

Has smoking any bearing on hearing status?

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INTRODUCTION

Smoking is a usual tendency that is prevalent in all social strata worldwide, especially among the working people. According to the Globe Health Organization, hearing loss has been ranked as the 15th leading cause of disability adjusted life years across age and sex categories.^[1] Apart from the systemic diseases caused by tobacco, it has been found that smoking affects the senses, which involves hearing.

While inhaling cigarette smoke, approximately 2500 harmful substances including thiocyanate, carboxyhemoglobin, and carbon monoxide gets accumulated. Squamous metaplasia of the tubal mucosa, altered mucociliary function of Eustachian tube and depletion of its hair cells are attributed by tobacco

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Introduction: Smoking is common habit around the globe. It affects not only cardiovascular system but also affects hearing system. Nicotine, the active ingredient causes ischemia of cochlear blood vessels. **Aims and Objectives:** This study aims to assess effect of smoking on hearing acuity. **Materials and Methods:** In this study, we included a total of 180 participants in which 90 were smokers and 90 were non-smokers. All participants were subjected to tuning fork test and pure tone audiometry and were analyzed accordingly. **Discussion and Conclusion:** In this study, we concluded that smoking causes sensorineural hearing loss in majority of cases and mixed in some of the cases involving high frequency loss. Furthermore, Bidi smokers were at higher risk to develop hearing loss.

KEY WORDS: Smoking, hearing loss, sensorineural hearing loss, high frequency

specific nitrosamines. Nicotine results in ischemia of the vessels of cochlea by causing vasospasm, of the cochlear, vascular loops, formation of carboxyhemoglobin, raised blood viscosity, decreased oxygen transport, and hampers oxyhemoglobin dissociation. As a consequence, the organ of Corti's hair cells suffer damage because the cochlear vessels' blood supply is reduced. Smoking has a compounding effect on both Raynaud's syndrome and high diastolic blood pressure.^[2]

The health effects of tobacco smoking depend on the history of exposure, which includes the length of time smoked, the quantity of cigarettes, the level of inhalation, and factors such as nicotine and tar content. As there is little research on this topic, the goal of the current study is to evaluate the substantial relationship between tobacco, and cigarette, smoking and its impact on smokers' hearing in reference to Indian population particularly in relation to high frequency hearing threshold.

Despite all the great effects tobacco control policies have had on public health, smoking's harmful effects continue to be a significant issue. Active and second-hand smoke exposure is two of the main factors that contribute to the development of middle and inner ear disorders.

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Smoking may hasten presbycusis, which is the age-related hearing loss. The auditory system acts to channel and transduces sound pressure waves into electrophysiological signals that can then be localized and interpreted by the higher cortical centers involving numerous structural and chemical changes coinciding with advancing age. Presbycusis is characterized by a combination of decreased function of the central, auditory, complex and the auditory periphery. This may be the reason why simple amplification of external sound with a hearing aid will not always fully correct the hearing disability of presbycusis experienced by the person.

As there is little research on this topic, the goal of the current study is to evaluate the substantial relationship between tobacco, and cigarette, smoking and its impact on smokers' hearing in reference to Indian population particularly in relation to high frequency hearing threshold.

Aims

The aim of the study was to evaluate the effect of smoking on hearing status.

Objectives

The association between degree of hearing loss in different types of smoking.

- Correlation between the duration of smoking and hearing loss
- The type of hearing loss in smokers, if any.

MATERIALS AND METHODS

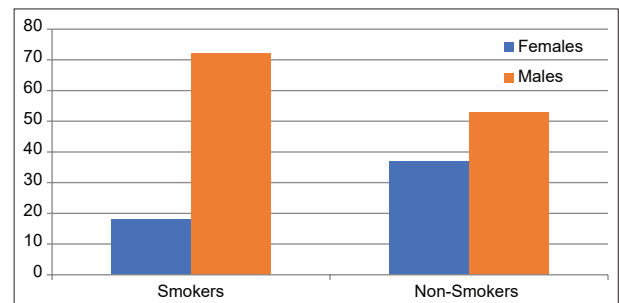
This study was conducted in the Department of Otorhinolaryngology and Head and Neck Surgery, Rohilkhand Medical, College and Hospital, Bareilly, a tertiary care and teaching hospital in western Uttar Pradesh. This cross-sectional study was conducted for a duration of 1 year (November 1st, 2020–October 31st, 2021). The sample size was calculated by the formula $4pq/n^2$. As per the study of Kumar *et al.*,^[3] the prevalence of hearing loss was 0.657%. The sample size came to be 90, that is, 90 smokers and 90 non-smokers. All subjects who had history of smoking, willing to take part in this study of age group of 18–60 years were included in this study whereas subjects who had history of ototoxic medication usage, diabetes mellitus, hypertension, known hearing loss, ear surgery, familial deafness, and noise exposure (occupational noise or non-occupational noise such as amplified music, etc.) were excluded from the study. All of the study participants underwent in-depth physical examinations in accordance with case record forms, and an extensive ENT examination and pertinent investigation were completed. The hearing tests were carried out in a sound treated room in the outpatient department of the Otorhinolaryngology Department. The hearing tests included a tuning fork test, pure tone audiometry (250 Hz–16,000 Hz frequency). Data will be analyzed using SPSS version 21 and appropriate statistics will be used.

RESULTS AND OBSERVATION

There were a combined 90 smokers and non-smokers in our study. Among smokers, there were 72 (80%) males and 18 (20%) females, compared to 53 (58.8%) males and 37 (41.11%) girls among non-smokers. There were 37 (41.1%) females and 53 (58.9%) males out of 90 controls in this study. As shown in Graph 1 and Table 1.

The present study observed that 40 (44.4%) subjects had sensorineural hearing loss (SNHL), 9 (10%) subjects had mixed type of hearing loss whereas 4 (4.4%) had conductive deafness. The pure tone audiometry was found to be normal in 37 (41.1%) subjects [Table 2].

Out of 45 smokers of bidis in this study, 12 (13.33%) had mild hearing loss, 22 (24.44%) had moderate hearing loss, 9 (10%) had moderately severe hearing loss, and only 2 (2.22%) had severe hearing loss. In contrast, out of 45 smokers of cigarettes, 25 (27.77%) had mild hearing loss, 11 (12.22%) had moderate hearing loss, 8 (8.88%) had moderately severe hearing loss, and 1 (1.11%) had severe deafness [Table 3].



Graph 1: The distribution of data based on gender among smokers and non-smokers

Table 1: The distribution of type of smoking based on gender among smokers

Type of Smoking	Gender		Total
	Male	Female	
Bidi	31	14	45
Cigarette	41	4	45
Total	72	18	90

Table 2: Type of hearing loss based on pure tone audiometry among smokers

Type of hearing on PTA	Frequency	Percent
PTA		
SNHL	40	44.4
CNHL	4	4.4
Mixed	9	10
Normal	37	41.1
Total	90	100

SNHL: Sensorineural hearing loss

Out of 90 cases, 22 (24.44) had history of <5 years of smoking in which we observed that 17 had normal hearing, five subjects had mild hearing loss and five had severe hearing loss. The subjects who had history of smoking between 5 and 10 years, out of 29, we found that 16 subjects had normal hearing, 12 had mild hearing loss, and 1 had moderate while 13 had severe deafness. The subjects who had history of smoking between 11 and 15 years, out of 12 subjects, 3 subjects had normal hearing, 5 had mild, and 4 had moderate while 9 had severe deafness. The subjects who had history of 16–20 years, out of 18 subjects, 1 had normal hearing, 8 subjects had mild, 9 had moderate, and 17 had severe deafness. The subjects who had history of smoking more than 20 years, out of 9 smokers, 6 had normal hearing, 3 had mild, 3 had moderate, 3 had moderate to severe, and 2 had severe deafness [Table 4].

The correlation of smoking and degree of acuity of hearing was found to be 0.719 through Pearson's correlation coefficient test. This difference of positive correlation was found to be very highly significant at P-value 0.000 which indicates that if the duration of smoking will increase, hearing loss will also be increased [Table 5].

Table 3: Type of smoking and degree of loss of hearing among smokers

Count	Cross-tabulation		Total
	Type of Smoking		
	Bidi	Cig	
Degree of hearing loss			
Mild	12	25	37
Moderate	22	11	33
Moderately severe	9	8	17
Severe	2	1	3
Total	45	45	90

Table 4: Association between duration of smoking and degree of hearing loss among smokers

Duration of smoking	Mild	Moderate	Moderately severe	Severe	No hearing loss	Total
<5 years	5	0	0	5	17	22
5–10 years	12	1	0	13	16	29
11–15 years	5	4	0	9	3	12
16–20 years	8	9	0	17	1	18
>20 years	3	3	3	9	0	9
Total	33	17	3	53	37	90

Table 5: Distribution based on hearing threshold frequency among the cases

S. No.	Hearing frequency loss	Frequency	Percent	Valid percent	Cumulative percent
1.	No hearing loss	26	28.9	28.9	28.9
2.	Low frequency	6	6.7	6.7	35.6
3.	Mid frequency	19	21.1	21.1	56.7
4.	High frequency	39	43.3	43.3	100.0
5.	Total	90	100.0	100.0	

DISCUSSION

Type of Smoking and Degree of Hearing Loss in Smokers

Out of 45 bidi smokers in this study, 12 (13.33%) had mild hearing loss, 22 (24.44%) had moderate hearing loss, 9 (10%) had moderately severe hearing loss, and 2 (2.22%) had severe hearing loss, whereas out of 45 smokers of cigarettes, 25 (27.77%) had mild hearing loss, 11 (12.22%) had moderate hearing loss, 8 (8.88%) had moderately severe hearing loss, and 1 (1.11%) had severe hearing loss. Age-stratified analysis carried out by Chang *et al.*^[4] smoking cigarettes was linked to speech-relevant frequency hearing loss in people in their 40 s, 50 s, and 60 s. In these age groups, the current smoking group exhibited a higher rate of hearing impairment than the passive smoking group and the non-smoking group. With the exception of people in their 40 s, passive smoking did not significantly increase the prevalence of hearing impairment. In comparison to the non-smoking group, the prevalence of speech-frequency bilateral hearing impairment was considerably higher in the current smoker group. Even while the prevalence of hearing impairment was higher in the group of passive smokers than in the group of non-smokers, the difference was not statistically significant. Gopinath *et al.*^[5] identified strong correlations between drinking alcohol and high-frequency hearing loss. Low-frequency hearing loss and high-frequency hearing loss were not substantially correlated with current smoking.

Duration of Smoking and Degree of Hearing Loss

In this study, there was seen a positive relationship between duration of cigarette smoking and degree of loss of hearing. The cases who smoked for a longer duration developed high degree of loss of hearing as compared to those who smoked for a lesser duration. In study conducted by Siegelau *et al.*,^[6] the greatest differences were those between 2% and 5 times as many males than women have hearing loss than women in any category.

All 12 such comparisons were highly significant ($P < 0.0001$). Furthermore, smallest differences are seen between cigarette smokers and non-smokers. These ranged from 1 to 1% times more in male smokers. In women, the differences were not consistent and ranged from one-half as great to 1% times as great in smokers compared with non-smokers. Furthermore, in each male age group who suffered loud noise, the smokers v/s non-smokers difference was not significant; whereas in male age groups that were not exposed, these differences were significant ($P < 0.001$). This fact suggests that the exposure effects are so large as to overcome the relatively small association with smoking. In research conducted by Mehrparvar *et al.*,^[7] the maximum threshold in high-frequency and conventional audiometry was found at 6000 Hz and 16,000 Hz, respectively, which was comparatively higher than the study's frequency range. Numerous other researches have established a direct link between SNHL and cigarette addiction. It was revealed in a population-based study conducted by Cruickshanks *et al.*^[8] that smokers had a 1.7-fold higher chance of developing SNHL than non-smokers do. Noorhassim and Rampal^[9] have demonstrated the multiplicative effects of smoking and age in the development of SNHL. Smoking is a significant risk factor for SNHL, as demonstrated by a number of further studies, including Itoh *et al.*^[10] and Fransen *et al.*^[11] According to the Cunningham *et al.*^[12] study, smoking induces high-frequency SNHL. An investigation conducted in India by Kumar *et al.*^[3] revealed findings that were consistent with our study's findings regarding a direct relationship between smoking and SNHL.

CONCLUSION

There is high tendency of smoking in males as compared to females, thereby, had high prevalence, of hearing loss. Bidi smokers developed more hearing loss, as compared, to cigarette smokers and the cases who smoked for a longer duration developed high degree, of hearing loss. There was significant association between duration, of smoking and SNHL, out of which majority developed cochlear pathology as nicotine primarily affects cochlear vascularity. Smoking affected high frequency hearing threshold more as compared to low frequency. Hence, our role should be to advise patients that no level of active smoking or second-hand-smoke exposure should be considered 'safe', and help to lower the burden of tobacco use by educating and advising their patients regarding the benefits of smoking cessation on hearing preservation.

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