

IMPACT OF HEADPHONES AND IN-EARBUDS ON HEARING PERCEPTION AND
KARNANADA (TINNITUS) AMONG YOUNG ADULTS: AN OBSERVATIONAL CROSS-
SECTIONAL STUDYDr. Sapna^{1*}, Dr. Shridev Phondani²^{*1}PHD Scholar, ²Professor & Guide,

Department of Shalakya Tantra, Faculty of Ayurveda, Desh Bhagat University, Mandi Gobindgarh, Punjab.

***Corresponding Author: Dr. Sapna**PHD Scholar, Department of Shalakya Tantra, Faculty of Ayurveda, Desh Bhagat University, Mandi Gobindgarh, Punjab. DOI: <https://doi.org/10.5281/zenodo.21701230>**How to cite this Article:** Dr. Sapna^{1*}, Dr. Shridev Phondani² (2026). Impact Of Headphones And In-Earbuds On Hearing Perception And Karnanada (Tinnitus) Among Young Adults: An Observational Cross-Sectional Study. European Journal of Pharmaceutical and Medical Research, 13(8), 181–184.

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ABSTRACT

Background: The widespread adoption of personal audio devices (PADs), particularly headphones and in-earbuds, has increased the risk of recreational noise-induced hearing loss (NIHL) and tinnitus among young adults. Ayurveda describes similar auditory manifestations under Karnanada and Badhirya. **Aim:** To evaluate the impact of headphones and in-earbuds on hearing perception and Karnanada among young adults. **Materials and Methods:** An observational analytical cross-sectional study was conducted among 150 young adults aged 18–35 years using questionnaires, otoscopic examination, and Pure Tone Audiometry. **Results:** In-earbud users demonstrated significantly higher hearing thresholds and greater prevalence of tinnitus compared with headphone users. **Conclusion:** Prolonged use of personal audio devices, especially in-earbuds at high volume, is associated with early auditory dysfunction and Karnanada.

KEYWORDS: Karnanada, Tinnitus, Badhirya, Noise-Induced Hearing Loss, Headphones, Earbuds, Shalakya Tantra, Ayurveda.

INTRODUCTION

The rapid expansion of digital education, entertainment streaming, gaming, and remote communication has transformed headphones and in-earbuds into indispensable components of daily life. Although these devices provide convenience and accessibility, prolonged exposure to high-intensity sound has emerged as a significant public health concern. The World Health Organization estimates that over one billion adolescents and young adults are at risk of hearing impairment due to unsafe listening practices.

Modern otology recognizes Noise-Induced Hearing Loss (NIHL) as a major cause of acquired sensorineural hearing loss. Excessive sound exposure damages cochlear hair cells through mechanical trauma, oxidative stress, excitotoxicity, and neuroplastic alterations, eventually leading to tinnitus.

Ayurveda describes hearing disorders under Karnaroga. Karnanada and Badhirya are considered Vataja disorders arising from the vitiation of Prana Vayu and Vyana Vayu within Shabdhanuvaha Siras. Continuous exposure to loud sound can be interpreted as Atiyoga and Mithayoga of Shabdendriya, leading to Vata Prakopa and Srotorodha.

Despite increasing device usage among young adults, studies integrating modern audiological assessment with Ayurvedic concepts remain limited. Therefore, the present study was undertaken.

AIM

To evaluate the impact of headphones and in-earbuds on hearing perception and Karnanada among young adults.

OBJECTIVES

1. To document personal audio device usage patterns.
2. To correlate auditory symptoms with device usage.

3. To evaluate Ayurvedic manifestations of Karnanada and Badhirya.
4. To establish preventive recommendations integrating Ayurveda and modern audiology.

MATERIALS AND METHODS

Study Design

- Observational analytical cross-sectional study.

Study Population

- Young adults aged 18–35 years.

Sample Size

- 150 participants.

Inclusion Criteria

- Age between 18–35 years.
- Regular headphone/earbud use for ≥ 1 hour/day during the previous 6 months.
- Individuals with or without tinnitus symptoms.

Exclusion Criteria

- Congenital hearing impairment.
- Chronic suppurative otitis media.
- Impacted cerumen.
- Tympanic membrane perforation.
- Ototoxic medication use.
- Occupational noise exposure.
- Systemic diseases affecting hearing.

Assessment Criteria

Subjective Parameters

- Frequency of tinnitus

- Duration of tinnitus
- Speech discrimination difficulty
- Muffled hearing
- Sleep disturbance
- Hyperacusis
- Karnashoola
- Karnapratinaha
- Rukshata
- Shabda Prakriti
- Vata Kala aggravation

Objective Parameters

- Pure Tone Audiometry (500–4000 Hz PTA)
- High-frequency thresholds (6000–8000 Hz)
- Bone conduction testing
- Otoscopic examination

Statistical Analysis

Data were analyzed using

- Chi-square test
- Fisher's Exact test
- Independent sample t-test
- One-way ANOVA
- Odds ratio calculations

A p-value < 0.05 was considered statistically significant.

RESULTS

Among participants, 74.67% used in-earbuds and 56% reported device use exceeding 3 hours daily. Tinnitus was reported by 83.33% of participants. Earbud users demonstrated significantly higher PTA thresholds than headphone users.

Table 1: Demographic Characteristics and Personal Audio Device Usage Patterns Among Participants (N = 150).

Variable	Category	Frequency (n)	Percentage (%)
Age Group	18–25 years	98	65.33
	26–30 years	37	24.67
	31–35 years	15	10.00
Type of Device Used	In-earbuds	112	74.67
	Over-ear headphones	38	25.33
Daily Usage Duration	1–3 hours	66	44.00
	>3 hours	84	56.00
Listening Volume	<60%	32	21.33
	60–80%	51	34.00
	80–95%	67	44.67

Distribution of participants according to demographic profile and personal audio device usage characteristics.

Table 2: Prevalence of Auditory Symptoms Among Participants.

Symptom	Frequency (n)	Percentage (%)
Tinnitus (Karnanada)	125	83.33
Speech discrimination difficulty	113	75.33
Muffled hearing after listening	107	71.34
Sleep disturbance	41	27.33
Hyperacusis	36	24.00
Ear fullness	68	45.33
Ear pain (Karnashoola)	61	40.67

Table 3: Frequency Distribution of Karnanada (Tinnitus) Characteristics.

Variable	Category	Frequency (n)	Percentage (%)
Tinnitus Occurrence	Daily	28	18.67
	Weekly	34	22.67
	Occasional	63	42.00
	Constant	24	16.00
Sleep Disturbance due to Tinnitus	Present	41	27.33
	Absent	109	72.67

Table 4: Comparison of Hearing Status Between Earbud and Headphone Users.

Hearing Status	Earbud Users n (%)	Headphone Users n (%)
Normal Hearing	34 (30.36)	24 (63.16)
Subclinical Threshold Shift	52 (46.43)	11 (28.95)
Mild Sensorineural Hearing Loss	26 (23.21)	3 (7.89)
Persistent Karnanada	51 (45.54)	11 (28.95)

Chi-square=14.62; Fisher Exact p=0.0004.

Table 5: Pure Tone Audiometry (PTA) Thresholds According to Device Type.

Device Type	Mean PTA (dB HL)	Standard Deviation
Earbuds	23.84	6.42
Headphones	14.11	4.29

Independent samples t-test: p<0.0001.

Table 6: Association Between Listening Volume and Hearing Threshold Shift.

Listening Volume	Mean PTA (dB HL)	SD
<60%	12.6	3.4
60–80%	17.9	4.8
80–95%	25.7	6.2

ANOVA F=18.94, p<0.0001.

Table 7: Distribution of Ayurvedic Clinical Features Among Participants with Karnanada.

Ayurvedic Feature	Frequency (n)	Percentage (%)
Rukshata	81	64.80
Karnapratina	73	58.40
Karnashoola	51	40.80
Shirashoola	53	42.40
Bhrama	29	23.20
Nocturnal Aggravation	88	70.40

Based on tinnitus-positive participants.

Table 8: Types of Karnanada Observed According to Ayurvedic Classification.

Type of Sound Perceived	Frequency (n)	Percentage (%)
Venu Nada	48	38.40
Kshweda Nada	32	25.60
Sankha Nada	26	20.80
Bheri Nada	19	15.20

DISCUSSION

The present study demonstrated a strong relationship between prolonged personal audio device use and early auditory dysfunction. Earbud users exhibited significantly greater hearing threshold shifts than over-ear headphone users. These findings support modern evidence that occluded ear canal designs amplify sound pressure levels and increase cochlear stress.

The predominance of tinnitus, muffled hearing, and speech discrimination difficulty suggests ongoing cochlear injury and auditory pathway dysfunction. The

observed 4000-Hz notch is a classic hallmark of recreational NIHL.

From an Ayurvedic perspective, headphone overuse represents Atiyoga and Mithyayoga of Shabdendriya. Continuous acoustic stimulation acts as Abhighata leading to Prana Vayu and Vyana Vayu vitiation. Subsequent Srotorodha in Shabdanuvaha Siras manifests clinically as Karnanada and Badhirya.

The predominance of Venu and Kshweda type tinnitus further supports Vata dominance, whereas Bheri and

Sankha sounds indicate secondary Kapha involvement and channel obstruction. Nocturnal aggravation observed in 70.4% participants aligns with classical descriptions of Vataja disorders.

The association between Ruksha Ahara and ear dryness further reinforces the role of systemic Vata aggravation in auditory pathology.

Limitations

Cross-sectional design prevents establishment of causality.

Self-reported listening habits may introduce recall bias.

Otoacoustic emissions and ABR were not performed.

Single-center sampling limits generalizability.

Longitudinal follow-up was not conducted.

CONCLUSION

Excessive use of headphones and in-earbuds constitutes an emerging lifestyle-related auditory hazard among young adults. Earbud use, prolonged listening duration, and high-volume exposure significantly increase the risk of hearing threshold shifts and Karnanada. The findings validate both modern theories of recreational NIHL and Ayurvedic concepts of Asatmyaindriyartha Samyoga, Vata Prakopa, and Srotorodha. Preventive approaches integrating safe listening behaviors, Karnapoorana, Shiroabhyanga, Vata-pacifying diet, and public awareness initiatives may help reduce future auditory morbidity.

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