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ASSOCIATION BETWEEN EARPHONE USAGE BY STUDENTS AND PREVALENCE OF HEARING LOSS: A STUDY CONDUCTED IN A MEDICAL COLLEGE

Otorhinolaryngology

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ABSTRACT

Introduction: Hearing loss is a prevalent concern in today's age, particularly among young adults frequently using earphones. As these devices have become portable and affordable, their use has increased. At high volumes, sound exposure could easily exceed the safety level. Some studies show that, compared with non-users, users of earphones have higher incidence of subtle outer hair cell damage. Others show no relation between use of earphones and hearing loss. **Objectives:** This study aims to investigate the prevalence of hearing loss among medical students related to their earphone usage, explores potential contributing factors and raises awareness about safe listening practices. **Methodology:** 50 willing undergraduate medical students were enrolled. After obtaining informed consent, they were asked to fill up a pretested questionnaire. Those who meet the inclusion criteria were examined to rule out otological pathology. Following this, Pure Tone Audiometry was conducted, transmitting pure tones of frequencies from 250-4000 Hz, for both air and bone conducted sounds using standard equipment. The audiograms were then analysed using appropriate statistical tests **Results:** Only 3 out of the 50 candidates showed minimal hearing loss and the hearing thresholds of the students varied in isolated frequencies. The only significant association was noted at hearing threshold of 1000Hz and candidates with exposure of more than 5 years($p<0.05$) **Conclusion:** This study did not reveal an adverse impact of use of earphones on hearing thresholds and only showed some variations at isolated frequencies. It also revealed that 42% of the candidates were not aware of safe hearing practices

KEYWORDS

earphones, deafness, sensorineural hearing loss, hearing threshold, pure tone audiometry

INTRODUCTION

Hearing loss is a growing concern in today's society, particularly among young adults who frequently use earphones[1]. The rise of portable and affordable audio devices has made it easier than ever to access music and other audio content, leading to an increase in their use, often at high volumes[4]. This trend raises critical questions about the long-term effects of sustained sound exposure on auditory health. Research indicates that exposure to high decibel levels, especially over extended periods, can surpass recommended safety thresholds, potentially leading to irreversible damage[10].

Several studies have attempted to unravel the relationship between earphone use and hearing loss, with mixed results. Some research has found a correlation between earphone usage and subtle outer hair cell damage in the cochlea, a crucial component of our hearing mechanism. This damage can manifest as a decrease in the ear's ability to process sound, resulting in diminished hearing sensitivity and increased susceptibility to noise-induced hearing loss[3,8].

Conversely, other studies suggest no significant link between earphone use and hearing impairment, indicating that factors such as individual listening habits, volume levels, and duration of exposure might play a more significant role in the onset of hearing issues[1,6]. This disparity in findings underscores the complexity of auditory health and the need for further research to establish clearer connections.

Hearing impairment can impact communication, educational outcomes, and overall quality of life. Therefore, understanding the relationship between earphone use and hearing loss is crucial for developing effective guidelines and preventative measures to protect auditory health, especially in the younger population that is most at risk[4,7]. In an age where music is a constant companion, promoting awareness and encouraging safe listening practices could be key steps in preserving hearing health for future generations.

This study aims to analyze the association between earphone usage patterns and hearing loss prevalence among medical students. By conducting audiometric testing and examining usage in terms of duration of exposure, we hope to provide insights into whether prolonged earphone use poses risks to hearing in this population. The findings may have implications for recommending safe listening practices to protect auditory health in young adults.

METHODOLOGY

This study was carried out in the Department of ENT, JJM Medical college, Davangere, Karnataka from September to October 2024, after acquiring clearance from the Institutional Ethics Committee.

The participants were undergraduate medical students of JJMMC and consequently in the age group of 18 to 25 years of age.

Sampling Procedure:

50 students were selected and were randomized. After obtaining informed consent, willing students were asked to fill up a pretested questionnaire via a google form. Those who meet the inclusion criteria were then examined to rule out any other otological pathology. Following this, Pure Tone Audiometry was conducted by an audiologist on each of these subjects which involved transmitting pure tones of frequencies ranging from 250 to 8000 Hz into the subject's ears, one side at a time.

Study of Design: Cross sectional study
Study Duration: 1 month, from September to October 2024

Sampling Criteria
Inclusion Criteria:

1. All medical students between the age of 18 to 25 irrespective of gender consenting for the study

Exclusion Criteria:

1. Those with previously diagnosed ear diseases such as Chronic otitis media, Otosclerosis or other middle and inner ear pathologies
2. Those who are diagnosed with hearing loss and are using hearing aids or other hearing assistance devices.
3. Those who have a family history of hearing loss
4. Those who are not consenting to the study

The hearing status of participants for each ear was measured for both air (250–4000 Hz) and bone (250–4000 Hz) conducted sound stimuli. A diagnostic audiometer (MAICO MA-42 two channel diagnostic audiometer, MAICO diagnostics GmbH, Germany) was used to obtain standard audiograms for all subjects. High quality earphones (MAICO AC headphones DD45) and bone transducer (MAICO BC Headphone B71) were used.

The audiograms were then be evaluated in detail and data analysed using IBM SPSS version 22 for windows. The qualitative variables are expressed as frequencies or percentages and compared between the

two groups using the Chi – square test. The quantitative variables are expressed as mean SD and compared using Unpaired T – test. A p - value < 0.05 will considered statistically significant

For data analysis, the subjects were divided into three groups based on exposure per day (Table 1)

Table 1: Group Division Based On Hours Of Exposure Per Day

Groups	Hours of exposure per day
Group A	<4hrs
Group B	4-6hrs
Group C	>6hrs

Based on number of years of exposure, they were then categorised into three groups (Table 2)

Table 2: Group Division Based On Years Of Exposure

Groups	Years of exposure
Group X	<3yrs
Group Y	3-5yrs
Group Z	>5yrs

RESULTS

Out of 135 willing participants, 50 subjects (100 ears) were included in the study, out of which 20 (40 ears) were male and 30 (60 ears) were female with a mean age of 22 ± 1.74 years.

None of the subjects showed conductive hearing loss on PTA

Table 3: Distribution Of Cases

	PTA	Number of subjects	Percentage
Right ear	Minimal hearing loss	1	2
	Within normal limits	49	98
Left ear	Minimal hearing loss	2	4
	Within normal limits	48	96

With rising daily exposure, the hearing thresholds increased somewhat, but it was not statistically significant as seen in Table 4

Table 4: Air Conduction Threshold Based On Hours Of Exposure Per Day

	250Hz	500Hz	1000Hz	2000Hz	4000Hz
Group A (<4hrs) (n=24)	17.8 ±5	13.6 ±2	10.2 ±4	9.7 ±3	9.65 ±7
Group B (4-6hrs) (n=20)	16.0 ±4	14.7 ±9	11.4 ±5	9.9 ±7	10.5 ±6
Group C (>6hrs) (n=6)	16.2 ±1	15.4 ±1	10.1 ±7	10.2 ±5	10.1 ±4
P value	0.25	0.16	0.4	0.61	0.23

On the basis of years of exposure, the thresholds varied significantly only at one frequency, 1000 kHz, as seen in Table 5. The hearing threshold was higher in Group Y and Z than in Group X

Table 5: Air Conduction Thresholds Based On Years Of Exposure

	250Hz	500Hz	1000Hz	2000Hz	4000Hz
Group X (<3yrs) (n=17)	15.3±6	14.1±6	11.5±3	10.5±4	9.9±4
Group Y (3-5yrs) (n=27)	15.1±3	13.9±5	15.6±6	9.9±8	10.1±3
Group Z (>5yrs) (n=6)	16.1±8	14.4±3	17.4±7	10.0±7	10.2±1
P value	0.42	0.26	0.05	0.32	0.21

Around 42 out of 50 students complained about having experienced non specific ear symptoms such as blocking sensation in the ears, ringing sensation or ear pain/discomfort while using earphones. The most common complaints were ear discomfort reported by 48% students followed by ear pain by 24%, ringing sensation by 8% and blocking sensation by 4%

The typical volume setting was found to be > 5 in 64% students on a scale of 1-10

22% students believed there is a strong connection between earphone usage and development of hearing impairment

DISCUSSION

In this study, we analyzed the variation of hearing thresholds in relation to earphone usage, focusing specifically on exposure defined by the number of hours per day and the number of years of use. Out of 50 candidates assessed, only 3 exhibited minimal to slight hearing impairment as classified by WHO grading standards. Among these individuals, 1 student experienced hearing impairment in the right ear while 2 had issues in the left ear. Interestingly, our findings indicated that while higher durations of daily earphone exposure did not correlate with a deterioration in hearing thresholds, there was a notable increase in hearing thresholds at 1000 Hz with an increasing number of years of exposure. This suggests that chronic exposure over time may have more significant implications for auditory health than mere daily usage.

In a study conducted by Hussain T et al, it was found that higher preferred volumes on personal listening devices in both quiet and noisy environments was associated with higher hearing thresholds and therefore the young adults were at a higher risk of hearing loss. They also noted that most likely, the users of such devices are often not aware of the potential negative consequences they can face[2]

Our findings resonate with the results from a study by Kashyap P et al., which similarly reported no significant adverse effects of personal listening device usage on hearing thresholds. This reinforces the notion that while immediate impacts may not be evident, longer-term effects could still manifest, particularly in specific frequency ranges[1]

Contrastingly, a study conducted by Byeon H et al. focused on adolescents in South Korea, revealing that listening to music through earphones for more than 80 minutes in noisy environments significantly increased the risk of developing hearing loss. This finding underscores the importance of context—specifically, the environment in which earphones are used—and highlights the potential for cumulative damage over time, especially in settings where background noise compels users to increase volume levels[4].

The study by Asghar S et al came to conclusion that mild sensorineural hearing loss was seen in upto one third of medical students who used electro acoustic devices regularly[6].

Panda et al. reported insignificant changes in audiograms, but significant impairments on high frequency audiometry, brainstem response audiometry (BERA) and distortion product otoacoustic emissions in subjects exposed to such devices[8].

The results of this study can be attributed to several factors. First, the investigation relied solely on pure tone audiometry, while a comprehensive audiological test battery—including high-frequency audiometry, BERA, and otoacoustic emissions—would be necessary for more concrete insights into this issue. Additionally, it was challenging to obtain a representative control group of non-users. The exact exposure levels in terms of sound volume could not be quantified because of the variety of devices used. Factors such as age, gender and co-morbid conditions will also have to considered to extrapolate this data to the general population. To draw firm conclusions about the impact of earphones on hearing, a larger study with a suitable control group would be needed. Such research would also act as a guide for appropriate public awareness activities and control measures if necessary.

CONCLUSION

The current study did not show any adverse impact of the use of earphones on hearing however, consistent and significant variations were seen in individual hearing thresholds which was found to be significant at isolated frequency of 1000Hz when comparing the years of exposure

The study also revealed that less than half of the students included in the study were unaware of safe listening practices and therefore it is important to raise awareness regarding the safe use of these devices

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