

The Association of Smoking with Hearing Loss in Indian Adult Males: A Comparative Study

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Abstract:

Background: While extensive research has been conducted to investigate the health risks associated with smoking, there exists a noticeable gap in the scientific literature regarding the specific correlation between smoking and hearing loss. This study endeavors to address this gap by undertaking a meticulous review of existing literature and performing a comprehensive analysis, with a particular focus on elucidating the association between smoking habits and the prevalence of hearing loss within the adult male population in India. By employing rigorous scientific methods, including statistical analyses and data interpretation, our aim is to contribute valuable insights that can inform public health policies and interventions aimed at mitigating the potential auditory consequences of smoking in this demographic. The results suggest a significant correlation between smoking habits and hearing impairment, highlighting the need for further investigation and public health interventions.

Aim: This study seeks to investigate the impact of smoking on hearing. Previous research has yielded mixed results, primarily in Western populations. The outcomes of this study may stimulate future inquiries, potentially shaping the development of early screening methods for hearing loss in smokers. Recognizing smoking as a significant risk factor can empower patients with information about its profound impact on hearing health."

Materials and Methods: The hearing tests were conducted in a soundproof room in the outpatient department of the ENT department at NIMS Hospital. The hearing examination included a general examination, ear examination, screening tuning fork test, and pure tone air-conduction and bone conduction tests using AD 226 Intra-acoustic audiometry. The audiometry test, conducted in a soundproof room at NIMS Hospital, utilized puretone audiometry (PTA) to assess hearing thresholds for different frequencies. Participants responded to tones, and the lowest volume level at which a response was recorded was considered the threshold. The study differentiated between right and left ears and independently assessed the extent of sensorineural hearing loss. This study included 110 subjects, including 55 smokers and 55 age-matched non-smokers. The data were analyzed using appropriate statistical tests.

Results: Smoking was found to be significantly associated with hearing loss. Furthermore, the hearing loss was primarily sensorineural, with the mild type (26–40 dB) being the most common in smokers.

Conclusion: The current study discovered a favourable relationship between smoking and its many characteristics with regard. In this study, smoking was associated with increased hearing loss in young and middle-aged males with 34.54% smokers and 10.90% non-smokers with hearing impairment among Indian adult males.

Keywords: Hearing, Smoking, Audiometer, Loss, Cigarette.

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Introduction

The World Health Organization (WHO) 2023 has documented an annual toll of 8.7 million fatalities attributable to tobacco consumption, comprising to an additional 1.3 million casualties among non-smokers exposed to second-hand smoke [1].

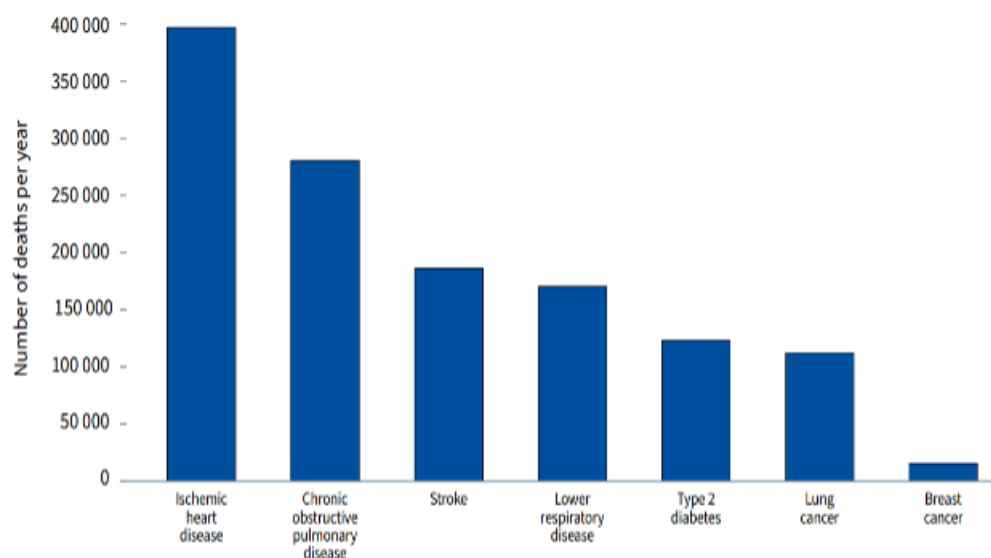


Figure 1: Main causes of death due to second hand smoke exposure

Hearing Loss Overview: As per the World Health Organization, the current global prevalence of individuals with hearing loss stands at 466 million, and projections indicate that approximately 900 million people will be affected by hearing impairment by the year 2050. A significant portion of childhood hearing loss, constituting 60%, is attributed to preventable factors, while an alarming 1.1 billion individuals aged between 12 and 35 face the risk of hearing loss owing to exposure to excessive noise [2].

The economic burden associated with untreated hearing loss is substantial, amounting to an annual global cost of \$750 billion in U.S. dollars. Globally, hearing loss affects 1.5 billion people, with 13% of adults over 18 facing difficulties even with hearing aids (Hurtado, 2023). Smoking has been associated with sensorineural hearing loss. Sensorineural hearing loss occurs when there is damage to the inner ear (cochlea) or the auditory nerve pathways leading to the brain.

This type of hearing loss is often irreversible and is commonly related to the aging process (presbycusis), exposure to loud noises, and certain medical conditions. In the case of smoking, it is believed that the toxic components of cigarette smoke, such as nicotine, can have detrimental effects on the delicate structures of the inner ear, leading to sensorineural hearing loss³. Additionally, smoking is linked to vascular issues, and compromised blood flow to the cochlea can contribute to this type of hearing impairment. (Alexy et al. 2022). Smokers exhibit a 1.69-times higher risk of hearing loss compared to non-smokers (Alexy et al. 2022).

This study seeks to investigate the impact of smoking on hearing. Previous research has yielded mixed results, primarily in Western populations. The outcomes of this study may stimulate future inquiries, potentially shaping the development of early screening methods for hearing loss in smokers. Recognizing smoking as a significant risk factor can empower patients with information about its profound impact on hearing health [4]. By leveraging a multidimensional approach encompassing clinical, biochemical, and audiometric assessments, we seek to elucidate the specific pathways through which cigarette smoking may compromise auditory function. The findings of this research endeavor are anticipated to advance our understanding of the nuanced relationship between smoking and hearing health, potentially paving the way for targeted interventions, public health initiatives, and the development of early detection strategies for this consequential health concern [5].

Material and Methods

The present cross-sectional study was conducted in the outpatient department of ENT patients at Nims Medical College, Jaipur, Rajasthan. Participants were categorized into either the smoker group (individuals with a history of smoking or current smokers) or the non-smoker group (individuals who had never smoked). The study group consisted of male smokers (n=55) aged between 25 and 55 years, while the age-matched control group (n=55) comprised subjects with no history of smoking. Participants in both groups were randomly selected based on inclusion and exclusion criteria, and

informed consent was obtained from each participant.

The hearing tests were conducted in a soundproof room in the outpatient department of the ENT department at Nims Hospital. The hearing examination included a general examination, ear examination, screening tuning fork test, and pure tone air-conduction and bone conduction tests using AD 226 Intra-acoustic audiometry. The audiometry test, conducted in a soundproof room at Nims Hospital, utilized puretone audiometry (PTA) to assess hearing thresholds for different frequencies. Participants responded to tones, and the lowest volume level at which a response was recorded was considered the threshold. The study differentiated between right and left ears and independently assessed the extent of sensorineural hearing loss.

Statistical analysis, including unpaired Student's t-test and chi-square test using SPSS version 17, revealed that both smoking and non-smoking groups had Puretone average values below 25 dB HL.

The analysis demonstrated statistically significant hearing loss in smokers compared to non-smokers, with a higher mean in the smoking group. Smoking was significantly associated with hearing impairment, with 34.54% of smokers and 10.90% of nonsmokers experiencing hearing problems. Age exhibited a slight increase in affected individuals, particularly in smokers, and sensorineural hearing loss was prevalent in both groups. The study classified hearing loss according to ASHA standards, revealing that the severity of hearing impairment in both groups indicated only mild hearing loss. However, smokers had a statistically higher mean hearing loss. In summary, the study underscores a statistically significant association between smoking and hearing impairment, emphasizing a higher prevalence of sensorineural hearing loss in individuals with a history of smoking.

Results

In the present study, all participants in both the study and control groups exhibited to a pure tone air-conduction and bone conduction tests using AD 226 Intra-acoustic audiometry. The audiometry test, conducted in a soundproof room at Nims Hospital, utilized puretone audiometry (PTA) to

assess hearing thresholds for different frequencies. Table 1 provides a detailed comparison between the study group and the control group for conventional puretone audiometry. The analysis revealed a statistically significant difference between the two groups, the smokers exhibited a statistically significant higher mean hearing threshold (21.1 ± 6.92 dB) compared to non-smokers (16.8 ± 5.23 dB). The difference of Hearing loss was statistically significant between the groups. The results of the study indicate a statistically significant association between smoking status and the occurrence of hearing loss. The data reveals that among smokers, 34.54% of subjects experienced mild hearing loss, whereas in the non-smoking group, only 10.90% exhibited mild hearing loss. When considering the degree of hearing loss (26-40 dB), smokers showed a higher prevalence of affected individuals (34.54%) compared to non-smokers (10.90%) (table 2.). Table 3 illustrate the relationship between smoking status, age groups, and the severity of hearing loss. The data is organized as follows:

Age and Hearing Loss Severity in Smokers:

Among smokers aged 25-35 years, 28.57% experienced no hearing loss, and 71.43% showed mild hearing loss (26-40 dB). For the age group 36-45 years, 31.57% had no hearing loss, and 68.42% exhibited mild hearing loss. In the 46-55 age group, 46.66% had no hearing loss, and 53.34% presented with mild hearing loss.

Age and Hearing Loss Severity in Nonsmokers:

Nonsmokers aged 25-35 years demonstrated a lower prevalence of no hearing loss (8.69%) and a higher percentage of mild hearing loss (91.31%). In the 36-45 age group, 10.52% of nonsmokers had no hearing loss, and 89.48% showed mild hearing loss. For the 46-55 age group, 15.38% had no hearing loss, and 84.62% exhibited mild hearing loss. Figure-1 illustrates the correlation between hearing loss and advancing age among Non-Smokers and Figure-2 depicts the association between hearing loss and the progression of age among Smokers. In conclusion, while there are variations in the prevalence of hearing loss across different age groups and smoking statuses. Further research with a larger sample size may be warranted to explore potential associations between age, smoking status, and hearing loss severity more comprehensively.

Table 1: Comparing Hearing status of Smokers and Non-smokers

Smoking Status	Mean (db.)
Smokers	21.1± 6.92
Non-Smokers	16.8± 5.23
p-value	< 0.001

Table 2: Comparison of smoking status and degree of hearing loss in smokers and non-smokers

Smoking status	No hearing loss		Affected subjects		Degree of hearing loss	Total
	Number	%	Number	%	26-40db	
Smokers	36	65.45	19	34.54	Mild	55
Non-Smokers	49	89.09	06	10.90	Mild	55
Grand Total	85		25			110

p-value < 0.001

Table 3: Comparison of hearing loss in smokers and non-smokers according to age

Smoking Status	Age (in years)	Affected Subjects		No Hearing loss	Severity 26-40db	Total	P value
		No	%				
Smokers	25-35	6	28.57	15	Mild	21	0.501
	36-45	6	31.57	13	Mild	19	
	46-55	7	46.66	08	Mild	15	
Nonsmokers	25-35	2	8.69	21	Mild	23	0.386
	36-45	2	10.52	17	Mild	19	
	46-55	2	15.38	11	Mild	13	
Grand total		25		85		110	

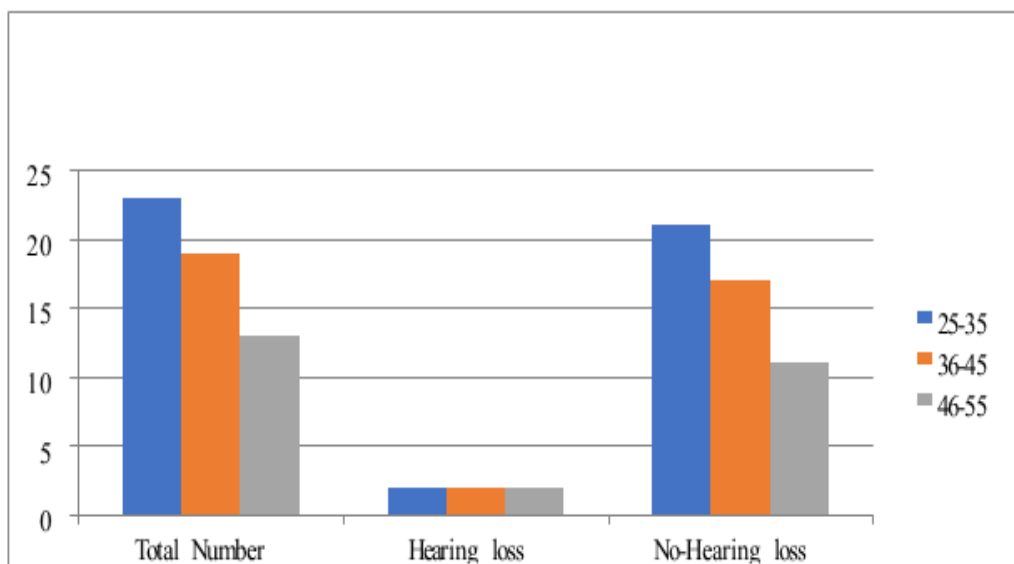


Figure 2: Showing Hearing loss in relationship with increase in age of Non-Smokers

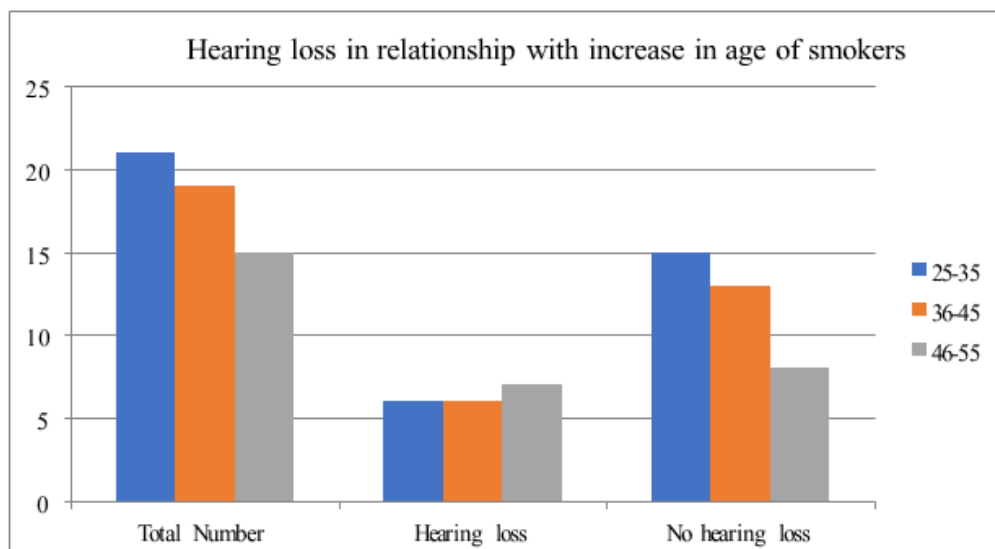


Figure 3: Showing Hearing loss in relationship with increase in age of Smokers

Discussion

While extensive research has been conducted to investigate the health risks associated with smoking, there exists a noticeable gap in the scientific literature regarding the specific correlation between smoking and hearing loss [6]. This study endeavors to address this gap by undertaking a meticulous review of existing literature and performing a comprehensive analysis, with a particular focus on elucidating the association between smoking habits and the prevalence of hearing loss within the adult male population in India [7]. By employing rigorous scientific methods, including statistical analyses and data interpretation, our aim is to contribute valuable insights that can inform public health policies and interventions aimed at mitigating the potential auditory consequences of smoking in this demographic [8].

Although various studies have been conducted to predict the hearing status among chronic smokers like some studies conducted by Cocchiarella et al., 1995, Nakanishi N et al., 2000. But inconsistent findings among their research findings necessitated this study for an Indian adult population. A study done by Kumar et al., 2014. reported sensory neural hearing loss in 77.5 % subjects, mixed in 18.3 % subjects. While in our study we only found sensorineural hearing loss among 34.54% smokers and 10.90% non-smokers which was significantly different among the control and study group [9]. Also, in our study there were no trends for conductive and mixed type of hearing loss in association with smoking among adult Indian male population. All of the individuals in our study (10.90%) and the smokers (34.54%) reported hearing loss between 26 and 40 dB, which indicates that they all had mild type of hearing loss [10]. The reason for this may be the smaller sample size, due to which it might be possible that none of the afflicted individuals had moderate, or severe type of hearing loss [11]. Other investigations conducted by Uchida et al [12], in which they reported the statistical interactions between smoking and hearing in which they also concluded that the smoking causes hearing loss in adult population [13].

This prevalence may be attributed to the smaller sample size, potentially limiting the representation of individuals with moderate or severe hearing loss in our study [14]. Our observations align with investigations by Uchida et al. (year), who reported statistical interactions between smoking and hearing loss in adults, supporting the conclusion that smoking may indeed be a causative factor for hearing loss in the adult population. The nuanced differences in our study underscore the importance of considering population-specific factors and

highlight the need for further research to deepen our understanding of the complex relationship between smoking and hearing impairment in the Indian context [15]. The correlation between smoking cigarettes and ageing was also accessed in our study. In which it was found that although not significantly, the prevalence of hearing loss increases with ageing, as can be seen in table 3. Additionally, the percentage of smokers with hearing loss increased with age and was higher than the percentage of non-smokers with hearing impairment. Thus, it was evident that smoking contributed to the age-related hearing loss that was accelerating [16]. These findings were quite similar to the earlier studies of K Adesh et al 2013 [17] in which they studied the effect of smoking on hearing, which was a hospital-based study conducted in Jawahar Lal Nehru medical college AMU, Uttar Pradesh India in Indian male population, in which they found that as the age increased, the percentage of Discussion [18]. Subjects with hearing loss also increased, both among the smokers and the non-smokers. Also, with increasing age, the percentage of the smokers who had hearing loss was more than the percentage of the non-smokers who had hearing impairment [19]. In our study, the results showing the multiplicative effect of age and smoking on the hearing impairment, which was also in accordance with the findings of Noorhassim et al.

Our study's findings on the association between hearing loss and advancing age are consistent with earlier research that has shown a connection between smoking and hearing loss with age. The proportion of ears that could respond decreased for each age-decade as the frequency increased [20]. According to earlier research done by Cruickshanks KJ et al and Itoha et al, smoking increased the risk of hearing loss and was a contributing factor in age-related hearing loss. Smoking has also been linked to age-related hearing loss by a multipurpose study.

Although the direct impairment of the auditory system and pathways was not investigated in the current analysis but some recent researches like research done by Rogha M et al [21] concluded that Cigarette smoking may affect the hearing through the direct ototoxic effect of nicotine on the cochlea. As smokers are constantly exposed to the levels of carbon monoxide in the range of 500 to 1,500 parts per million. They also concluded that the carbon monoxide in tobacco smoke causes a rise in the carboxyhemoglobin levels in smokers, which may in turn reduce the oxygen which is available for the organ of Corti [22], resulting in damage to the hair cells which are sensitive to oxygen, and leading to hearing loss.

The current investigation discovered a positive association between smoking and its many features and hearing status. This study was distinctive since it was carried out in an Indian population (Rajasthan India), about which there was very little data regarding the effects of smoking on hearing health. We hope that our research may open the door to more extensive studies in the future.

Conclusion

The current study discovered a favourable relationship between smoking and its many characteristics with regard. In this study, smoking was associated with increased hearing loss in young and middle-aged males with 34.54% smokers and 10.90% non-smokers with hearing impairment among Indian adult males.

In this study, only sensorineural hearing loss impairment was seen among smokers as well as non-smokers. It was also found that although not significantly, the prevalence of hearing loss increases with ageing.

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