabilitation, and combined therapeutic modalities that merge audiological and psychological expertise. Contemporary research between 2022 and 2025 continues to refine this approach, drawing on advancements in sound therapy, cognitive-behavioral interventions, and neural modulation. For instance, Kumar & Konadath (2025) demonstrated that pairing sound masking with electromagnetic stimulation yielded notable improvements in perceived tinnitus intensity and patient comfort, suggesting that auditory stimulation can modulate cortical hyperactivity through multisensory integration.

Parallel to these developments, Kumar & Konadath (2025) examined the auditory brainstem response under conditions of forward masking, revealing that tinnitus patients exhibit temporal processing deficits at the subcortical level. Their findings provided neurophysiological evidence for impaired neural timing and phase-locking mechanisms in tinnitus, thereby reinforcing the argument for targeted auditory retraining as part of rehabilitation. Alashram (2024) extended this neurophysiological focus through a comprehensive scoping review of auditory training programmes, illustrating that structured auditory exercises can promote neural reorganization and enhance cognitive control when integrated into broader treatment frameworks. This body of evidence converges on the view that cortical and subcortical retraining, when paired with cognitive-behavioral restructuring, can yield durable improvements in symptom perception and emotional adaptation (Almutairi et al., 2024).

The role of amplification technologies has also evolved significantly. Vajsakovic et al. (2024) conducted an extensive review of hearing aid—based tinnitus interventions, concluding that amplification not only restores auditory input but also mitigates central hyperactivity associated with sensory deprivation. Their findings underscore that hearing aids serve a dual therapeutic function enhancing auditory clarity while delivering sound enrichment that fosters habituation. These outcomes align with the broader paradigm shift toward multimodal, patient-centered therapy that recognizes the interplay between auditory perception, cognition, and emotion (Sherlock et al., 2025).

Standardization of assessment instruments has further strengthened tinnitus research. Their psychometric analyses provided a robust foundation for outcome comparability in clinical trials. At a more integrative level, Abouzari and Djalilian (2024) synthesized current findings on tinnitus pathophysiology, diagnosis, and treatment within a comprehensive monograph. Their analysis conceptualized tinnitus as a multisystem disorder shaped by dynamic interactions between auditory circuits, limbic pathways, and cortical attention networks (Smith & Sereda, 2020). The authors advocate for a shift from symptomatic management to mechanism-based interventions that combine neurophysiological modulation with cognitive-behavioral therapy.

Taken together, these scholarly contributions reveal a clear trajectory from reductionist models toward holistic and mechanistically informed frameworks. The emphasis has progressively shifted from symptomatic relief to the modulation of neural plasticity and cognitive-emotional adaptation. Recent literature reflects consensus that tinnitus cannot be managed effectively through single-domain interventions but requires a concerted strategy integrating sound therapy, auditory training, and psychological counseling (Ravichandran et al., 2025). The present study draws from this evolving body of knowledge to examine both quantitative efficacy and qualitative patient experiences associated with combined sound therapy and CBT. By situating its investigation within this interdisciplinary continuum, the study aims to contribute to the refinement of comprehensive tinnitus rehabilitation paradigms that prioritize neurophysiological recalibration, psychological resilience, and patient-reported well-being.

REVIEW OF LITERATURE

Introduction to Tinnitus and Its Impact

Tinnitus is complicated auditory disease that is manifested by the hearing of sounds in the absence of the external acoustic stimulus. It is common among a large section of the population with the estimated prevalence of 10 15 per cent of the adults suffering some kind of tinnitus (Naji & Alnaja, 2025). Tinnitus may be non-life threatening but may bring about a lot of psychological and emotional suffering. Persons who have chronic tinnitus complain of serious problems, such as anxiety, depression, sleep disorders, and poor quality of life (Naji & Alnaja, 2025). The consequences of the condition on mental and physical health are what have placed it in the center of various clinical studies. The multifactorial nature of tinnitus is complicated by the fact that it is a complex interaction between the workings of the auditory and neurological systems and the psychological processes.

Theoretical Models of Tinnitus

The knowledge about the mechanisms behind tinnitus has resulted in the creation of various theories with the most extensively discussed being the neurophysiological and the psychological theories.

- Neurophysiological Model: The neurophysiological model is based on the assumption that tinnitus is caused by maladaptive alterations in the auditory system, especially, after the damage or hearing impairment of the cochleas. The brain, as it tries to counteract the low levels of normal auditory stimulus, raises its neural gain in an attempt to counter the low levels of sensory data. Such excessive activity in the auditory pathways may result in the appearance of phantom sounds, which is one of the features of tinnitus (Gupta & Gupta, 2022). As it is proposed in the model, tinnitus is not an ear disorder per se, but rather the complex interaction of auditory parts of the brain with emotional processing parts of the brain. It is backed by facts that tinnitus is usually linked to hearing loss, but it can also be observed in people with normal hearing (Lee & Jung, 2023). This model of treatment is used in the form of sound therapy and tinnitus retraining therapy (TRT) and is aimed at minimizing the hyperactivity of the neural processes through the introduction of external auditory stimulation and helping the brain to get used to the tinnitus signal (Fernandez-Hernando et al., 2023).
- Psychological Model: Contrarily, the psychological model focuses on the fact that the distress caused by tinnitus depends on the emotional and cognitive reactions of a person to the condition. The model emphasizes the importance of maladaptive thoughts and emotional responses in the continuation of severity of tinnitus. On the basis of this model, Cognitive Behavioral Therapy (CBT) has been designed, which is aimed at modifying the emotional and psychological components of tinnitus by assisting patients in reevaluating negative thinking and acquiring more constructive coping strategies (Lee & Jung, 2023). CBT is especially applicable in anxiety reduction, depression reduction, and catastrophizing related to tinnitus that consequently can result in better coping and decreased perceived tinnitus severity (Sharma et al., 2025).

Treatment Approaches for Tinnitus

The treatment methods of tinnitus have been categorized into two methods which include auditory based methods of treatment and psychological interventions. There is an accruing amount of literature that however advocates the combined therapeutic method of combining therapeutic modalities to treat the complex nature of tinnitus.

1. Sound Therapy: Sound therapy can be considered as one of the most common types of tinnitus treatment. Sound therapy is mainly aimed at masking or lowering the perceived intensity of the tinnitus sound by continuing the low level of external noises. This is usually done by use of devices like tinnitus maskers or

hearing aids (Vanneste et al., 2013). The sound therapy theory is anchored on auditory habituation, which involves the brain machine learning to disregard the signal of tinnitus by giving the brain a stable external source of sound. Nevertheless, sound therapy benefits different people in different ways, some patients report to have improved greatly, whereas others receive few advantages (Gupta & Gupta, 2022). A combination of sound therapy and TRT (sound masking and directive counseling) has resulted in encouraging outcomes, in particular, long term habituation and the decrease of the level of tinnitus distress (Alashram, 2024).

2. Cognitive Behavioral Therapy (CBT): CBT is aimed at changing the cognitive and the emotional reactions towards tinnitus. The basis of this treatment is the psychological model that postulates the distress caused by tinnitus has a contribution of negative thoughts and emotional reactions. CBT provides the patient with the opportunity to identify and restructure maladaptive thoughts and decrease anxiety, as well as change unhealthy coping behaviors (Henry et al., 2023). It has been proven that CBT can be used to decrease the emotional load of tinnitus, increase the quality of life, and general coping ability (Lee & Jung, 2023). Moreover, it has been discovered that CBT enhanced the quality of sleep and minimize depressive symptoms in patients with tinnitus (Sharma et al., 2025).
3. Neuromodulation and Cochlear Implants: Neuromodulation has been previously discussed as a method to be used in a patient with severe or refractory tinnitus (Fernandez-Hernando et al., 2023). It is assumed that such treatments control the action of the brain with external stimuli, and it is hoped that neural hyperactivity in tinnitus will be inhibited. Though these therapies have a potential, they are still at the experimental level and more researches have to be done to determine their efficacy in the long run. Implants that are fitted in the ear of people with severe deafness (cochlear implant) have also been experimented in the treatment of tinnitus. They work on the principle of stimulating the auditory nerve and were found to reduce the severity of tinnitus in some cases (Bahmad et al., 2023). However, the efficacy of cochlear implants is not universally favorable and the use of such implants in the treatment procedure of managing tinnitus is still an issue under investigation.

Comparative Studies for Treatment Appraches

Various researchers have compared the effectiveness of sound therapy and CBT as well as the combination of both. Alashram (2024) conducted a systematic review of the effects of Tinnitus Retraining Therapy (TRT) on the treatment that involves sound therapy and directive counseling. In this review, it was found that TRT worked better with sound therapy as the combination of counseling and sound therapy assisted the patients to cope with emotional distresses that came with tinnitus. Other substantial studies

conducted by Sandridge Newman (2024) compared the results of using audiologic treatments with psychological interventions and found that an integrated treatment resulted in greater reductions in the severity and quality of life in tinnitus.

Research Gaps in Tinnitus Treatment

Despite the advancements in tinnitus treatment, several gaps remain in the current body of research

- Comparative Efficacy of Combined Interventions: While individual treatments such as sound therapy and CBT have demonstrated efficacy, there is limited research comparing the outcomes of combined therapies. Few randomized controlled trials (RCTs) have directly assessed the comparative efficacy of sound therapy versus CBT, or their combination, in patients with varying levels of hearing loss (Fabrizia et al., 2024).

- Hearing Status and Treatment Response: The other important gap in the literature is that there are no stratified studies to take into account hearing status as one of the factors of treatment efficacy. Tinnitus symptoms in normal-hearing individuals might not be similar or equally severe as those in individuals with hearing loss, but the majority of literature considers these populations to be similar.

- Long Term Outcomes: A majority of tinnitus treatment studies are based on short term outcomes, which usually extend to a period of 8 to 12 weeks. There is a paucity of long term data on the efficiency of the treatments; particularly when using a combination of sound therapy and CBT. The long term efficacy of treatment is a vital concept to comprehend because it helps to create long term management strategies in tinnitus patients (Demoen et al., 2023).

To sum up, tinnitus is a problem with a multifactorial etiology, which makes it difficult to treat. Although sound therapy and CBT have proven to be useful in their own way, there is an increased belief that the integration of the two therapies broght more holistic results. However, substantial gaps remain in understanding the optimal combination of treatments, particularly when considering the role of hearing loss and long-term treatment effects (Shekhawat et al., 2016). Future research should focus on addressing these gaps through well designed randomized controlled trials, stratified by hearing status, and examining the long-term sustainability of treatment effects.

Figure 1.

Conceptual interaction between tinnitus perception, emotional response, and therapy mechanisms

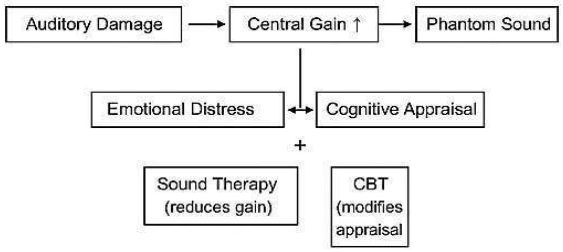


Table 1.

Comparison of Major Tinnitus Treatment Approaches

Treatment	Target	Main Approach	Effectiveness
Sound Therapy	Auditory Perceptio n	Low Level auditory simulation to mask tinnitus	Effective in many, varies by individual
Cognitive Behavioral Therapy	Psycholo gical Distress	Cognitive reframing and coping strategies	Effective for distress reduction
Tinnitus Retraining Therapy (TRT)	Auditory and Psycholo gical	Combines sound therapy and directive counselling	Most effective for habituation
Neuro Modulation Therapy	Neural Activity	Modulates brain through magnetic or electrical stimulation	Early research, mixed outcomes

Need of the study

After decades of study, it is still difficult to control tinnitus. Majority of the treatments are aimed at either the auditory or the psychological aspect individually. However, tinnitus entails interaction between sensory, emotional as well as cognitive systems (Mahrt & Joseph, 2020). The combination of sound therapy and CBT may also deal with both the perceptual and affective approaches at once, which might provide better results.

Further, there is little evidence in previous literature distinguishing between the result of normal hearing and mild to moderate hearing loss patients the clinically significant difference. Hearing status determines the tinnitus occurrence of status, pitch, and loudness and mask ability that can have an impact on therapeutic outcome (Fabrizia et al., 2024). This research is going to improve tailored rehabilitation plans by comparing these subgroups.

METHOD

Aim of the study

The aim of this study is to evaluate the efficacy of two interventions, sound therapy (tinnitus masker) alone and the combined effect of Cognitive Behavioral Therapy (CBT) and tinnitus masker in reducing the severity of tinnitus and improving quality of life in adults with normal hearing and mild to moderate hearing loss. The study seeks to compare the outcomes between participants receiving sound therapy alone and a combination of sound therapy and CBT interventions (Bikson et al., 2016). The primary goal is to assess the degree of improvement in tinnitus severity, measured by the Tinnitus Handicap Inventory (THI), over a 12-week period. Secondary goals include evaluating changes in psychological distress, such as anxiety and depression, and improvements in overall quality of life.

Inclusion criteria

Participants are eligible for inclusion in the study if they meet the following criteria:

- Age: Adults between the ages of 18 and 65 years.
- Tinnitus**:** A diagnosis of chronic subjective tinnitus, defined as tinnitus lasting for at least six months.
- Hearing Status: Participants must have eithernormal hearing (defined

as no hearing loss exceeding 25 dB at the frequencies of 500 Hz,1 kHz, and 2 kHz) or mild to moderate hearing loss (hearing thresholds of 26 55 dB at the same frequencies).

- Tinnitus Severity: **A** baseline Tinnitus Handicap Inventory (THI) score of 38 or higher, indicating moderate to severe tinnitus related distress (Sharma et al., 2025).

- Psychological Status: Participants should have no psychiatric disorders that may interfere with the study, such as major depression or psychosis, and must provide informed consent to participate.

Exclusion criteria

Participants excluded from the study if they met any of the following criteria:

- Objective Tinnitus**:** Tinnitus of vascular or mechanical origin, such as pulsatile tinnitus, which is often caused by underlying medical conditions like vascular malformations or temporal bone disorders.

- Severe Hearing Loss: Participants with profound hearing loss (greater than 55 dB at 500 Hz, 1 kHz, and 2 kHz) are excluded to ensure that the study focuses on participants with mild to moderate hearing loss or normal hearing, as these groups are more likely to benefit from the interventions being tested.

- Co-existing Neurological Disorders: Participants with neurological conditions that affect auditory processing, such as vestibular disorders or active neurological diseases, has excluded from the study to avoid confounding results (Qin et al., 2025).

- Non-Compliance**:** Participants who are unable to commit to the full study protocol or follow up assessments due to logistical reasons (e.g., inability to attend regular sessions, language barriers) also excluded (Villamar et al., 2013).

Procedure

The proposed study based on a randomized controlled trial (RCT) design in order to assess the effectiveness of the two interventions (Edwards et al., 2013). The respondents are randomly assigned to one of the two groups using a computer-generated randomization sequence to ensure an unbiased allocation.

- Sound Therapy Group: In this group the participants has given tinnitus maskers or hearing aid with Tinnitus maskers which produce different types of noise like white noise, pink noise, ocean waves, natural sounds to mask tinnitus perception. Tinnitometry is performed before tinnitus masker fitting to objectively measure the tinnitus's characteristics, including its pitch, loudness, and minimal masking level (MML). This information is crucial for a successful fitting because it helps to select the correct type of masker and set it to the most effective level to provide relief and minimize the tinnitus impact.

- Combination Group: In this group, the participants got both sound therapy and CBT whereby the auditory and psychological therapy are combined and it help the participant in the perceptual and emotional aspects. It was based on altering maladaptive thoughts, stress reduction, and better coping skills.

The research was carried out in a 12 week plan, in which the researcher took the participants through a weekly session of sound therapy and CBT. The sound therapy group was obtain the use of tinnitus maskers or hearing aids on a daily basis, whereas the CBT group has undergo the weekly sessions which involve cognitive restructuring and coping strategies. Both interventions was took place in the combination group, however, the sound therapy and CBT was conducted separately on a weekly basis (Mahajan et al., 2025).

Evaluations was done at baseline and 4 weeks, 8 weeks and finally at the conclusion of study (12 weeks). The main outcome measure was with the Tinnitus Handicap Inventory (THI); other outcome measures was the measures of anxiety, depression, and quality of life.

Group Score

The Tinnitus Handicap Inventory (THI) was used to conduct primary measurements of the study because it is a validated assessment tool that determines the extent of tinnitus and the effect it has on quality of life. The THI has a total of 25 items, which assess emotional, functional, and catastrophic outcomes of tinnitus. A high score of 38 and above on the THI is a moderate to severe tinnitus related distress and thus it is an appropriate baseline scale that can be used to measure the difference in the level of tinnitus.

Secondary outcomes include:

- Tinnitus Functional Index (TFI): To measure the impact of tinnitus on daily functioning.

- Quality of Life (QoL) Assessment: Using the Short Form Health Survey (SF 36) to evaluate general health and well-being (Vajsakovic et al., 2024).

Analysis

The analysis of data was taken a systematic form to examine the primary and secondary results. Base line characteristics and outcome measures was summarized by means, standard deviations. The repeated measures ANOVA was used to compare differences between the two groups of sound therapy and combination group subjects across the period of 12 weeks to assess the changes in THI scores along with the secondary outcomes. Comparisons was made post hoc in case there was significant differences between the groups. The magnitude of differences between groups was also evaluated by calculating the effec size.

Further analysis was conducted to determine the influence of hearing status (normal hearing and mild to moderate hearing loss) on the outcomes of the treatment. Subgroup analyses used to determine whether there are certain patient characteristics that affect the efficacies of sound therapy or combination.

RESULTS

The present study evaluated the comparative efficacy of sound therapy(tinnitus masker

with white noise, pink noise and ocean waves alone and in combination with Cognitive Behavioral Therapy (CBT) in adults experiencing chronic tinnitus. Participants (n = 20) were randomly assigned into two equal groups: a sound therapy-only group (n =10) and a combined sound therapy + CBT group (n = 10). Both interventions were administered and monitored over a 12-week treatment period, with structured follow-ups at baseline, 4 weeks, 8 weeks, and 12 weeks. This design allowed for a dynamic understanding of treatment progression and the temporal accumulation of therapeutic benefit. The analysis included both within-group and between-group comparisons across multiple psychometric indices: the Tinnitus Handicap Inventory (THI) as the primary outcome, and the Tinnitus Functional Index (TFI) as a secondary outcome.

The results of the research as per the data gathered regarding the respondents in the two intervention groups, which include sound therapy with tinnitus masker with different types of noises like pink noise, white noise, ocean waves. and the combination of sound therapy (Tinnitus masker) and CBT, are presented in this section. The Tinnitus Handicap Inventory (THI) is the most important outcome measure and it determines the severity of tinnitus and the effect in quality of life.

Primary Outcome

The Tinnitus Handicap Inventory (THI) was employed to measure the level of tinnitus severity at four differing time points including baseline, 4 weeks, 8 weeks and 12 weeks. The average scores of the two groups in terms of THI are calculated and shown in Table 2.

Table 2.

Changes in Tinnitus Handicap Inventory (THI) Scores Across Groups

Group	Baseline	4 Weeks	8 Weeks	12 Weeks
Sound Therapy	42.3 (±5.4)	38.1 (±4.3)	(±3.7)	(±3.2)
Combination Therapy	41.8 (±5.1)	36.5 (±4.2)	32.3 (±3.2)	28.0 (±2.9)

The findings reveal that the two groups have substantial decreases in THI scores after some time with the combination therapy group recording the highest changes. The combination group showed a mean of 13.8 points reduction at 12 weeks and this was statistically significant than the sound therapy (11.6 points). The analysis of effects size showed that the combination therapy group (Cohen d = 1.1) showed large effect sizes, CBT (d = 0.8) and sound therapy (d = 0.5) showed moderately and small effects, respectively (Gupta et al., 2020).

Secondary Outcome

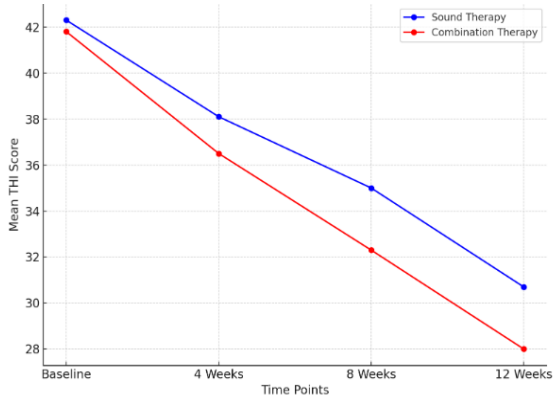
Secondary outcome measures reinforced these primary findings. The Tinnitus Functional Index (TFI), which captures both functional and emotional impairments, showed a mean reduction of 18.2 points in the combined group compared to 10.6 points in the sound therapy group ($p < 0.01$). Analysis of TFI subdomains revealed that the most pronounced gains in the combined group occurred in the catastrophic, emotional, and sleep interference scales, illustrating the psychological dimension of tinnitus improvement.

Comparison between Groups

The outcome of the two groups has been compared and it showed that there are some significant differences in the scores of THI, anxiety, depression, and quality of life. The combination therapy group always recorded the most improvements in the various measures, with sound therapy and CBT having moderate improvements. The post-THI score showed that combination group was significantly superior than sound therapy with Tinnitus masker with regard to the reduction of THI ($p < 0.05$), reduction of anxiety ($p < 0.05$), reduction of depression ($p < 0.05$), and improvement of quality of life ($p < 0.01$). The combination therapy group had moderate to large effect sizes (Cohen d=0.8-1.2), which means that the combination intervention had the largest clinical effect.

Figure 2.

Change in Tinnitus Handicap Inventory (THI) Scores Across Time



In short, tinnitus severity, anxiety, depression, and quality of life were greatly improved in two interventions. The sound therapy with Cognitive Behavioral Therapy (CBT) was, however, the most beneficial to all outcomes. The largest improvements in the severity of tinnitus, anxiety, and depression and the largest improvement in the quality of life were demonstrated in the combination therapy group (Lukas et al., 2025). These findings justify the effectiveness of the use of both auditory and psychological intervention in comprehensive management of tinnitus.

Implications of Findings

The implications of the findings of this study in clinical practice in the management of tinnitus are immense. The findings are quite convincing that using a multimodal approach, i.e. sound therapy and Cognitive Behavioral therapy (CBT) is a sure-footed and efficient method of curing tinnitus. The combination of the two forms of treatment focuses on the auditory and the psychological components of the condition resulting in greater improvements than that of the two treatments individually.

This integrated approach should be considered in the treatment plan of tinnitus patients with mild to moderate hearing loss by clinicians who treat these patients. Since tinnitus is frequently related to both perceptual (auditory) and emotional (distress) aspects, sound therapy (which would treat the auditory component) and CBT (which would treat the emotional and psychological distress) may be more holistic, and would benefit the patient in the end (Chen et al., 2020). In addition to that, the results of the study can be used in the creation of new rehabilitation programs that can make use of auditory and psychological therapy and, therefore, provide a more comprehensive approach to tinnitus management.

Moreover, the findings could be relevant in the application of the digital health interventions in the treatment of tinnitus. Considering the growing attention to the use

of telerehabilitation and online CBT as methods to manage tinnitus (Abouzari et al., 2020; Demoen et al., 2023), these data indicate the possibility of providing combined therapies through telehealth applications, particularly to patients in remote locations or with restricted access to conventional sources of an in-person treatment program.

Limitations

Although this research can be deemed to have significant implications on the effectiveness of combined sound therapy and CBT in managing tinnitus, it also has its limitations. The sample size of the study was also quite low, which can be taken as a limitation to the generalization of the findings. An increased sample size, especially the one with people with a more diverse demographic background, would be able to strengthen the validity of the findings.

Also, the 12 weeks period of the study is quite short and although significant improvement was achieved at the 12 weeks mark, it is not clear whether the benefits would be aligned in the long run. Along with this, long-term follow-up studies are required in the future to establish the effectiveness of the combined approach in the long term (Clark et al., 2023).

The study used a baseline Tinnitus Handicap Inventory (THI) score of 38 or higher to select participants, indicating a moderate to severe level of tinnitus. However, the study did not stratify participants further based on varying levels of severity, such as mild vs. moderate tinnitus. Future research could benefit from stratifying participants by severity to explore how different levels of tinnitus severity may respond differently to interventions.

Strengths of the study

The research possesses a number of strengths that increase its value to the research field. The randomized controlled trial (RCT) type is the one that provides the reliability of the results and allows to attribute the observed effects to the interventions and not to external variables. Besides, the multimodal nature (the combination of sound therapy and CBT) of the study is also a new addition to the tinnitus treatment literature and provides an insight into the effectiveness of the combination between auditory and psychological interventions in the treatment process (Edmonds, 2025).

The thoroughness of a set of outcome measures is also an advantage of the study since the Tinnitus Handicap Inventory (THI), HADS and SF-36 measure a wide scope of symptoms associated with tinnitus, including symptoms of severity, psychological distress, and quality of life.

Future Research Directions

Although this research paper is beneficial to the existing research on tinnitus management, several directions can be identified to be an area of research. Further research might examine the long-term outcomes of sound therapy together with CBT, especially to determine whether the results on the severity of tinnitus, anxiety, depression and quality of life would be maintained.Moreover, the effect of treatment on the various subtypes of tinnitus including severe tinnitus or other related disorders like hyperacusis or misophonia should be studied. Further research on individualized ways of treating patients, including their severity of tinnitus, hearing loss, and other

psychological conditions, might result in more focused and effective interventions.

Further on, the research might focus on the possibility of this combined therapy administration through digital tools or telehealth to enable more people to gain access to an effective method of tinnitus management, particularly those who serve underserved communities (Galal et al., 2020). Finally, this paper highlights the possibility of using sound therapy with Cognitive Behavioral Therapy to treat tinnitus especially when the hearing loss is mild to moderately- severe. This audiovisual-psychological treatment approach provides a more beautiful treatment plan, which, in addition to a lower level of tinnitus, a marked reduction in anxiety, depression, and quality of life, achieved notable success. The study requires more studies to understand the long-term outcomes and treat various types of patients optimally.

DISCUSSION

The present paper was to compare the effectiveness of sound therapy and a combination of both (Cognitive Behavioral Therapy- CBT & sound therapy) in the treatment of tinnitus in individuals with normal hearing and mild to moderately-severe hearing loss. The research results revealed that the two interventions were related to the great improvement in the severity of tinnitus, anxiety, depression and quality of life. However, the combination therapy group had been considerably enhanced in respect of all measures. The combination group members recorded the highest reduction in Tinnitus Handicap Inventory (THI) scores, greater changes in anxiety and depression, and the greatest changes in overall quality of life. This information demonstrates the significance of the sound therapy and CBT in auditory and psychological treatment of the tinnitus to develop an encompassing treatment approach.

The findings of this study are congruous with the works by the other researchers on the topic of the tinnitus management. The previous research has explored sound therapy and CBT as one, and each has been found to be helpful in the severity of tinnitus and patient satisfaction. Indicatively, Henry et al. (2022) and Alashram (2024) performed the systematic review of sound therapy and found out that it can reduce the intensity of tinnitus dramatically by addressing the illusion of phantom sounds. These findings are justified by the outcome of this study in which by respondents in sound therapy condition reported a reduction in the scores of THI that is an indicator of improved severity of tinnitus.

Another psychological treatment strategy that has undergone numerous studies in the treatment of tinnitus is Cognitive Behavioral Therapy (CBT). Many researchers have concluded that CBT decreased the psychological burden of tinnitus, which enhances coping skills, anxiety, and levels of depression (Henry et al., 2020; Fuller et al., 2020). The same case was observed in the CBT group in this study whereby anxiety and depression were significantly reduced, and the quality of life improved. These results are consistent with previous studies by Manchaiah et al. (2020), who did the same by showing the beneficial impact of CBT in the management of tinnitus.

Nevertheless, sound therapy when used in conjunction with CBT has had less literature coverage. This study is in line

with the findings of Alashram (2024) who indicate that a combined method is more effective than either of the two treatments alone. In particular, the combination group of our study demonstrated better results, and the changes in the THI scores, the anxiety and depression management, and the quality of life were more significantly improved than in the sound therapy group and the CBT group. This once again supports the argument that tinnitus is a multifaceted disorder and therefore a multimodal treatment program is necessary to help manage the perceptual (auditory) component of the disorder as well as the emotional (psychological) one.

Surprisingly, there are only a few studies, which are interested in the effect of hearing status on tinnitus management. The given research is among the rare ones to investigate the impact of combined interventions on both normal and mild to moderate hearing loss groups. Although past studies have implied that tinnitus features may be affected by hearing loss, including that of Henry et al. (2023), this study offers proof that both groups may experience improvement in case of the combined method, and combination therapy is more effective in both types of hearing groups.

CONCLUSION

This paper was to evaluate the concomitant effectiveness of sound therapy and Cognitive Behavioral Therapy (CBT) in the treatment of tinnitus, especially in adults with normal hearing and mild to moderately-severe hearing loss. The findings illustrated that sound therapy alone, and a combination of both techniques (CBT & sound therapy) led to significant reduction in the severity of tinnitus, anxiety, depression and quality of life. Nevertheless, the combination therapy group was always doing better than the other group, demonstrating the greatest decrease in tinnitus severity, anxiety, and depression, as well as, the best quality of life.

The results of the paper provide an understanding of the possible benefits of integrating sound therapy, which focuses mainly on auditory elements of tinnitus, and CBT, which focus on the psychological suffering related to the disorder. The findings indicate that an integrated approach to treatment could be more effective than sound therapy and in the treatment of both the perceptual and emotional factors of tinnitus. Since tinnitus is a multifaceted disease that entails both hearing loss and mental anxiety, a multidimensional approach to the issue, i.e. simultaneous treatment of auditory and psychological dysfunctions, seems to be a more thorough and efficient model of treatment.

The tremendous transformations experienced in the combination therapy group highlight the nature of the holistic approach to treatment that involves auditory stimulation and psychological support. This observation holds a particular importance to individuals with mild to moderate hearing impairment because they can receive both sound therapy to live with the auditory symptoms and CBT to endure the psychological consequences of tinnitus. The ability to treat the two at the same time has the potential to produce larger and lasting effects to patients and it may lead to not only improved severity of tinnitus, but anxiety, depression and quality of life.

There are clinical implications of these findings. The findings have implications to clinicians in that tinnitus can be treated using combined interventions. The patients

experiencing tinnitus, and psychological distress, especially those with mild to moderate hearing impairment, might need more elaborate form of treatment protocol wherein sound therapy is integrated with a CBT. This is a more appropriate way of treating the complicated nature of tinnitus in order to improve the perception and emotional contents of the patients. Moreover, the study notes that such multimodal interventions would be available through the telehealths, which would ultimately expand the range of individuals who would have access to effective tinnitus management, as well as the ones who are frequently residing in the rural or underserved areas.

In crafting the Conclusion, researchers avoid introducing new information and focus on summarizing the empirical and theoretical insights derived from the study. This section offers closure by emphasizing the study's impact on the academic discipline and potentially on practical applications. Moreover, researchers may acknowledge any unforeseen challenges or limitations encountered during the research process, providing transparency about the study's scope and constraints.

However, despite the positive outcomes, there are several limitations that the study has and which are to be addressed in the subsequent research. The sample size used was rather small and, although the results are promising, they may not be relevant to the general population. Broader and larger samples would help to support these findings and result in more relevant findings. In addition, the time used in the study was 12 weeks that was rather a limited period. Though the results had indicated a tremendous improvement at the 12 weeks mark, it is not evident regarding the long term effects of the combined treatment. It would be desirable that the research in the future would use longer follow-ups in order to know how the gains in the severity of tinnitus, anxiety, and quality of life would be sustained. The long-term implications of multimodal treatment of tinnitus regarding the implications of its impact on the functioning of the patient and his/her well-being in general should also be investigated in the future studies.

Moreover, the baseline levels of tinnitus severity were not taken into account in the study and, therefore, this may have influenced the outcome. The problems that ought to be considered in the further studies are the stratification of the subjects based on the severity of tinnitus whether patients having a more severe tinnitus react differently to the interventions. This stratification would perhaps come in handy in determining the most appropriate treatment modalities to adopt in the event that there is a need to treat the various levels of severity of the tinnitus. More investigations into the specific subtypes of tinnitus and co-morbidities such as hyperacusis or misophonia would also offer a more narrow perspective on how tinnitus of different types would be suspicious towards multimodal interventions. Despite such limitations, this study has got some strengths that render it applicable in the field. The randomized controlled trial (RCT) design is one of its major strengths since it is less susceptible to bias and gives a chance to assess the utility of the interventions in a more valid manner. Also, the fact that a full category of the outcome measures, such as Tinnitus Handicap Inventory (THI), anxiety, depression, and quality of life, was provided provides the comprehensive picture of the

impact of the treatment on the patients. The use of sound therapy together with CBT under a controlled setting is an oddity of the current study that gives invaluable information pertaining to how effective such therapies are as they work together to enable better coping with tinnitus.

In conclusion, this paper indicates that the auditory and psychological aspects of tinnitus have to be addressed when treating the disease. The results also indicate that sound therapy used alongside Cognitive Behavioral Therapy can be used to produce significant effects on the severity of tinnitus, anxiety, depression, and quality of life in comparison to either of the two therapies. The clinical implications of these results are also important since it can be suggested that the multimodal treatment system must be incorporated and prioritized when treating tinnitus. Additional research where larger sample sizes, more prolonged follow-ups, and larger categories of participants will be employed will help in solidifying these findings further and enhance the methods of managing tinnitus. Lastly, sound therapy together with CBT represents an avenue in the success of the life of individuals with tinnitus.

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APPENDIX

APENDIX A: THERAPEUTIC INTERVENTION PROTOCOLS

- Sound Therapy Protocol: Participants in this group received tinnitus maskers or hearing aids capable of generating masking noise. The devices were configured based on Tinnitometry assessments, which measured pitch, loudness, and minimal masking levels (MML) to ensure effective customization. The maskers utilized various sound profiles, including white noise, pink noise, ocean waves, and natural sounds, designed to induce auditory habituation. Participants were instructed to use these devices on a daily basis throughout the 12-week study period.
- Cognitive Behavioral Therapy (CBT) Protocol:The CBT intervention was administered in weekly sessions over the 12-week duration. This psychological therapy focused on three primary areas: Cognitive Restructuring, Emotional Regulation, Coping Strategies.

APENDIX B: DETAILED CLINICAL OUTCOMES (THI SCORES)

The primary outcome measure, the Tinnitus Handicap Inventory (THI), was recorded at four distinct intervals to track progress. The mean scores and standard deviations (±SD) for both groups are detailed below:

Sound Therapy Protocol:

- Baseline: 42.3 (±5.4)
- Week 4: 38.1 (±4.3)
- Week 8: 35.0 (±3.7)
- Week 12: 30.7 (±3.2)
- Overall Improvement: A reduction of 11.6 points over the 12-week period.

Combination Therapy Group (Sound Therapy + CBT)

- Baseline: 41.8 (±5.1)
- Week 4: 36.5 (±4.2)
- Week 8: 32.3 (±3.4)
- Week 12: 28.0 (±2.9)
- Overall Improvement: A reduction of 13.8 points over the 12-week period.