

OCCUPATIONAL HEARING HAZARDS - AN AYURVEDIC PERSPECTIVE ON
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ABSTRACT

Occupational hearing hazards are a major yet often neglected public health concern, particularly among individuals working in industries with prolonged exposure to excessive noise, pressure variations, water immersion, and ototoxic chemicals. Noise-induced hearing loss (NIHL) is one of the most common occupational disorders and is characterized by gradual, irreversible sensorineural hearing impairment resulting from damage to cochlear hair cells. Ayurveda considers hearing as the function of *shrotrendriya*, with *karna* being a *vata shthana*, and attributes hearing disorders to *mithayoga* of *shabdendriya*, leading to *vata-kapha dushti* and impairment of *shabdavaha srotas*, ultimately resulting in *Badhirya*. Modern preventive measures such as engineering controls, administrative interventions, hearing protection devices, periodic audiological screening, and hearing conservation programs are essential in reducing occupational hearing loss. Ayurvedic management emphasizes *nidana parivarjana*, *snehana*, *swedana*, *nasya*, *karna purana*, *basti*, *rasayana* therapy, and adherence to *dinacharya* and *sadvritta* to maintain auditory health, pacify aggravated *vata*, and prevent disease progression. early identification of temporary hearing changes, prompt intervention, and lifestyle modifications are crucial to preventing permanent auditory damage. The present review integrates contemporary concepts of occupational hearing hazards with classical Ayurvedic principles to provide a comprehensive understanding of their etiopathogenesis, prevention, and management.

KEYWORDS: Occupational hazards, Hearing, *Badhirya*, *Karnapoorana*, *Rasayana*.**INTRODUCTION**

Hearing is one of the most essential special senses, enabling communication, environmental awareness, social interaction, and overall quality of life. occupational exposure to hazardous agents such as excessive noise, vibration, pressure changes, water immersion, and ototoxic chemicals has emerged as a significant cause of hearing impairment worldwide. among these, noise-induced hearing loss (NIHL) is the most prevalent occupational hazard affecting workers in industries such as mining, construction, manufacturing, transportation, textiles, and aviation.

The most recent Global Burden of Disease report (2019) estimated that 1.57 billion people, or 20.3% of the world population, are affected by some form of hearing loss.^[1] WHO estimates that in India, approximately 63 million people are suffering from significant auditory

impairment.^[2] NIHL is the second most common cause of hearing loss after Presbycusis (age-related hearing loss). Since NIHL develops gradually and is usually painless, affected individuals often remain unaware of the condition until significant and irreversible hearing impairment has occurred. In addition to hearing loss, occupational hazards may cause tinnitus, acoustic trauma, otitic barotrauma, otitis externa, and vestibular dysfunction, adversely affecting work efficiency, communication, and quality of life.

Despite the availability of hearing conservation programs, engineering controls, and personal protective equipment, occupational hearing disorders remain a major public health challenge, particularly in developing countries where awareness and preventive measures remain inadequate.

Ayurveda recognises *karna* as the *adhithana* of *shrotrendriya* and considers it a *vata sthana*. Classical texts describe *mithyayoga* of *shabdendriya* (improper exposure to sound), *pratishyaya*, *jalakrida*, *karnakandu*, and other etiological factors that vitiate *vata* predominantly along with *kapha*, leading to *shabdavaha srotodushti* and ultimately *Badhriya*.^[3] *Badhriya* is one among the 28 *karnagataroga* mentioned by *Sushruta*^[4] and 25 by *Vagbhata*.^[5] Ayurvedic management focuses on *nidana parivarjana*, *vatahara chikitsa*, *nasya*, *karna purana*, *snehana*, *swedana*, *basti*, *rasayana* therapy, *sadvritta*, and adherence to *dinacharya* for preserving auditory health and preventing disease progression.

This review aims to integrate contemporary concepts of occupational hearing hazards with Ayurvedic principles, highlighting their etiopathogenesis, clinical manifestations, preventive measures, and therapeutic approaches to promote a holistic strategy for hearing conservation in occupational settings.

MATERIALS AND METHODS

This study is a narrative review based on information collected from Ayurvedic classical texts such as *Charaka Samhita*, *Sushruta Samhita*, *Ashtanga Hridaya*, and various *Shalakya Tantra* references, modern ENT textbooks, research articles, WHO and NPPCD reports, and occupational health guidelines. Relevant data on occupational hearing hazards, hearing physiology, types of hearing loss, and Ayurvedic concepts of *karna roga* and *Badhriya* were compiled and analysed to correlate modern occupational hearing disorders with Ayurvedic principles such as *vata prakopa*, *shabdavaha srotodushti*, and *indriya dourbalya*, along with their preventive and therapeutic approaches.

DISCUSSION

Occupational hazards are work-related sources of potential harm that can affect the physical, mental and social well-being of workers. They mainly arise from physical factors such as heat, cold, radiation and noise; chemical factors including toxic dust, gases and other chemicals; and biological factors such as viral, bacterial, fungal and parasitic agents. These hazards are particularly relevant among industrial and factory workers, miners, textile workers, traffic police, farmers, call centre workers, pilots, teachers and other high-risk occupations, emphasizing the need for a safe and healthy workplace. Occupational hearing disorders are often underdiagnosed because symptoms develop gradually and workers often adapt to early communication difficulties.

Occupational Hearing Disorders: A Concise Review Noise-Induced Hearing Loss (NIHL)

Occupational noise exposure remains one of the most prevalent and preventable causes of hearing impairment worldwide. Workers employed in manufacturing, construction, mining, transportation, aviation, military, and communication industries are particularly vulnerable

because of prolonged exposure to sound levels exceeding recommended occupational limits.

Prolonged or repeated exposure to noise levels approaching or exceeding 90 dB increases the risk of noise-induced hearing loss, while intense impulse noise above 140 dB may cause acute acoustic trauma. Common high-intensity sources include firecrackers (125–150 dB), firearms (163–170 dB), industrial machinery (~140 dB), and artillery fire (140–185 dB). Steady-state noise remains relatively constant over time, but safe daily exposure decreases rapidly as sound intensity rises—approximately 8 hours at 90 dB, 4 hours at 95 dB, 1 hour at 105 dB, and only 15 minutes at 115 dB.

NIHL results from both mechanical and metabolic injury to the cochlea.^[6,7] Repeated acoustic overstimulation initially produces a temporary threshold shift (TTS), which may recover after cessation of exposure. Continued exposure leads to a permanent threshold shift (PTS) characterised by irreversible loss of outer hair cells, subsequent inner hair cell damage, synaptopathy, and degeneration of auditory neurons. Oxidative stress, mitochondrial dysfunction, excitotoxicity, and microvascular compromise are central mechanisms responsible for cochlear apoptosis and progressive hearing impairment. Clinically, NIHL presents with gradual bilateral sensorineural hearing loss, difficulty understanding speech in noisy environments, and tinnitus. A 4-kHz audiometric notch is the classic early finding, although adjacent frequencies become involved as the disease progresses. Importantly, substantial cochlear injury may occur before patients perceive hearing difficulty, emphasising the need for active screening in high-risk populations. Although established NIHL is generally irreversible, timely rehabilitation with hearing aids, cochlear implantation in selected patients, auditory training, counselling, and assistive listening technologies can significantly improve communication and quality of life. Current evidence does not support routine therapeutic use of antioxidants or micronutrient supplementation for reversal of NIHL. Prevention remains the most effective strategy and includes engineering controls, administrative controls, appropriate hearing protection, worker education, and comprehensive hearing conservation programs with regular auditory monitoring.

Acoustic Shock Syndrome

Call-centre and communication workers constitute a unique occupational group exposed to prolonged headset use and continuous background noise. Sudden, unexpected high-intensity sounds transmitted through a headset may precipitate acoustic shock syndrome, manifesting as ear pain, tinnitus, hyperacusis, dizziness, headache, anxiety, and transient hearing disturbance. While the exact pathophysiology remains uncertain, cochlear stress, middle-ear muscle dysfunction, and central auditory sensitisation have been implicated.

Preventive measures include limiting headset output, reducing workplace noise, using sound-level limiting devices, maintaining equipment, and conducting periodic hearing evaluations.

Otitic Barotrauma

Otitic barotrauma occurs when the Eustachian tube fails to equalise middle-ear pressure during air travel, diving, or hyperbaric exposure. Patients typically present with ear fullness, severe otalgia, conductive hearing loss, tinnitus, and occasionally vertigo. Management includes analgesia, treatment of underlying nasal or sinus disease, and pressure-equalisation manoeuvres such as swallowing, yawning, or the Valsalva manoeuvre. Avoidance of flying or diving during upper respiratory infections is an important preventive measure.

Otitis Externa: (swimmer's ear)

Otitis externa is an inflammatory disorder of the external auditory canal, commonly associated with retained moisture and infection by *Pseudomonas aeruginosa* or *Staphylococcus aureus*. symptoms include otalgia, pruritus, aural fullness, otorrhea, and temporary hearing reduction. treatment consists of aural toilet when indicated, topical antimicrobial therapy with or without corticosteroids, analgesia, and avoidance of further moisture exposure.

Environmental Ototoxicity

Exposure to industrial solvents, heavy metals, pesticides, and certain medications can damage the cochlea, vestibular system, or auditory nerve. of particular concern is the synergistic interaction between noise and ototoxic chemicals, which may accelerate auditory damage even at exposure levels that are individually considered acceptable. A detailed occupational and medication history, early recognition of symptoms, reduction or elimination of exposure, and regular audiometric follow-up are therefore essential components of occupational health practice.

KEY INVESTIGATIONS

- Pure-tone audiometry (PTA): Gold standard for diagnosis and serial monitoring of NIHL, useful for identifying temporary or permanent threshold shifts and the characteristic 4-kHz notch.
- Otoacoustic emissions (OAE): Sensitive indicator of early outer hair cell dysfunction and valuable for screening before significant threshold elevation occurs.
- Tympanometry and acoustic reflex testing: Assess middle-ear function and help differentiate conductive from sensorineural pathology.
- Auditory brainstem response (ABR/BERA): Useful when behavioural audiometry is unreliable, in medicolegal evaluation, and when retrocochlear pathology is suspected.
- Speech audiometry: evaluates speech recognition and functional communication deficits that may not be fully reflected by pure-tone thresholds.

- Vestibular assessment: Considered in patients with dizziness, imbalance, or suspected vestibulo-toxic exposure.

Rehabilitation^[8,9]

Rehabilitation should be individualised and may include hearing aids, cochlear implants in selected patients, bone-anchored hearing devices, auditory rehabilitation, communication training, and assistive listening technologies. Sudden sensorineural hearing loss should be recognised as a distinct otologic emergency in which prompt corticosteroid therapy may improve outcomes.

BHADHIRYA

The *shrotrendriya*: Anatomical and Functional Perspective^[10]

The *shrotrendriya* is one of the *pancha jnanendriyas*, responsible for the perception of *shabda*. *akasha mahabhuta* is the predominant *mahabhuta* of *shrotrendriya*, as sound is the *guna* of *akasha mahabhuta*. the proper functioning of hearing depends upon the integrity of the *shrotrendriya*, *manas*, *atma*, and the unobstructed transmission of sensory impulses through the *shrotravaha srotas*. *karna* serves as the *adhithana* of the *shrotrendriya*. *Sushruta* describes the ear as being nourished by an intricate network of *sira*, *snayu*, and *srotas*, which maintain its structural and functional integrity. the auditory pathway is closely associated with the *shiras*, emphasizing the intimate relationship between the ear and the central nervous system.

Among the *doshas*, *prana vata* plays a vital role in receiving and transmitting auditory stimuli, while *vyana vata* facilitates the conduction and coordination of sensory impulses. the normal perception of sound (*shabda grahana*) depends on the unobstructed movement of *vata* within the *shrotravaha srotas*. any derangement of *vata dosha*, either independently or in association with *kapha*, leads to impairment of auditory perception, resulting in *Badhriya*. thus, preservation of the normal state of *vata* and the patency of the *shrotravaha srotas* is fundamental for maintaining healthy hearing.

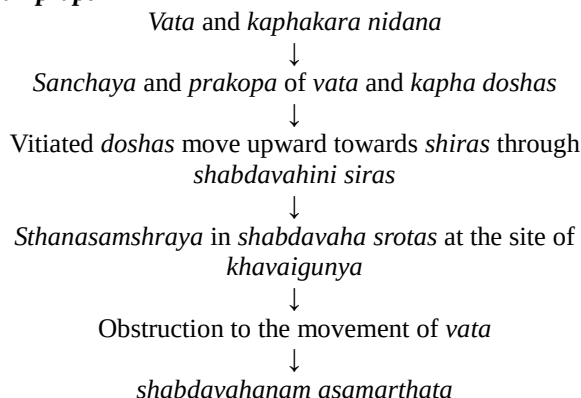
Badhriya is described by *Acharya Sushruta* and *Vagbhata* as one of the important *karnarogas*. According to *Sushruta Samhita* aggravated *vata* associated with *kapha* lodges in the *shabdavaha sira*, causing impairment in sound perception when untreated.

Nidana of *Badhriya*^[11]

Aharaja Nidana: excessive intake of *ruksha*, *sheeta*, *laghu*, and *katu ahara* aggravates *vata*, reducing tissue nourishment essential for hearing.

Viharaja Nidana: *mithyayoga* of *shabda*, *vegavidharana*, *divaswapna* and *ratrijagarana*, *ativayama* and *ativayava*

Agantuja Nidana: *karnaabhighata*, *shiroabhighata*, exposure to *vata* provoking environmental factors.

Samprapti^[12]**Chikitsa**

Karna roga is predominantly a *vata-pradhana* disorder; hence, treatment aims at *vata* shamana and nourishment of the auditory structures. *samana* and *vishesha chikitsa* of *Badhira* have been mentioned.

Samanya chikitsa^[13]

In conditions such as *karnashoola*, *karnanada*, *karnakshweda*, and *Badhira*, a common treatment approach is adopted that is *ghritapana*, *rasayana yoga*, *avyayama*, *akathana* and *ashirasnana*.

Ghrita pana: *Ghritapana* alleviates *vata* and *pitta*, promotes *rasa* to *majja* and *shukra dhatu* nourishment, and enhances *ojas*. owing to its *snigdha*, *guru*, and *mridu guṇas*, it counteracts the *ruksha* and *khara* qualities of aggravated *vata*, the principal *doṣha* in *Badhira*. its *Samaskārasyānuvartanatva* property enhances the efficacy of processed drugs, while its *bṛṇhaṇa*, *dhatu-poṣhaṇa*, and *rasayana* actions support the structural and functional integrity of the *shrotrendriya*, retard degenerative changes, and aid in the restoration of auditory function.

Avayama: *Sthanika chikitsa* in *karnapradesha* should be supported with strict observation of *avyayama* as *vyayama* aggravates *vata dosha*, the principal factor involved in the pathogenesis of the disease. owing to its *ruksha*, *laghu*, and *chala* qualities, excessive exercise increases *vata* and promotes its *urdhvagati* toward the *shira* and *shrotrendriya*, further disturbing the *shabdavaha srotas*. this aggravation may enhance *srotorodha*, *dhatukshaya*, and impairment of auditory function, thereby delaying recovery.

Akathana: *Akathana* (avoidance of excessive or strained speech) minimises the overactivity of *udana* and *prana vata*, thereby preventing further aggravation of *vata dosha* in the *urdhvajatrugata*. this helps to maintain the normal function of the *shabdavaha srotas* and reduces functional stress on the auditory apparatus. by providing physiological rest to the head, throat, and auditory pathways, *akathana* creates a favourable environment for tissue repair and supports the therapeutic action of *karnapurana*, *nasya*, and other *vata*

pacifying interventions, thereby promoting preservation and recovery of hearing.

Ashirasnana: *Ashirasnana* (avoidance of head bath, especially with cold water) helps prevent aggravation of *vata dosha* and reduces *kapha* accumulation in the *shabdavaha srotas*, thereby preventing *srotorodha*. By maintaining warmth around the head and ear, it minimises congestion, supports normal auditory function, and promotes an environment conducive to the restoration and preservation of hearing.

Rasayana: *Rasayana* therapy plays a vital role in the prevention and management of *Badhira*. By promoting healthy aging, preserving the integrity of the *dhatu*, and enhancing sensory function, *rasayana* therapy conceptually parallels modern strategies aimed at preventing cochlear degeneration through antioxidant and neuroprotective mechanisms.

Few *rasayana*^[14] includes *chyavanaprasha*, *amalakaghrita*, *amalaki avalehya*, *lauhadi Rasayana*, and *triphala rasayana* among these formulations, *chyavanaprasha* is widely recognized for its rejuvenative properties. its chief ingredient, *amalaki* (*Phyllanthus emblica*), is rich in vitamin C, tannins, ellagic acid, and gallic acid, which possess potent antioxidant, anti-inflammatory, and mitochondrial-protective effects. these properties may help reduce oxidative stress.

Vishesha chikitsa^[15]

Snehana: Prolonged application of *sneha* during *abhyanga* enables its gradual penetration through the successive *dhatu*, promoting *dhatu poṣhaṇa* and restoring tissue integrity. *snehana* through its *snigdha*, *mridu* and *vatahara* properties pacifies the aggravated *vata dosha*, nourishes the *karna* and *shravaha srotas*, and supports normal auditory function.

Swedana: *Swedana karma* facilitates *srotoshodhana* and *vatanulomana*. *naḍi sweda* provides localized fomentation, while *piṇḍa sweda* offers both fomentation and nourishment. due to its *uṣhṇa*, *tikṣhṇa*, *sara*, and *sukshma guṇas*, *swedana* liquefies and mobilises *grathita kapha*, relieves *srotorodha*, and purifies the *karnavaha srotas*. it facilitates *vatanulomana*, improves local circulation and tissue nourishment, and enhances the absorption of *sneha*, *nasya*, and *karnapoorana dravyas*. by removing *kapha-avarana*, normalizes *vata* and restores the patency of the auditory channels.

Vamana: *Vamana* with *pippali siddha sarpi* is indicated in *kapha-anubandhita Badhira*. due to its *uṣhṇa*, *tikṣhṇa*, *sukshma*, *vyavayi*, and *vikasi* properties, it liquefies and mobilises the accumulated *kapha* towards the *amashaya*, from where it is expelled through *vamana karma*. This eliminates *kapha* from the *urdhvajatrugata pradesha*, relieves *srotorodha*, restores the patency of the

shrotravaha srotas, facilitates normal *vata gati*, and thereby improves hearing function.

Snehavirechana: *Eranda taila* indicated as *sneha virechana*, exerts its therapeutic effect through its *snigdha*, *ushna*, *tikshna*, *sukshma*, *vyavayi*, and *vikasi* properties. it produces *mridu virechana*, facilitating the expulsion of accumulated *doshas* and *srotoshodhana*. its *snigdha* property pacifies *vata*, while the *ushna*, *tikshna*, and *sukshma* properties liquefy and mobilise *kapha*, relieving *kapha avarana* of *vata*.

Nasya: It is a principal *panchakarma* procedure for *urdhvajatrugata vikaras*, based on the classical principle “*nasa hi shiraso dwaram*” (the nose is the gateway to the head). it alleviates *vata-kapha dosha*, clears the *srotas*, nourishes the *indriyas*, and promotes the health of the *shiras* and *karna*, making it an important therapy in *Badhira*. Modern studies suggest that intranasal drug delivery can bypass the blood–brain barrier through olfactory and trigeminal pathways, supporting the therapeutic rationale of *nasya* in auditory and neurological disorders.

Shirobasti and Shirodhara: *Shirobasti* (retention of medicated oil over the cranial region) and *Shirodhara* (continuous pouring of medicated liquid over the forehead) helps to pacify *prana vata* and are especially indicated when associated with symptoms such as tinnitus, vertigo, anxiety, and disturbed sleep. these therapies are believed to exert their effects through multiple mechanisms, including enhancement of parasympathetic activity, reduction of stress-induced sympathetic overactivity, improvement of cerebral and cochlear microcirculation, and promotion of mental relaxation.

Raktamokshana: In selected cases with associated *rakta dushti*, *raktamokshana*, performed to improve local circulation, relieve congestion, and facilitate better auditory function. this procedure act synergistically to reduce symptoms, prevent recurrence.

Karnapoorana yogas according to different Acharyas

Sushruta	Charaka	A.H	A.S	Chakradatta
Ashvattapatra Khalla taila Kukkutavasa Vamshavalekhana Sneha Dipika talla Arkankura taila Ashtamutra Bilva taila	Daru vachadi taila Gandha taila	Erandadi taila Prativishadi taila Sarshapa taila Kshara taila Dipika taila Drakshadi taila	Apamarga kshara Taila Kshara taila Bilva taila	Kshara taila, apamarga kshara taila Swarjika kshara taila, Dashamula taila Bilva taila

Dinacharya: regular practice of *nasya*, *kavala*, *gandusha*, *dhumapana*, *snana*, and *chankramana* as components of *dinacharya* helps preserve the health of the *shrotrendriya* by maintaining the equilibrium of *vata* and *kapha* and ensuring the proper functioning of the *urdhvajatrugata srotas*.

Basti: is regarded as the prime treatment for *vataja* disorders. in classics some of the *indriyaprasadana basti*^[16] has mention that include *shaliparnyadi yapana basti*, *mayuradi yapana basti*, and *masha taila basti* etc. it pacifies aggravated *vata*, restores its normal physiological functions, and promotes *srotoshodhana*, thereby facilitating proper neural conduction and auditory function. through systemic absorption and gut–brain axis modulation, *basti* enhances microcirculation, reduces neuroinflammation, and supports neuroprotection.

Dhupana: it is indicated in *kapha*-associated condition in order to alleviate *kapha* obstruction in the *urdhvajatrugata srotas*. such as *kshouma*, *guggulu*, and *agaru* smeared with *ghrita* facilitate the clearance of accumulated *kapha*, improve the patency of the eustachian tube, and promote ventilation of the middle ear, thereby benefiting conductive hearing impairment.

Karnapurana: it is widely indicated in the prevention and management of *Badhira*. it involves the instillation of lukewarm medicated oil or ghee into the external auditory canal to nourish the *shrotrendriya*, pacify *vata dosha*, and maintain the integrity of the auditory pathways. It is described in the classics as both a *swasthasya rakshana* and *aturasya vikara prashamana* measure.

the procedure consists of instilling the medicated *taila* in ear till ear canal get filled and retaining it for 100 *matrakala*. by providing *sneha* to the auditory canal, *karnapurana* alleviates *rukshata*, relieves *vata*-induced dysfunction, and supports the normal physiological function of hearing. From a contemporary perspective, the rich vascularity of the external auditory canal may facilitate local therapeutic action, while the lubricating and anti-inflammatory properties of medicated formulations contribute to symptom relief.

Nasya^[17]- nourishes the *shiras* and supports *prana* and *udana vata*.

Kavala and Gandusha^[18] - improve local circulation and *dhatu poshana*.

Dhumapana^[19]-eliminates *utklishta kapha*, clears the *srotas*, and prevents *srotorodha*.

Snana^[20] -promotes *indriya prasada*

Chankramana^[21] -enhances *agni, rasa* circulation, and nourishment of *dhatu*. Collectively, these measures promote *vata anulomana*, *srotoshuddhi*, and optimal nourishment of the auditory apparatus, thereby helping prevent the development and progression of *Badhira*.

Vega dharana

1) Trit vega dharana^[22] it causes *rasa dhatu kshaya* leading to *vata prakopa* that causes *karna sroto rukshata* and *shrotendriya dourbalya*. avoiding the suppression of thirst maintains adequate hydration, preserves the *snigdha* of the body, and supports the normal

functioning of *vata*. It ensures proper nourishment of the *karna srotas* and *shrotendriya*, thereby helping maintain auditory function and preventing the development and progression of *Badhira*.

2) Ashru vega dharana^[23] it aggravates *vata* leading to *shiras* and *indriya vaigunya* that impairs the normal functions and nourishment of *karna srotas* and *shrotendriya*. avoiding the suppression of tears maintains the normal physiological activity of *vata* and promotes the health of the *shiras* and *indriyas* and supports proper nourishment and functional integrity of the *shrotendriya*.

Pathyaapathya^[24,25]

	PATHYA	APATHYA
AHARA	<i>shali, godhuma, yava, mudga, patola, shighru, vartaka mamsa-lava, mayura, harina, titira, vanakukkuta</i>	<i>Viruddha annapana</i>
VIHARA	<i>Brahmacharya Alpakathana</i>	<i>Dantakashta, Shirasnana, Vyayama, Kanduyana, Tushara, Vegadharana</i>

CONCLUSIONS

Occupational hearing hazards remain one of the most significant yet preventable causes of acquired hearing loss worldwide, imposing substantial personal, social, and economic burdens. Continuous exposure to excessive occupational noise and ototoxic agents can lead to irreversible auditory damage, adversely affecting communication, work efficiency, psychosocial well-being, and overall quality of life. These challenges highlight the need for comprehensive hearing conservation strategies that prioritise hazard identification, engineering and administrative controls, appropriate use of hearing protection devices, periodic audiological surveillance, health education, and early intervention.

From an Ayurvedic perspective, the concept of *Badhira* provides a holistic understanding of hearing disorders by emphasising the role of *nidana parivarjana*, maintenance of *indriya bala* and restoration of physiological balance through preventive and therapeutic measures. Classical interventions such as *karnapurana*, *nasya*, *panchakarma*, *rasayana chikitsa*, and appropriate lifestyle modifications aim not only to manage hearing disorders but also to preserve auditory function and enhance resilience against occupational stressors. Contemporary experimental studies further suggest that several Ayurvedic medicinal plants possess antioxidant, anti-inflammatory, neuroprotective, and otoprotective properties, although robust multicentric clinical trials are required to establish their efficacy in occupational hearing disorders.

An integrative approach combining modern occupational hearing conservation practices with evidence-informed Ayurvedic principles offers a promising, patient-centred strategy for preventing hearing loss and promoting long-

term auditory health. Strengthening interdisciplinary research and generating high-quality clinical evidence will facilitate the scientific integration of Ayurveda into occupational health programs, ultimately contributing to sustainable hearing healthcare and improved quality of life for workers worldwide.

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