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**Original Research Article**

# Evaluation of change in knowledge and attitude about noise and its effect on hearing: post awareness programme among adolescents in Varkala, Thiruvananthapuram district, Kerala

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## ABSTRACT

**Background:** There are significant literature evidence across the globe and in India, regarding the effects of recreational noise exposure among young adults and college students, but there is a dearth of literature support regarding its effects among the students of senior grade studying in Indian subcontinent. Since the awareness among school students help in the early preventive measures and hearing conservation, studies must focus on these population to reduce the burden of recreational noise-induced hearing loss on our future generation. This study aims to evaluate the change in knowledge and attitude about noise and its effect on hearing: Post awareness programme among adolescents in Varkala, Thiruvananthapuram district, Kerala.
**Method:** A survey was conducted among the school students within the age group 16-18 years. A questionnaire containing questions related to knowledge and attitude towards noise and its effect on hearing was developed and distributed to the students prior to and after an awareness program making use of a visual awareness material. Wilcoxon signed rank test was used for pre and post comparison.
**Results:** The p value of each aspect related to the knowledge and attitude is less than the significance level, so we can say that there is a significant change in the level of knowledge and attitude after the awareness program.
**Conclusions:** The study highlighted low pre-awareness levels among participants regarding noise's impact on hearing. The awareness program effectively improved understanding, emphasizing its importance for all age groups in dispelling misconceptions and fostering positive attitudes.

**Keywords:** Recreational noise, Awareness, Hearing loss, Students, Hearing conservation

## INTRODUCTION

Hearing loss is estimated to be the fourth leading cause of disability worldwide, with 6.1% of the world's population, or 466 million people with a disabling hearing impairment (WHO, 2018). Hearing loss can make it harder for an individual to perform routine activities.[1] Risk factors for adult hearing loss include loud noise (occupational and recreational), ear issues like cerumen impaction and chronic infections, ototoxicity, head trauma, smoking, age-related sensorineural degeneration, nutritional deficiencies, viral infections, and delayed-onset genetic hearing loss (WHO, 2018). 'Noise' comes from the Latin word 'nausea', impulsive, unwanted sounds. Individuals face various environmental noises like traffic, railway, aircraft, industrial, recreational, and neighborhood noises. Health issues from noise exposure encompass hearing loss, communication interference, sleep disruptions,

cardiovascular effects, mental health disturbances, impaired task performance, negative social behavior, and annoyance reactions.[2]

Noise-induced hearing loss (NIHL) results from prolonged or intense noise exposure, whether recurrent or a single exceptionally loud instance. Children and adolescents, due to increased outdoor mobility and loud leisure pursuits, tend to be more sensitive. The key contributors to NIHL in recent times include high-frequency noises from motorized traffic, trains, aircraft, loud music, computer games, leisure activities, industrialization, and urbanization.

When the sound exposure crosses 75-85 dB, the auditory system comes under stress, causing damage to the cochlea and the mechanical destruction of the sensory cells and intense metabolic activity at the cellular level (WHO, 2015). Noise is measured in decibel unit of dB (A) units. For a very high-level impulsive noise exposure of 130-140 dB/85 dB A (SPL), short time or greater than eight hours, it induces irreversible hearing loss.[3] NIHL typically starts with progressive loss at higher frequencies (3K-6KHz) in pure tone audiometry, later affecting lower frequencies (500-2KHz). In audiograms, the focus often lies around 4KHz, showing a V-notch pattern, followed by a permanent recovery up to 8KHz.

Hearing levels can recover after several hours/days following exposure, resulting in a temporary threshold shift.[4] Long-term, high-dose noise exposure can result in irreversible hearing loss unless medical personnel intervene or the exposure is continued. Some individuals do not have obvious complaint of hearing loss, but have difficulty hearing in noisy situations, discriminate speech among transient &moderate levels of background noise, referred to as 'hidden hearing loss'.[5] Most NIHL studies focus on work-related noise exposure, the second most common workplace risk after industrial injuries (WHO Europe, 2017). Occupational noise contributes to 16% of adult hearing loss, varying from 7% to 21%.[6] Many workers in industrial labor, heavy vehicle operation, traffic policing, piloting, and train services, like locomotive crews, face occupational NIHL risks due to their work-related noise exposure.[6,7]

Recreational noise is an escalating public health concern, capable of causing hearing damage by physically harming the auditory system. The rapid evolution of technology including personal listening devices, mobile phones and advanced music systems with high volumes significantly contributes to this hearing loss, particularly impacting young individuals exposed to diverse recreational noise sources.[8] This risk has increased with accessibility. Risk of recreational NIHL is heightened in entertainment venues, with a threefold increase in the past two decades in the number of people exposed to loud noises in social settings.[9] Recreational noise exposure can lead to additional auditory effects such as tinnitus and hyperacusis and non-auditory effects like psychological distress, reducing alertness, sociability, information absorption, and overall activity levels in individuals.[10]

Unhealthy listening habits put around 1.1 billion young people worldwide at risk of hearing loss. In middle- and high-income nations, roughly half of adolescents and young adults (12-35 years) encounter unsafe sound levels when using personal audio devices, and 40% exposed to potentially harmful sound levels in clubs, discos, and bars (WHO, 2015).

Teens often use music players, attend concerts, engage in music channels, and visit arcades, some use personal listening devices while sleeping, reading, or on public transport.[11] Excessive use of Personal Listening Devices (PLDs) like smart phones, iPods, and MP3 players for media consumption can cause hearing impairment, as suggested by a study. Over 90% of college students are believed to own a PLD.[12]

In India, regulations stipulate that the noise level at the boundary of a public place with loudspeakers or public address systems should not exceed 10 dB(A) above the ambient noise standards for the area, or 75 dB(A), whichever is lower. For private places, noise should not exceed 5 dB(A) above the ambient air quality standard for the area. Workplace noise exposure should be limited to an eight-hour continuous A-weighted sound pressure level, LAeq, 8h, of less than 85 dB(A). Additionally, a proposed limit of a C-weighted peak sound pressure level, peak of 140 dB(C) is suggested for peak noise.[13]

Earphones/headphones grant full audio control, allowing private audio experiences in public spaces. In a study, most students used earphones to listen aloud without bothering others. Some used them for isolation, while others as a fashion statement.[14] With technological advancements and wider access, recreational noise exposure is expected to rise among individuals engaging in leisure activities. It's crucial to educate adolescents and young adults about the detrimental impacts of noise and encourage them to limit exposure to hazardous noise levels.

Limited research focuses on senior-grade Indian students regarding recreational noise effects in India. Studying this group is crucial for early awareness in schools to prevent hearing loss. The study aims to assess changes in knowledge and attitudes toward noise and its impact on hearing due to increased gadget usage from online classes, the pandemic, and leisure apps.

This study aims to evaluate the change in knowledge and attitude about noise and its effect on hearing: Post awareness programme among adolescents in Varkala, Thiruvananthapuram district, Kerala.

## METHODS

### *Research design*

Comparative approach among Cohort participants.

The participants of the study were students studying higher secondary from Varkala taluk of Thiruvananthapuram District, Kerala. The study was carried during 2022.

### *Ethical considerations*

Informed consent form the school administration, students were obtained after sharing the participation information about the study. The participants were provided information about the aim, outcome and risks and benefits of participating in the study. With the sufficient information given and handed over the participation information sheet, the participant who gave consent to participate in study were included. Study was approved by institutional ethical committee on 8th July 2022 (reference no Bshrf/RC/IEC/D/11/MASLP/2021-22).

Convenient cluster sampling was used. The sample size for the study was based on the Cochran's formula

$$= \frac{z^2 p(1-p)}{d^2}$$

Where Z is 1.96 at 5% level of significance, d is the margin of error assumed to be 0.05, p=0.09, 1-p calculated as 0.91. The sample size required for the study was 125.

### *Inclusion criteria*

The study included only the students studying higher secondary from Varkala taluk of Thiruvananthapuram district, Kerala in the age criteria of 16-18 years.

### *Exclusion criteria*

The study excluded all participants who were less than 16 years and those who were unable to read English. Students those who had obvious/reported, cognitive/communicative impairment were also not included.

### *Procedure*

A noise awareness questionnaire in English was validated by senior audiologists and teachers, covering demographic, knowledge, and attitude information with 28 questions. Relevancy and essentiality of each question were rated using a 4-point Likert scale, resulting in all questions being considered for the final questionnaire after minor modifications.

A Power Point presentation on hearing aspects, loss, and prevention was created, validated by audiologists, and included explanatory visuals and a video demonstrating ear protection device usage. It covered types of hearing loss, causes, noise effects, recreational hearing loss awareness, and the significance of ear protection devices.

Students completed the questionnaire before and after an awareness program conducted through the validated presentation. Changes in knowledge and attitudes about noise's impact on hearing were assessed through pre- and post-awareness responses. Statistical analysis was done using SPSS version 20.0, including descriptive and inferential statistics, with the Wilcoxon signed-rank test employed for comparing pre- and post-awareness responses due to non-parametric data distribution.

## RESULTS

The students participated in the study were from English medium schools. Out of the 55 students who responded to the questionnaire, 17 were male participants while 38 were females. Demographic details of the participant are given in the following tables (Table 1-4).

**Table 1: Personal listening devices.**

| Personal listening devices | N | Percentage (%) |
|---|---|---|
| **Headphones/ earphones** | 28 | 50.90 |
| **Headphones/ earphones and loudspeaker** | 24 | 43.60 |
| **Only loudspeaker** | 2 | 3.60 |
| **None** | 1 | 1.80 |

**Table 2: Daily usage in hours.**

| Daily usage | N | Percentage (%) |
|---|---|---|
| **Less than 1 hour** | 15 | 27.30 |
| **1-2 hours** | 22 | 40.00 |
| **2-3 hours** | 11 | 20.00 |
| **More than 3 hours** | 7 | 12.70 |

**Table 3: Range of volume level.**

| Volume level range | N | Percentage (%) |
|---|---|---|
| **<30%** | 0 | 0 |
| **30-50%** | 15 | 26.80 |
| **50-70%** | 24 | 42.90 |
| **>70%** | 16 | 28.60 |

**Table 4: Duration of usage.**

| Duration of usage (in years) | N | Percentage (%) |
|---|---|---|
| **0-3** | 37 | 67.30 |
| **3-6** | 13 | 23.60 |
| **>6** | 5 | 9.10 |

Figure 1 and 2 represent the pre and post responses of the participants for the domain "knowledge" and Figure 3 and 4 represent the pre and post responses of the participants for the domain "attitude". From the figures it is observable that there was a notable change in knowledge and attitude after the intervention of the awareness program.

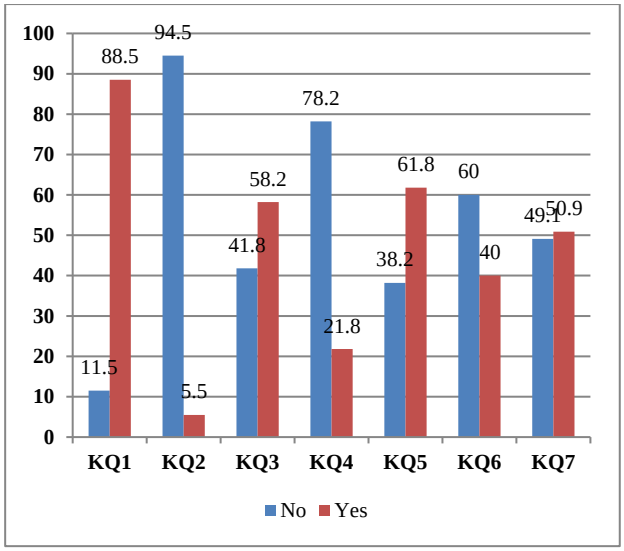


**Figure 1: Knowledge: pre-awareness program responses of the participants.**

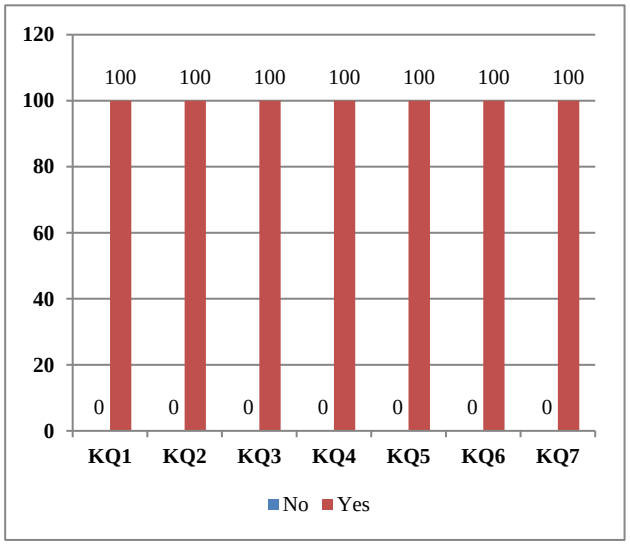


**Figure 2: Knowledge; post-awareness program responses of the participants.**

Wilcoxon signed rank test was conducted for the pre and post comparison of the obtained data. The p value of each aspect related to the Knowledge (Table 5) and attitude (Table 6) was less than the significance level, i.e., $p<0.05$ which indicates that there is a significant change in the level of knowledge and attitude after awareness program.

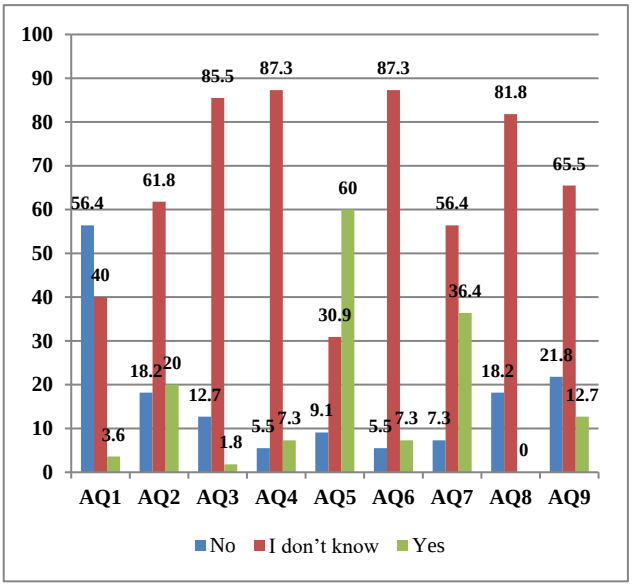


**Figure 3: Attitude; pre-awareness program responses of the participants.**

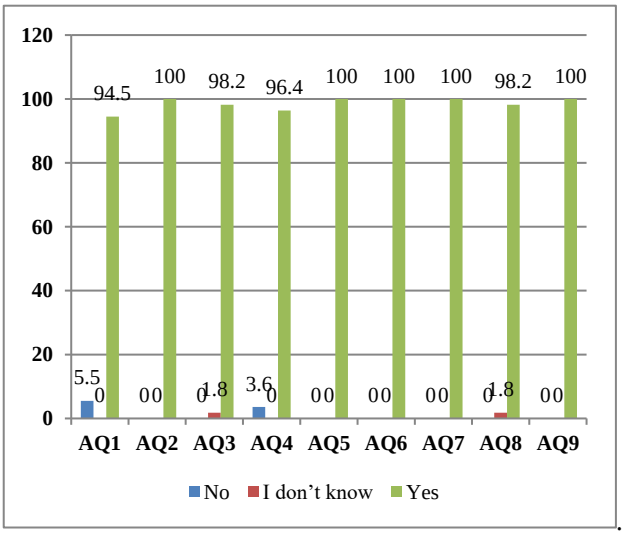


**Figure 4: Attitude; post-awareness program responses of the participants.**

**Table 5: Analysis of responses of the knowledge section of the questionnaire.**

| Knowledge section of the questionnaire | Z sore | P value |
|---|---|---|
| **Do you know that loud music and noise could damage the hearing?** | -3.162 | 0.000 |
| **Do you think that the noise can cause hearing loss?** | -7.211 | 0.000 |
| **Do you think that hearing loss caused by noise can be prevented?** | -4.61 | 0.000 |
| **Are you aware about ear protection devices?** | -6.481 | 0.000 |
| **Is there is any solution for the hearing loss?** | -4.583 | 0.000 |
| **Are you aware about hearing aids?** | -5.745 | 0.000 |
| **Do you think that the use of headphones/earphones for longer duration cause hearing loss?** | -2.236 | 0.000 |

**Table 6: Analysis of responses of attitude section of the questionnaire.**

| Attitude related questions (Pre and post questions) | Z score | P value |
|---|---|---|
| **Do you think ringing in the ears is a warning signs for over exposure to loud sound?** | -6.286 | 0.000 |
| **Do you think listening to loud music cause hearing loss?** | -6.032 | 0.000 |
| **Do you think hearing loss due to noise exposure can be treatable?** | -6.909 | 0.000 |
| **Do you think hearing aid brings hearing back to near normal just as eyeglasses bring vision back?** | -6.856 | 0.000 |
| **Do you think hearing evaluation is necessary to carry out if the person is raising his/her voice when they talk?** | -4.245 | 0.000 |
| **Do you think ringing sensation in the ears can be treated?** | -6.887 | 0.000 |
| **Is a hearing evaluation required every year?** | -5.476 | 0.000 |
| **Do you believe that recreational uses should be restricted?** | -6.796 | 0.000 |
| **Is increasing the volume while listening a sign of hearing loss?** | -6.305 | 0.000 |

## DISCUSSION

Study findings reveal a high usage of headphones/earphones among students, followed by a significant number using both headphones/earphones and loudspeakers. Daily device usage primarily falls within 1-2 hours, suggesting usage during free time, possibly limited by academic commitments. Majority favor volume levels between 50-70%, with fewer opting for levels above 70%, possibly due to concerns about music quality. Most students reported using personal listening devices for 0-3 years, likely due to parental restrictions on access to smart phones and tablets for younger children

In the present study, significant changes in knowledge were observed before and after the awareness program, indicating heightened awareness among students regarding the prolonged use of personal listening devices and its impact on hearing. Additionally, participants displayed a notable shift in attitude towards a more positive outlook following the program, with significant changes observed in their responses.

After 10 days following the awareness program, a subset of 20% of the total participants (n=55) was surveyed again, revealing a correlation coefficient factor of 0.87. This indicates strong reliability in the responses, leading to the conclusion that they were highly reliable.

In the 'knowledge' section of the questionnaire, two patterns emerged: a majority shifted from "no" to "yes," while the second pattern involved maintaining a "yes" response both before and after the awareness program. these findings suggest that all participants in the study benefited in terms of their understanding of noise and its effects on hearing. in the attitude section, three patterns were identified: changes from "I don't know" to "yes," "no" to "yes," and retention of "I don't know" before and after the program. most participants exhibited a positive attitude towards questions about noise and its effects on hearing, with a few retaining uncertainty, possibly due to difficulty grasping all the information from the awareness program.

Due to the limited effectiveness of hearing education programs, Chang proposed that auditory simulations could help individuals understand the frustrations of noise-induced hearing loss (NIHL) and tinnitus, as well as the associated communication challenges.[15] Before and after the simulation, attitudes, intentions, motivations, and fears regarding NIHL were evaluated among young participants. Those who underwent the simulation alongside health education showed significant improvements. Their motivation to protect against noise, attitude toward reducing noise exposure, intention to change listening habits, and fear of loud noise exposure all notably improved.

In the present study, a video featuring the 'Karna' mannequin, developed by Dr. SR Chandrasekhar institute of speech and hearing, Bangalore, was used. 'Karna' demonstrated the use of ear protection devices, resulting in reduced sound intensity, which interested students. Participants found the program "very informative and useful." Changes in responses and feedback indicated the program's effectiveness in altering knowledge and attitudes about noise's impact on hearing

HCPs offer students numerous benefits, such as reduced NIHL risk, enhanced academic satisfaction and productivity, improved quality of life, and decreased mental stress, fatigue, and irritability. Classroom-based educational hearing conservation initiatives (EdHCP), part of school-based health promotion programs, focus on educating students about hearing loss effects and preventive measures. In India, A formal EdHCP targeting high school or university students has yet to be developed.[16] Teachers and administrators must be sensitive to noise in particular; this issue should be emphasized in lessons, and students should be trained in schools from an early age. Bulunuz found that noise levels in Turkish elementary schools were significantly higher than national and international upper limits.[17] As a result, teachers and students were given noise awareness and sensitivity training. Before the awareness program, a survey revealed that students and teachers had little knowledge, understanding, sensitivity, or awareness of noise pollution. However, post-training observations,

questionnaires, and teacher reflections revealed that students' and teachers' awareness and sensitivity to noise pollution increased.

Incorporating noise-related information, its detrimental effects, and hearing loss education into school curricula can establish an early hearing education program. Ideally, as part of a national curriculum, age-appropriate materials covering hearing loss and its economic, health, and social impacts could be integrated into subjects like economics, human biology, or social and environmental courses.

Parents' involvement in the education of noise-induced hearing loss risk factors allows them to strengthen any new positive behaviors at home. According to Chang 46% of parents were worried or concerned about their children's listening to loud music, and they most frequently warn young people of the dangers of listening to music at high volumes, mostly the older group of their children, i.e., 18- to 25-year-old. The educational qualification of the parents may influence the children's auditory behavior. This might be owing to the parents' good awareness and experience regarding the negative effects of noise.[18]

### *Limitations*

Limitations were less sample size which may limit the generalization of results. The program can be conducted in more students and in other age groups. The program can be conducted in more local languages to be accessible to general public.

## CONCLUSION

The aim of the study was to evaluate the knowledge and attitude about noise and its effect on hearing, post an awareness programme among adolescents living in Varkala, Thiruvananthapuram district, Kerala. A total of 55 participants (17 males and 38 females) participated in this study. The study was conducted in two phases, in the first phase the questionnaire (comprising general questions and questions related to knowledge and attitude), a Microsoft power point presentation and a video presentation were developed and validated. Post content validation, total of 28 questions (12 general questions, seven knowledge related questions and nine attitude related questions) were approved. The Power Point presentation included information about hearing loss, types of hearing loss, causes, information about noise, effect of noise on hearing, awareness about recreational hearing loss, how to prevent recreational hearing loss and the importance of ear protection devices. The video presentation was based on the ear protection devices, types and its importance. The procedure was conducted at the premises of the pre-university schools (with the permission of the authority), where the students (18-25 years) were studying. The questionnaire which was developed in the first phase was administered twice, once before and later after the awareness program to measure the change in level of knowledge and attitude about noise and its effect on hearing.

The result reveals that there was an overall significant difference in knowledge and attitude after the awareness program. There was a highly significant change obtained while comparing the significant difference between the pre and post responses to the questionnaire. The pre-questionnaire reveals less awareness in the participants about effect of noise on hearing. After the awareness program a positive response obtained from the participants which shows that the study was successful in creating the awareness about noise and its effect on hearing.

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*Ethical approval: The study was approved by the Institutional Ethics Committee*

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