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# Assessment of Noise-Induced Hearing Loss in Under Graduate Medical Students

Research Article

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**ABSTRACT:** Assessing hearing loss in undergraduates is crucial to ensuring their academic success and overall well-being. Early detection and intervention can significantly improve educational outcomes and quality of life.

**Aims and objectives:** To assess noise-induced hearing loss in undergraduate medical students

And create awareness about the harms of earphones and stereo usage.

**Methodology:** the data was collected using a pre-designed, pretested, semi-structured questionnaire, which included the frequency of earphone usage per day, duration of listening earphones, playing stereo at high volumes, and duration of stereo usage by simple random sampling.

**Key Words:** Noise Induced Hearing Loss, NIHL, Students, Diabetes 2 Type

**INTRODUCTION:** The World Health Organization estimates that around 360 million individuals have moderate to profound hearing loss for various reasons[1]. Occupational or firearm-related exposure, as well as recreational activities, have been traditionally linked to rates of hearing loss[2-3]. In 2015, the World Health Organization also highlighted that approximately 1.1 billion young people are at risk of hearing loss due to unsafe listening behaviors, especially related to recreational activities such as using personal audio devices with high-volume music for extended periods and exposure to loud environments like bars, entertainment venues, and sporting events[3]. The International Organization for Standardization (ISO) has played a significant role in hearing health by developing standards for estimating hearing thresholds and noise-induced hearing impairment[4]. These standards are based on data from various countries' noise and hearing study databases. The emphasis on standardization and scientific rigor aims to strengthen the reliability of the data and the robustness of research in this field. In the United States, hearing is one of the health outcomes measured by the National Health and Nutrition Examination Survey (NHANES), a program conducted by the National Centre for Health Statistics to assess individuals' health and nutritional status. Researchers use audiometric notches in a hearing test, which are dips in the ability to hear certain frequencies, as indicators of possible noise-induced hearing loss. According to 2011 data, about 24% of adults aged 20–69 in the United States exhibit an audiometric notch, with variations based on age, gender, race/ethnicity, and occupational noise exposure[5]. For example, a study of 6,557 automotive manufacturing workers in China reported that in 62% of the evaluated settings, noise levels exceeded the recommended level of 85 dBA. The prevalence of hearing loss varied across different job categories and was associated with both noise levels and cumulative noise exposure[6].

Occupational noise exposure is the primary risk factor for work-related hearing loss, highlighting the need for policy changes. A study analyzed hearing test results from 2000 to 2008 for workers aged 18–65 with higher occupational noise exposure than the average worker[7]. The study revealed concerning statistics: 18% of the surveyed workers had hearing loss, with the mining industry showing the highest prevalence and risk at around 27%. Other sectors with higher prevalence and risk included construction (23.48%), manufacturing (especially wood products and non-metallic mineral products at 19.89%), apparel (20.18%), and machinery (21.51%). Estimates for rates of hearing loss were reported for people in the agriculture, forestry, fishing, and hunting[8](AFFH) sector. The overall prevalence of hearing loss was 15%, but some subsectors of those industries exceeded that rate. The highest prevalence was found among forest nurseries and gathering of forest products workers at 36% and timber tract operations at 22%. The aquaculture subsector had the highest adjusted risk (adjusted probability ratio of 1.7) among all sub-sectors of the AFFH industries[9]. The same methodology was used to determine the prevalence of hearing loss among noise-exposed U.S. workers within the healthcare and social assistance sector. The prevalence of hearing loss in the medical laboratory's subsector was 31%, and in the offices of all other miscellaneous health practitioner's subsector was 24%. The child day-care services subsector had a 52% higher risk than the reference industry. While the overall sector prevalence for hearing loss was 19%, the prevalence in the medical laboratories and the offices of all other health practitioners' sectors was 31% and 24%, respectively. The child day-care services subsector had a 52% higher risk than the reference industry of workers not exposed to noise at work (couriers and messengers). Audiometric records show that about 33% of working-age adults with occupational noise exposure have evidence of noise-induced hearing damage, and 16% of noise-exposed workers have material hearing impairment[10]

The percentage of hearing loss in people with diabetes ranges from 5.3% to 28.1%, while in people without diabetes it ranges from 3.4% to 24.1%. The risk associated with hearing loss in people with diabetes ranges from 22.8% to 35.1%, compared to 17.2% to 20.1% in those without diabetes. This is quite eye-opening. The correlation between type 2 diabetes and hearing impairment was found to be independent of risk factors for hearing impairment, such as noise exposure, earwax build-up, ototoxic medication, smoking, and tobacco use[11].

**Aim and Objectives:** 1. To assess noise-induced hearing loss in undergraduate medical students  
2. To create awareness about the harms of earphones and stereo usage.

**Material and Methods:**

**Study type:** cross-sectional study

**Study population:** undergraduate students of Rama Medical College, Kanpur

**Study area:** Rama Medical College, Kanpur

**Study duration:** March 2024 to May 2024

**Inclusion criteria:** students who gave consent

**Exclusion criteria:** students who were not willing

**Sampling technique:** simple random sampling.

**Sample Size:** according to a previous study by Natarajan et al. in 2017, the proportion of noise-induced hearing loss varies from 16% to 21% across various geographic regions. (2) Applying a formula for one proportion, i.e.,  $N = 4PQ/D^2$

$P = 21\%$

$Q = 100 - P = 100 - 21 = 79\%$

$D = 5\%$  as Absolute precision

$N = 4 \times 21 \times 79 / 5^2 = 265$ , adding 10% non-response, was 291, but we could select 300 students.

**Data collection:** from available Four batches of undergraduate students, two batches were randomly selected for the study, and out of 300 students, 269 were selected randomly for screening. Participants were explained about the rationale of the study and verbal informed consent was obtained, the data was collected by using pre-designed, pretested, semi structured questionnaire which included information regarding, Frequency of earphone usage per day, duration of listening ear phone, playing stereo at high volumes, duration of stereo usage. A total of 32 questions were asked to the students. Out of these, 24 questions were used for Pure Tone Audiometry. Those students who obtained more than 5 scores were selected for PTA. Thus, 85 students were chosen for PTA in the audiometry room of the ENT department.

**Ethical approval:** ethical approval was obtained from the ethical committee of Rama Medical College, Kanpur.

**Data analysis was done using Microsoft Excel and SPSS version 26.**

**Results:** Most participants use earphones twice or 3-4 times per week (each group constituting 40.1%). The most common duration of earphone usage is less than 30 minutes (42.7%).

A smaller percentage of participants use earphones for extended periods, with 12.3% using them for more than 1 hour (Table 1). Stereos at high volume are almost evenly distributed among participants, with 49.1% using them at high volume and 50.9% normal.

Most participants listen to stereos for less than 30 minutes (65.8%).

Fewer participants listen to stereos for over 30 minutes (34.2%). (Table 2). The history of ear disease is low, with only 2.2% reporting past ear diseases, suggesting that ear diseases are not common in this population. A significant proportion of participants (33.1%) experience ear aches, which may indicate underlying issues related to ear health or environmental factors.

Headaches are the most prevalent symptom, followed by the inability to concentrate and irritability. These symptoms can be associated with or exacerbate hearing issues. Insomnia, ear discharge, and tinnitus are less frequently reported but still present in the population.

A small percentage (6.8%) do not exhibit any symptoms, suggesting that hearing issues may not always present with obvious symptoms. A notable minority (15.9%) have a family history of decreased hearing, indicating the importance of considering genetic factors in hearing health assessments. Among the 85 participants who underwent Pure Tone Audiometry, 65.9% have normal hearing.

However, 34.1% of the participants were found to have some degree of hearing loss. Typical NIHL is present in 20.7% of the participants. This hearing loss is often associated with prolonged exposure to loud noises, suggesting that many participants may have been exposed to harmful noise levels, possibly due to environmental or occupational factors.

**Unilateral Mild Hearing Loss:** The most common type of hearing loss, with 58.6% of participants affected. **Implications:** Unilateral hearing loss affecting one ear may be caused by various factors, including infections, trauma, or localized exposure to loud noise. This high prevalence indicates that most participants with hearing loss experience it in only one ear, which can significantly impact their auditory perception and spatial hearing abilities.

**Bilateral Mild Hearing Loss:** Present in 20.7% of the participants.

**Implications:** Bilateral hearing loss affecting both ears suggests a more systemic or widespread issue, potentially indicating prolonged exposure to noise or underlying health conditions that affect hearing bilaterally. This type of hearing loss can have a more profound impact on communication and quality of life than unilateral hearing loss.

Thus, most (79.3%) have mild hearing loss, with most experiencing it unilaterally (58.6%). Typical NIHL and bilateral mild hearing loss are equally present (each 20.7%).

Although No association of NIHL with Diabetes in youth students was detected in our study.

**Table 1: Frequency and duration of earphone usage(N=269)**

| FREQUENCY       | CATEGORY    | NUMBER | PERCENTAGE |
|-----------------|-------------|--------|------------|
|                 | Twice       | 108    | 40.1%      |
|                 | 3-4 Times   | 108    | 40.1%      |
|                 | >5 Times    | 53     | 19.8%      |
| <b>DURATION</b> | <30 Minuets | 115    | 42.7       |
|                 | >30 Minuets | 67     | 24.9       |
|                 | <1 Hour     | 54     | 20.1       |
|                 | >1 Hour     | 33     | 12.3       |

**Table 2: frequency and duration of stereo usage(N=269)**

| VARIABLE                     | CATEGORY    | NUMBER | PERCENTAGE |
|------------------------------|-------------|--------|------------|
| <b>STEREO AT HIGH VOLUME</b> | YES         | 132    | 49.1       |
|                              | NO          | 137    | 50.9       |
| <b>STEREO DURATION</b>       | <30 MINUTES | 177    | 65.8%      |
|                              | >30 MINUTES | 92     | 34.2%      |

**Table 3: screening for hearing loss(N=269)**

| VARIABLES                     | CATEGORY | NUMBER | PERCENTAGE |
|-------------------------------|----------|--------|------------|
| <b>HISTORY OF EAR DISEASE</b> | yes      | 6      | 2.2        |
|                               | no       | 263    | 97.8       |

|                                    |                          |     |       |
|------------------------------------|--------------------------|-----|-------|
| <b>EAR ACHE</b>                    | Yes                      | 85  | 33.1  |
|                                    | No                       | 149 | 53.9  |
|                                    | n/a                      | 35  | 13    |
| <b>SYMPTOMS</b>                    |                          |     |       |
|                                    | Headache                 | 71  | 40.34 |
|                                    | Inability to concentrate | 31  | 17.6  |
|                                    | Insomnia                 | 19  | 10.79 |
|                                    | Irritability             | 29  | 16.47 |
|                                    | Ear Discharge            | 8   | 4.54  |
|                                    | Tinnitus                 | 6   | 3.4   |
|                                    | Asymptomatic             | 12  | 6.8   |
| <b>DECREASED HEARING IN FAMILY</b> | yes                      | 43  | 15.9% |
|                                    | no                       | 226 | 84.1% |

**Table 4: The selected participants for PTA (pure tone audiometry) (N=85)**

| <b>VARIABLE</b>       | <b>NUMBER</b> | <b>PERCENTAGE</b> |
|-----------------------|---------------|-------------------|
| <b>NORMAL HEARING</b> | 56            | 65.9%             |
| <b>HEARING LOSS</b>   | 29            | 34.1%             |

**Table 5: Participants with hearing loss (N=29)**

| VARIABLE              | NUMBER | PERCENTAGE |
|-----------------------|--------|------------|
| TYPICAL NIHL          | 6      | 20.7%      |
| U/L MILD HEARING LOSS | 17     | 58.6%      |
| B/L MILD HEARING LOSS | 6      | 20.7%      |

**Discussion:** Hearing impairment affects about 6% of the world's population, about half of which is preventable[12]. The far-reaching implications of hearing loss concerning the development of communication skills and social and economic quality of life warrant an urgent need to highlight the magnitude and severity of the problem. Noise-induced hearing loss (NIHL) results from multifactorial damage to auditory structures following exposure to occupational, environmental, or recreational sources of loud sound[13]. In A study by Lorena et al., noise exposure's effect on locomotor activity manifested in a decrease in the behavior, especially during exposure to human voices[14]. High-level noise exposure presents special challenges to the auditory system. The mammalian ear has evolved to detect sounds with displacements in the sub-angstrom range while, at its upper limits, it can faithfully encode sounds 106 units above the threshold or over a dynamic range of 120 dB SPL. However, with repeated exposure to sounds in the ear's upper range (above 85 dB SPL), the auditory periphery, or cochlea, progressively deteriorates. The damage caused by noise is pervasive and affects virtually all of the cellular subsystems of the inner ear (sensory cells, nerve endings, and vascular supply[15]. Health promoters should focus their attention on those young adults who are most at risk and provide them with targeted, practical advice about reducing their leisure noise exposure and avoiding hearing loss. Collegiate-level music students are also exposed to potentially hazardous sound levels throughout the day. Although collegiate-level music students do not perform as frequently as professional musicians, they typically maintain a rigorous practice schedule, increasing their chances of developing hearing loss[16].

**Conclusion:** 85 subjects aged 19 to 25 years were tested, and the results were 56(65.9%) study subjects had normal hearing, whereas 29(34.1%) had hearing loss. Out of 29 (34.1%) study subjects 6(20.7%) had typical NIHL 17(58.6%) had unilateral mild hearing loss and 6(20.7%) had bilateral mild hearing loss.

**Recommendation: 1 Awareness and Education:** Increase awareness about the importance of ear health and early detection of symptoms related to hearing loss.

**Regular Screenings:** Encourage regular hearing screenings, especially for those reporting earaches and common symptoms such as headaches and irritability.

**Medical Consultation:** Advise individuals with frequent ear aches, tinnitus, or a family history of decreased hearing to seek medical consultation for further evaluation and potential early intervention.

**Genetic Counselling:** Provide genetic counseling and education for those with a family history of hearing loss to understand the potential hereditary risks and preventive measures.

**Further Research:** Conduct additional research to explore the environmental or lifestyle factors contributing to the high prevalence of ear aches and related symptoms in this population.

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