KNOWLEDGE, ATTITUDES, AND PRACTICES REGARDING NOISE-INDUCED HEARING LOSS AMONG ADOLESCENTS IN SAUDI ARABIA: SYSTEMATIC REVIEW

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Abstract

Background: The phrase "noise-induced hearing loss" (NIHL) describes a type of sensorineural hearing impairment caused by either sudden loud sounds or extended exposure to high noise levels. Exposure to loud noises can result in lasting alterations to hearing sensitivity due to irreversible harm to the inner ear. Several risk factors influence the occurrence of NIHL, including individual characteristics like genetic predisposition, age, gender, and lifestyle choices, as well as noise-related factors such as duration of exposure, sound levels, and frequency.

Objective: To assess the knowledge, attitudes, and practices related to noise-induced hearing loss among adolescents in Saudi Arabia using a validated scored data collection tool.

Method: PubMed, SCOPUS, Web of Science, and Science Direct were systematically searched for relevant literature. Rayyan QRCI was employed throughout this comprehensive process. Results: Variable results have been shown by each study. Most of them have shown fair level of knowledge regarding NIHL, others have shown poor level of knowledge. The favourable outlook of individuals towards changing their lifestyle indicates a necessity for awareness campaigns about NIHL to enhance societal education levels. We suggest that future research should investigate the impact of occupation on NIHL.

Conclusion: this study has identified a significant occurrence of hearing loss within Saudi society. A majority of participants recognized that such hearing concerns could be prevented. Nevertheless, many were not informed about the minimum exposure time to noise or sound, or the intensity of sound that could result in hearing impairment.

Keywords: Noise-induced hearing loss, Adolescents, Knowledge-attitude-practice, Saudi Arabia, Hearing loss prevention, Public health education.

Introduction

Noise-induced hearing loss (NIHL) is one of the leading preventable causes of hearing impairment globally.

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More than a billion people around the world are impacted by hearing loss (1). In the United States, noise-induced hearing loss (NIHL) is said to be the most common occupational health issue (2). Notably, it is estimated that a third of all hearing loss cases are due to noise exposure, making it the most frequently preventable cause of hearing loss (3). The consequences of NIHL account for an increasing burden on both individuals and society. The financial impact on society is substantial and continues to grow, with projected annual costs of \$242.4 million in compensation for work-related hearing loss in the United States. NIHL can result from brief episodes of loud sounds or prolonged exposure to elevated noise levels. Such incidents cause harm to cochlear hair cells, affect nearby supporting cells, and ultimately lead to the degeneration of related auditory nerve fibers. The degree of damage to the inner ear and the corresponding hearing loss are connected to the volume and length of noise exposure. The sources of loud sounds can come from both professional and recreational activities; although workplace noise may be more intense, leisure-related noise is becoming increasingly common in modern society. Noise-Induced Hearing Loss (NIHL) has emerged as a global concern over the past twenty years, largely due to the rising prevalence of smartphones. Moreover, there has been an increase in the prevalence of personal listening devices (PLDs), such as headphones and earphones. Misapplication of these devices can result in challenges with speech comprehension, tinnitus, vertigo, and diminished hearing ability (7).

Despite being one of the most common disabilities in Western societies, there is limited awareness regarding the current understanding and perceptions of NIHL within the general population. An earlier cross-sectional study conducted by Crandell et al. (8) involving 200 young adults in college found that this demographic had a significant understanding of the impact of noise on hearing health. However, their research also indicated that it is important to raise awareness among young adults regarding the dangers and risks associated with being exposed to loud noise. Additionally, another cross-sectional study involving 83 workers revealed a negative perception among workers towards preventive measures for noise-induced hearing loss (NIHL). (9)

Methodology

Following PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, this systematic review was carried out [8].

Study Design and Duration

This systematic review began in February 2024.

Search strategy

A comprehensive search was conducted across four major databases: PubMed, SCOPUS, Web of Science, and Science Direct, to identify pertinent literature. The search was limited to materials published in English, tailored to the unique requirements of each database. Relevant studies were identified by translating the following keywords into PubMed Mesh terms: "noise-induced hearing loss," "attitude to noise," "young adults," and "Saudi Arabia." The Boolean operators "OR," "AND," and "NOT" were employed to refine the keyword search. The results included human trials, publications available in full text in English, and materials that could be downloaded at no cost.

Selection criteria

We considered the following criteria for inclusion in this review:

• Studies that summarized the knowledge about noise-induced hearing loss among adolescents in Saudi Arabia among the Saudi population.

- Studies conducted between 2018-2024.
- Only human subjects.
- English language.
- Free accessible articles.

Data extraction

Rayyan (QCRI) was utilized on two occasions to validate the results of the search methodology [9]. The researchers incorporated inclusion and exclusion criteria to the aggregated search findings to assess the relevance of the titles and abstracts. Each paper that satisfied the inclusion criteria underwent a comprehensive review by the evaluators. The authors discussed strategies for addressing any conflicts that arose. The finalized study was submitted using a pre-existing data extraction form. The authors gathered information regarding the study titles, authors, year of study, location, participants, gender, type of participants, prevalence of the two most common blood groups, and key outcomes. Additionally, a separate document was prepared for the assessment of bias risk.

Strategy for data synthesis

A qualitative assessment of the research outcomes and components was

performed by creating summary tables based on relevant studies. After gathering data for the systematic review, the most effective approach for leveraging the information from the chosen study articles was established.

Risk of bias assessment

The ROBINS-I risk of bias assessment technique for non-randomized treatment trials was used to evaluate the quality of the included studies. Confounding, research participant selection, intervention classification, divergence from intended interventions, missing data, outcome assessment, and choice of the reported result were the seven assessed themes.

Results

Search results

An overview of the procedure used to choose studies is provided in Figure 1. (Table 1, Table 2).

Discussion

The adverse effects of loud sound exposure on human well-being are not immediately obvious. The consequences of Noise-Induced Hearing Loss (NIHL) pose a growing challenge for both individuals and society as a whole. The economic impact on society is considerable and continues to escalate, with an estimated annual cost of \$242.4 million in compensation for work-related hearing loss in the United States. Furthermore, there has been an increase in the utilization of personal listening devices (PLDs), such as headphones

and earphones. Improper use of these devices may result in challenges with speech comprehension, tinnitus, balance issues, and diminished hearing ability. Consequently, numerous articles have been published to investigate individuals' perceptions and attitudes towards noise-induced hearing loss (NIHL) and the use of PLDs. Our systematic review sought to evaluate the knowledge, attitudes, and practices concerning noise-induced hearing loss (NIHL) among adolescents in Saudi Arabia, utilizing a validated data collection tool with scoring capabilities. The studies referenced earlier have produced varying results. In the research carried out by Faisal Alzahrani and colleagues in the Makkah Region of Saudi Arabia, a considerable proportion of participants demonstrated awareness of NIHL. Conversely, research carried out by Abdulaziz S. AlQahtani and colleagues at the University of Hail in Saudi Arabia indicates a low level of awareness regarding noise-induced hearing loss (NIHL). In another study by Mohammed Algarny and his team, it was found that 49.32% of medical students in Saudi Arabia are aware of NIHL, suggesting that a notable number of these students have a grasp of the condition. However, a separate investigation by Raed A.M. Alzahrani and associates highlighted a lack of knowledge about NIHL among the Saudi population. Conversely, research by Khalid A. Alshehri and colleagues indicates that the general awareness of ear health and the management of noise-induced hearing loss (NIHL) is moderate. Similarly, a study by Nasim Alnuman and others highlights a significant need to enhance awareness of NIHL among young adults, suggesting a low level of understanding regarding this condition. A cross-sectional study conducted in Saudi Arabia, published in 2017, assessed participants' beliefs and knowledge about NIHL. Out of 739 respondents, 25% reported experiencing mild to severe hearing loss, with a notable majority being male and frequently using volume



Figure 1. The study selection procedure is summed up in a PRISMA flowchart.

Author	Country	Study design	Participants (n)	Mean age(years old)
Faisal Alzahrani, et.al, 2023 (10)	Makkah Region, Saudi Arabia	A cross-sectional survey	(384)	30 ± 10
Abdulaziz S. AlQahtani,et.al, 2022 (11)	University of Hail, Hail, Saudi Arabia	A cross-sectional survey	(1086)	24.8 ± 12.6
Mohammed Alqarny, et.al, 2023 (12)	Saudi Arabia	A cross-sectional survey	(422)	NM
Raed A.M. Alzahrani, et.al, 2018 (13)	Albaha Region Jeddah, Saudi Arabia	A Cross-sectional Study	(296)	32±12
Khalid A. Alshehri et.al, 2019 (14)	Jeddah, Saudi Arabia	A Cross-sectional Study	(2372)	31.31 ± 11.85
Nasim Alnuman, et.al, 2019. (15) Amman, Jordan		A cross-sectional survey	(287)	21.52 ± 2.18

Study name	Assessment tool	Key findings	Conclusion
The Connection Between Awareness of Noise-Induced Hearing Loss (NIHL) and the Utilization of Personal Listening Devices in the Makkah Region of Saudi Arabia	An electronic Arabic questionnaire with a total of 37 questions	In this research, a significant majority recognized that loud noises can damage hearing (87.2%) and that exposure to noise can exacerbate existing conditions (79.4%). Additionally, 70.6% acknowledged that hearing loss caused by noise is preventable, while half reported feeling knowledgeable about the associated risks.	In the research, 74.6% of participants recognized the risks of Noise-Induced Hearing Loss (NIHL) and expressed a desire to reduce the volume levels of their audio devices. Additionally, 81% advocated for the inclusion of sound-warning features, 92.7% endorsed alarm functionalities, and 15.9% were in favor of implementing sound output restrictions.
Awareness about the relation of noise induced hearing loss and use of headphones at Hail region	A questionnaire of a total of 37 questions divided into 6 categories	A total of 69.6% of respondents acknowledged that high volume levels can impact hearing, while 66.6% indicated that a noisy environment also affects hearing ability. Furthermore, 63.1% concurred that exposure to loud sounds can deteriorate hearing. Additionally, 19.4% observed that low or muffled voices may indicate early signs of hearing impairment, 22.7% identified ringing in the ears as a potential warning sign, 45.3% recognized that an increase in TV or radio volume may signal hearing issues, and 58.7% believed that problems caused by noise exposure are preventable.	The general population exhibits a limited understanding of hearing loss and its underlying causes, with over half of the respondents engaging in detrimental listening practices through their personal devices. Contributing factors to the development of hearing loss include age, the volume at which sounds are played, and the length of weekly listening sessions.
Awareness of Noise-Induced Hearing Loss and the Use of Hearing Protection Among Medical Students in Saudi Arabia: A Mixed Methods Study Combining Qualitative and Quantitative Approaches.	A mixed-methods approach was employed, involving a questionnaire survey and semi- structured interviews.	In Saudi Arabia, 59.32% of medical students recognize the issue of noise-induced hearing loss. Cultural and social influences do not have a significant impact on this awareness (p=0.184). There is a correlation between higher income and increased awareness (odds ratio = 2.03, p=0.057). Additionally, 20.4% of students currently use earplugs, while 23.8% intend to use them in the future.	The findings of the study reveal that 59.32% of medical students in Saudi Arabia are aware of noise-induced hearing loss, indicating that a considerable number of these students have knowledge and comprehension of this condition. This suggests that nearly half of the medical student population in Saudi Arabia is informed about noise-induced hearing loss.
Knowledge, Behaviors, and Attitudes about Noise- induced Hearing Loss among Adults in Albaha Region	A 16-item self- administrated questionnaire	A total of 53% of respondents indicated that hearing loss can occur at any age, while only 19% were aware that there is currently no cure for this condition. Although 42% of participants recognized that earplugs and earmuffs can help prevent hearing loss, a striking 94% reported never having used them. Additionally, nearly 15% identified bloody discharge as a potential symptom of Noise-Induced Hearing Loss (NIHL). Overall, the findings of the study revealed a limited understanding and awareness regarding NIHL among the participants.	The understanding of Noise-Induced Hearing Loss (NIHL) among Saudis is currently inadequate. This lack of knowledge could result in an increased incidence of NIHL in the future.
Public awareness of ear health and hearing loss in Jeddah, Saudi Arabia	an electronic survey questionnaire	Regarding awareness of Noise-Induced Hearing Loss (NIHL), younger participants exhibited the lowest scores (9.93 \pm 2.13), whereas individuals aged 40 and above achieved the highest scores (10.85 \pm 1.76). Female participants provided more correct responses compared to their male counterparts (10.73 \pm 2.03 versus 10.54 \pm 2.03). Additionally, Saudi participants outperformed non-Saudi participants significantly (p = 0.005). Those with a family history of hearing loss scored higher than those without such a history (10.89 \pm 1.82 versus 10.53 \pm 1.97).	A significant correlation exists between age and awareness levels: individuals aged 40 and above demonstrated the highest likelihood of answering questions accurately, whereas those aged 18 and below were the least likely to respond correctly. Overall, the general awareness regarding ear health and the management of noise-induced hearing loss (NIHL) is considered to be moderate.
Awareness of Noise-Induced Hearing Loss and Use of Hearing Protection among Young Adults in Jordan	an electronic survey questionnaire	A total of 81.2% of respondents recognized that exposure to loud noises can harm hearing, with no notable difference observed between genders ($x2 = 0.159$, $p = 0.69$). Following the survey, 56.3% expressed a likelihood of using earplugs in the future, marking a significant rise from the initial usage rate of 9.8%.	The findings highlight a significant necessity to enhance awareness of Noise-Induced Hearing Loss (NIHL) among young adults. Additionally, they underscore a substantial opportunity for educational initiatives aimed at fostering a more positive attitude towards the use of earplugs and hearing protection.

Table 2. Clinical characteristics and	doutcomes of the included studies.
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levels exceeding 80%. Interestingly, around 75% of participants expressed a preference for lowering the volume rather than reducing the number of listening sessions per day. A separate study carried out in Jordan indicated that most participants acknowledged the connection between loud sounds and hearing loss. In a similar vein, Joubert found that 89% of their sample (n = 265) recognized the link between loud noise and hearing issues. Additionally, Quintanilla-Dieck et al. reported that over two-thirds of their sample (n = 250) were aware of the risks associated with noise-induced hearing loss.

Conclusion

This study has identified a significant prevalence of hearing loss within Saudi society. A majority of individuals acknowledged that these hearing problems could be prevented. Nevertheless, many were not informed about the minimum duration of exposure to noise or the intensity of sound that could result in hearing impairment. The favorable attitude of individuals towards

lifestyle changes indicates a necessity for awareness campaigns on Noise-Induced Hearing Loss (NIHL) to enhance the educational awareness of the community. We recommend that future research investigate the impact of occupational factors on NIHL.

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