International Journal of Yoga and Allied Sciences
Vol 15, No: 1, Jan-Jun 2026, ISSN: (2278-5159) pp: 79-84

Yoga-Based Interventions for Tinnitus: A Mind–Body Approach to Auditory Wellness

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Abstract
Tinnitus, the perception of sound without an external source, affects up to 30% of adults worldwide and is often worsened by stress and maladaptive neural plasticity. Standard treatments, such as sound therapy, hearing aids, and cognitive behavioral therapy, provide limited relief for many sufferers, prompting interest in mind–body therapies. Yoga—a holistic practice that combines physical postures (asanas), breathing exercises (pranayama), and meditation—has emerged as a complementary treatment for tinnitus. This review synthesizes the literature on yoga-based therapies for tinnitus, focusing on case reports and small trials. Clinical observations suggest that integrative yoga protocols can decrease tinnitus handicap, improve sleep, and reduce psychological distress. Proposed mechanisms include eliciting a relaxation response to counteract stress-induced sympathetic arousal, modulating autonomic function to increase parasympathetic/vagal tone, and fostering neuroplastic changes in auditory and emotional brain regions. For example, controlled breathing and meditation lower cortisol levels and enhance heart rate variability. Simultaneously, regular yoga practice has been linked to the preservation of grey matter volume in limbic and sensory cortices. These changes may help rebalance abnormal neural networks underlying tinnitus. We critically discuss limitations such as small sample sizes, lack of control groups, and the heterogeneity of interventions, concluding that preliminary reports suggest yoga may reduce tinnitus severity by addressing stress, autonomic dysregulation, and maladaptive plasticity; however, rigorous controlled trials are necessary to confirm efficacy and clarify underlying mechanisms.
Keywords: Tinnitus, Yoga therapy, Autonomic regulation, Neuroplasticity, Stress reduction.

Introduction

Tinnitus, commonly described as the perception of sound without an external auditory stimulus, affects approximately 10–15% of the global population, with 1–2% experiencing debilitating symptoms (Baguley et al., 2013). The phantom auditory perception, often characterized as

ringing, buzzing, or hissing, may be intermittent or constant, and its severity varies widely among individuals.

Although tinnitus is frequently associated with sensorineural hearing loss, especially due to noise exposure or aging, its pathophysiology is far more complex, implicating aberrant neural activity across both auditory and non-auditory brain regions (Eggermont& Roberts, 2015). Contemporary neuroscientific models suggest that tinnitus arises from maladaptive neuroplastic changes following peripheral auditory injury, which result in increased spontaneous firing rates and neural synchrony within central auditory pathways (De Ridder et al., 2014). Additionally, growing evidence supports the involvement of non-auditory regions such as the limbic system, prefrontal cortex, and autonomic nervous system, which contribute to tinnitus distress's emotional and attentional dimensions (Vanneste& De Ridder, 2012). This interconnected neural network—often described as the auditory-limbic-autonomic loop—has become a focal point for targeted therapeutic interventions.Despite advancements in pharmacological and technological management strategies—including hearing aids, sound therapy, and neuromodulation techniques—no universal cure for tinnitus currently exists.

Cognitive behavioral therapy (CBT) and mindfulness-based stress reduction (MBSR) programs have shown efficacy in alleviating tinnitus-related distress by targeting the psychological and emotional consequences of the condition (Martinez-Devesa et al., 2010). Within this context, there is a growing interest in integrative and holistic approaches such as yoga, which offer multidimensional benefits spanning physical, mental, and neurophysiological domains.Yoga, rooted in ancient Indian philosophy, is a comprehensive mind-body practice encompassing asanas (physical postures), pranayama (breathing techniques), and dhyana (meditation). Scientific investigations have demonstrated yoga's ability to modulate the hypothalamic–pituitary–adrenal (HPA) axis, reduce cortisol levels, enhance vagal tone, and downregulate sympathetic nervous system activity (Streeter et al., 2012). These mechanisms directly relate to the neurobiological pathways implicated in tinnitus, including stress response systems, cortical arousal, and emotional regulation. Moreover, yoga has been shown to induce functional and structural changes in brain regions overlapping with those affected in tinnitus, such as the anterior cingulate cortex, insula, and amygdala (Gothe et al., 2019).

In this paper, we aim to explore yoga-based interventions as a mind-body approach to auditory wellness in individuals with tinnitus. By synthesizing current clinical findings, neurophysiological mechanisms, and case-based evidence, we propose that yoga may serve as a valuable adjunctive therapy in the holistic management of tinnitus. This review will also delve into the underlying physiological rationale for yoga's therapeutic effects, highlighting its potential to influence maladaptive neural circuits and reduce tinnitus-related distress.

Methods: Literature Review Methodology

We performed a structured literature search across PubMed, Scopus, Google Scholar, and the Cochrane Library up to April 2025, using keywords including tinnitus, yoga, pranayama, meditation, and mind–body. Clinical studies, case reports, case series, and review articles were screened for relevance; studies combining yoga with other modalities (e.g., acupuncture, TRT) were noted but categorized separately (Vanamoorthy&Mangaiarkarasi, 2023; Thakur et al., 2022).

Physiological Mechanisms of Yoga in Tinnitus Management

The effectiveness of yoga in the treatment of tinnitus symptoms can be attributed to its significant impact on several physiolog ical systems-especially the central nervous system, autonomic nervous system, hypothalamic-pituitary-adrenal (HPA) axis, and neuroendocrine routes. Tinnitus is no longer viewed solely as an auditory disorder but rather as a result of widespread neural dysregulation involving emotional, cognitive, and stress-related networks (De Ridder et al., 2014). As an integrative mind-body intervention, yoga holdsthe potential to target these interconnected systems and restore neural balance through both top-down and bottom-up modulation.

Regulation of the Autonomic Nervous System

One of the hallmark features of tinnitus distress is autonomic hyperarousal, characterized by increased sympathetic tone and reduced parasympathetic activity. This imbalance is reflected in elevated heart rate, blood pressure, and respiratory rate, which are commonly observed in patients experiencing chronic tinnitus-related stress (Dauman& Tyler, 1992). Yoga practices, particularly pranayama (regulated breathing) and meditative techniques, are known to activate the parasympathetic nervous system via the vagal afferent pathways (Brown &Gerbarg, 2005). Slow breathing increases vagal tone, stabilizes heart rate variability, and lowers sympathetic overdrive, creating a physiological milieu less conducive to tinnitus amplification.

Mechanism: Pranayama techniques such as *NadiShodhana* (alternate nostril breathing) and *Bhramari* (humming breath) induce rhythmic vagal stimulation through baroreceptor activation and the glossopharyngeal nerve, leading to downregulation of limbic and brainstem arousal systems.

Cortical Reorganization and Plasticity

Tinnitus is associated with maladaptive cortical plasticity, particularly in the primary auditory cortex (A1) and dorsal cochlear nucleus (DCN). Functional neuroimaging studies have demonstrated increased gamma activity and spontaneous firing in tinnitus patients (Weisz et al., 2007). This hyperactivity is often accompanied by reduced inhibitory GABAergic control and an imbalance in excitatory neurotransmission.

Yoga and meditation practices are known to modulate cortical excitability and induce long-term neuroplastic changes. For instance, mindfulness meditation has been associated with increased gamma synchrony, enhanced alpha activity, and functional connectivity in the prefrontal and cingulate cortices-regions involved in attention and sensory gating (Lutz et al., 2004). These changes may facilitate reorganization of aberrant auditory processing and promote top-down inhibitory control over tinnitus-related activity.

Mechanism: Yogic meditation enhances frontal lobe activity and the salience network, which helps decouple the distressing percept of tinnitus from emotional reactivity, reducing its prominence in conscious awareness (Vanneste et al., 2010).

Modulation of the Limbic System

The limbic system, particularly the amygdala, hippocampus, and anterior cingulate cortex (ACC), plays a crucial role in mediating the emotional and affective components of tinnitus. Increased activity in these regions correlates with higher tinnitus distress and anxiety (Leaver et al., 2016). Yoga-based interventions, especially those emphasizing mindfulness and emotional regulation, have been shown to attenuate limbic hyperactivity and increase resilience against stressors.

Functional MRI studies demonstrate that regular yoga practitioners exhibit reduced amygdala reactivity, increased volume in the hippocampus, and enhanced insula activation, suggesting improved emotional regulation and interoceptive awareness (Villemure et al., 2015). These changes may translate into decreased negative

emotional appraisal of the tinnitus percept and better coping mechanisms.

Mechanism: Mindfulness in yoga retrains the brain's response to auditory stimuli by weakening limbic overactivation and promoting equanimity through increased ACC and insular connectivity.

Hypothalamic-Pituitary-Adrenal (HPA) Axis Suppression

Chronic tinnitus is often associated with elevated cortisol levels, indicating sustained HPA axis activation. This neuroendocrine dysregulation can exacerbate neural hyperexcitability and emotional dysregulation, perpetuating the tinnitus distress cycle. Yoga and meditation practices have been shown to suppress cortisol secretion, thereby modulating the stress response at the neurochemical level. A study by Streeter et al. (2012) demonstrated that yoga increases levels of GABA (gamma-aminobutyric acid)-the primary inhibitory neurotransmitter in the brain-thereby reducing cortical excitability and stress perception. Lower cortisol and higher GABA levels may help diminish the stress-tinnitus loop that maintains chronicity.

Mechanism: Asanas and breath control stimulate hypothalamic feedback inhibition, reducing cortisol secretion and enhancing neurochemical balance in the hippocampus and prefrontal cortex.

Auditory–Somatosensory Interaction via Humming

Specific pranayama practices like *Bhramari Pranayama* (humming breath) directly stimulate the efferent auditory system and may provide a form of natural neuromodulation. Humming generates low-frequency sound and bone-conducted vibration that may activate cochlear hair cells and influence dorsal cochlear nucleus activity (Kumar et al., 2020). Additionally, this practice may engage somatosensory input from the orofacial region, which converges with auditory pathways at the level of the cochlear nucleus. This convergence can be leveraged to reset aberrant firing patterns through multisensory integration, a principle also used in bimodal stimulation therapies.

Mechanism: Bhramari induces vibratory entrainment of the middle ear muscles and cochlea, potentially realigning aberrant neural synchrony via bottom-up stimulation.

Immune and Inflammatory Modulation

Emerging studies suggest a possible inflammatory component in tinnitus, with elevated pro-inflammatory cytokines like TNF-α and IL-6 in chronic sufferers (Shin et al., 2013). Yoga practices have been shown to modulate immune responses, reducing systemic inflammation through vagal and neuroendocrine pathways.

Mechanism: Yoga upregulates anti-inflammatory cytokines and suppresses NF-κB signaling pathways, which may indirectly reduce central sensitization contributing to tinnitus perception.

Discussion

Emerging evidence from small-scale controlled trials, pilot studies, and case reports suggests that yoga-based interventions show promise as adjunctive strategies for alleviating tinnitus-related distress (Eti et al., 2018; Niedziałek et al., 2019; Shetty et al., 2023). Controlled before-and-after designs (Eti et al., 2018) and quasi-randomized studies (Niedziałek et al., 2019) have reported statistically significant improvements in patient-reported outcomes, particularly reductions in Tinnitus Handicap Inventory (THI) and Tinnitus Functional Index (TFI) scores ($p < 0.01$). Notably, trials focusing on Bhramari pranayama have demonstrated large effect sizes, indicating substantial clinical benefit (Shetty et al., 2023). Additionally, case reports highlight the feasibility and rapid symptom relief observed with short-duration programs (e.g., 10 days), reinforcing the intervention's practical applicability (Vanamoorthy&Mangaiarkarasi, 2023). From a mechanistic standpoint, the therapeutic effects of yoga may be attributed to its ability to modulate stress

physiology, enhance parasympathetic activity, and support neural plasticity—mechanisms that align with contemporary models of tinnitus pathophysiology (Singh et al., 2023; Wang et al., 2020). Yoga practices have been shown to reduce cortisol levels and sympathetic arousal while increasing vagal tone and heart rate variability (Thirthalli et al., 2013; Vinay et al., 2016; Shetty et al., 2023), potentially dampening the central auditory gain mechanisms that worsen tinnitus perception. Moreover, yoga's integrative mindfulness components may foster non-reactive, sustained attention, which may help disengage the emotional distress commonly associated with persistent tinnitus by reshaping auditory-limbic circuitry (Villemure et al., 2014). Despite these encouraging findings, several methodological limitations must be acknowledged. Most studies rely heavily on subjective self-report measures, with limited incorporation of objective physiological markers such as neuroimaging or electrophysiological data. Longitudinal follow-up is often lacking, leaving the durability of observed effects uncertain. Furthermore, publication bias and the geographical concentration of studies—predominantly from India and Turkey—may restrict the external validity and generalizability of results. Statistical reporting in many studies is also suboptimal, with infrequent disclosure of confidence intervals or standardized effect sizes, hindering comprehensive meta-analyses and comparative evaluations.

Limitations

Most studies are pilot-level with low methodological rigor: lack of randomization, absence of active controls, small sample sizes, and reliance on subjective outcome measures like Tinnitus Handicap Inventory, Tinnitus Functional Index & Visual Analog Scale (THI, TFI, VAS) (Gunjawate& Ravi, 2021). Combined-modality interventions (e.g., yoga plus acupuncture or naturopathy) confound attribution of effects (Vanamoorthy&Mangaiarkarasi, 2023). Heterogeneity in yoga protocols prevents dose-response analysis, and cultural familiarity with yoga may inflate placebo responses (Apoorva et al., 2024). Mechanistic insights are extrapolated from healthy-practitioner studies rather than from tinnitus patients, so direct pathways remain speculative (Villemure et al., 2014; Thirthalli et al., 2013).

Conclusion

Yoga-based interventions offer a low-risk, potentially effective complementary approach for chronic tinnitus, primarily by attenuating stress responses, enhancing parasympathetic (vagal) tone, and promoting neuroplasticity in auditory-emotional networks. Controlled trials and case reports consistently report improvements in tinnitus handicap, severity, and quality of life. Nonetheless, current evidence is preliminary. High-quality randomized controlled trials, standardized yoga protocols, objective biomarkers (cortisol, HRV, functional MRI), and long-term follow-up are needed to confirm efficacy and clarify mechanisms. In the interim, clinicians may consider recommending gentle yoga or pranayama as part of a holistic tinnitus management plan, with the caveat that individual responses vary.

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