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**Original research article**

# Study of Effect of Smoking on Hearing Loss by Audiometric Screening

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**Abstract**

**Background:** Few of the studies advocate that cigarette smoking is highly associated with the development of hearing loss both Conductive and Sensorineural type. However, comprehensive audiological evaluation on smokers has been scarce. Thus there is an extremely important need to assessthe hearing status in smokers and to view pathophysiology of auditory system in greater detail.

**Objectives:** To study the incidence of hearing loss in rural population by puretone audiometry and to study the effect of smoking on hearing loss.

**Methodology:**, This is Cross sectional study 500 people fulfilling Inclusion/Exclusion criteria who gave their consent were included in the study. The population included in the study was from the rural area of various age groups in Hoskote and were screened for hearing loss. Their detailed history was taken and those having ENT disease,head injury, history of ototoxic medication intake, history of noise exposure were excluded from the study. The technique of pure tone audiometry is the based on ASHA method. All the individuals were subjected to DPOAE screening.

**Conclusion:** In our study, mild sensorineural hearing loss was more significant in smokers. Cigarette smoking is clearly evident to effect on cochlear which was measured through a decreased response in distortion product otoacoustic emissions ( DPOAE).

**Keywords:** Sensorineural hearing loss , pure tone audiometry.

## Introduction

Hearing loss is one of the most common sensory impairments, and results from pathological conditions along the auditory pathway (Martínez-Pérez et al., 2013). Hearing impairment hampers the ability to understand speech, and leads to difficulties in communication and social connectivity. The prevalenceof hearing impairment is increasing and the World Health Organization (WHO) reported that 360million people, which exceeds is over 5% of the worlds' population, have disabling hearing loss(defined as an average hearing threshold of ≥ 40dBHL), and that one-third of people over 65 years old are affected by disabling hearing loss (World Health Organization., 2015).There are various risk factors for hearing loss; genetic causes, complications at birth, infectious disease, chronic ear infections, the use of ototoxic medications, exposure to noise, sex, ageing and so on.Among the different associated factors, ageing is a well-known and major factor in hearing loss(Cruickshanks et al. 1998; Agrawal et al., 2008 ). Age-related hearing loss usually begins in the third decade of life, progresses gradually, and typically involves the hearing threshold at high frequencies. Additionally, men are reported to have a higher risk for developing hearing loss (Gopinath et al., 2009;Demeester

et al., 2008 ) probably due to their greater likelihood of exposure to extrinsicototoxic insults. On the other hand, while smoking is a well-known risk factor for many health problems, the association of cigarette smoking and hearing loss has been inconsistent (Rosenhall et al., 1993; Karlsmose et al., 2000). Other studies found that smoking pack-years and ageing have multiplicative effects on developing hearing impairment (Noorhassim et al. for a longer period than younger people, and therefore a longer duration of smoking would have affected the cochlear circulation more and could thereby result in a high prevalence of hearing loss. From this perspective, it is essential to evaluate the hearing loss amongsmokers categorized by age and with adjustment for the age.

**Objectives**

To study the incidence of hearing loss in rural population by pure tone audiometry and otoacoustic emissions, study the effect of smoking on hearing loss.

**Review of Literature**

Smokers are nearly 70% more likely than non-smokers to suffer hearing loss, according to a study including more than 3,000 people. Another study found otherwise, absolving cigarettes from blame in hearing loss. The first study, conducted in the United States and published in the Journal of the American Medical Association, June 1998, concluded that the risk of hearing impairment often increases with the number of cigarettes smoked. In many cases, hearing problems increase proportionately with the intensity and duration of exposure to cigarette smoke. In general, smokers are 1.69 times more likely to damage their hearing ability. Heavy smokers are more than 1.30 times aslikely to have a hearing loss in all age groups but the oldest. The greater prevalence of hearing loss among smokers remains the same after adjusting for factors such as occupational noise exposure, age and lifestyle. According to the study, 25.9% of smokers in the youngest age group studied - 48 to 59 years of age - smoking caused hearing loss, compared to 16.1% among non-smokers. 22.7% of ex- smokers were suffering from hearing loss. The same trend was found in the older age groups. The study found that passive smoking may cause hearing loss as well. Non-smokers living with a smoker were found to be 1.94 times more likely to suffer from hearing problems than those who were not living witha smoker. Evoked otoacoustic emissions, EOAEs, are proved to be sounds aroused in response to external acousticstimulus by the cochlear outer hair cells. Transiently evoked otoacoustic emissions, TEOAEs, are the most clinically utilized EOAEs. TEOAEs are detectable in 98% of people with normal hearing, regardless of age or sex, while two ears of any individual produce similar TEOAEs waveforms. Gegenava et al (2016) done a study on comparison of TEOAE magnitudes in cigarette smokers and nonsmokers. The TEOAE occurrence and characteristics in individuals of both samples with audiometrically proved hearing losses and in those without were also specifically examined. 30 smokersand and 30 nonsmokers within the age range of 30-59 years were involved in the present study after informed concent. OAEs were performed to each subject by Madsen Capella's-OAE/middle ear analyzer-GN Otometrics, (Danmark). After OAE testing each subject was performed routine pure-tone audiometry and tympanometry. Obtained results were statistically treated by the student's t-distribution. A study was done by Cruickshanks et al on Cigarette Smoking and Hearing Loss. The examination included otoscopy, screening tympanometry, and pure-tone air-conduction and bone-conduction audiometry. Smoking history was ascertained by self-report. Hearing loss was defined as a pure-tone average (0.5, 1, 2, and 4 kHz) greater than 25-dB hearing level in the worse ear. After adjusting forother factors, current smokers were 1.69 times as likely to have a hearing loss as nonsmokers (95% confidence interval, 1.31-2.17). This relationship remained for those without a history of occupational noise exposure and in analyses excluding those with non–age-related hearing loss. There was weak evidence

of a dose-response effect. Siegelaub et al reported on a large study of 33146 men and women seen at Kaiser-Permanente, Oakland,Calif. Among men without a history of noise exposure, current smokers were more likely than nonsmokers to have a hearing loss at 4000 Hz, but the size of the effect was small. There was no association among women. Honeth et al (2016) investigated a cross-sectional study among Swedish hunters if tobacco use modifies hearing loss, expressed as prevalence ratio (PR), between unprotected exposure to impulse noise from hunting rifle caliber (HRC) weapons and high-frequency hearing impairment (HFHI). Results were demonstrated that in all, 202 hunters completed a questionnaire regarding the hearing test. Associations were modeled using Poisson regression. Current, daily use of tobacco was reported by 61 hunters(19 used cigarettes, 47 moist snuff, and 5 both). Tobacco users tended to be younger, fire more shots with HRC weapons, and report more hunting days.

**Material and methods**

It was a cross sectional study, all individuals attending ENT department The study was conducted on individuals of either sex , Age between 20 to 50 and presentingto ENT Department of our institution Study duration of two years. This study was carried out in Darbhanga medical college and Hospital Darbhanga, Laheriasarai Bihar. Sample size: 500 cases were included in the study.

**Inclusion Criteria**

Subjects 20 – 50 years of age.

**Exclusion Criteria**

Subjects with history of ear dis ease, Subjects with history of previous ear surgery, Subjects with exposure to ototoxic medica36tion

The test using pure tone audiometer is applicable to most of the adults and children over 4 years of age to identify hearing threshold levels of an individual, enabling determination of the degree, type and configuration of a hearing loss. 500 individuals of various age groups(20 to 50 years) in and around Hoskote were selected for hearing loss. Detailed history was taken to exclude: ENT disease, head injury, intake of ototoxic medication , and history of noise exposure, its type and duration was recorded.

The personal history and life style habits like smoking and consumption of alcohol was also recorded. The rate of smoking was calculated by pack years. After complete examination to rule out any disease, the individuals were subjected to pure tone audiogram The duration of presentation of stimulus should be for 1 - 3 seconds . Rhythmic presentations should be avoided which may lead to the patients anticipating near threshold levels and likewise regular automatic switching should not be used.

**Results**

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. **Chi-square test** was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation. **Independent t test** was used as test of significance to identify the mean difference between two quantitative variables.

**Mean age distribution with respect to smoking status**

| | Age | P value |
|---|---|---|

| | | Mean | SD | |
|---|---|---|---|---|
| Smoking | Present | 32.98 | 9.27 | 0.455 |
| | Absent | 32.29 | 9.24 | |

Mean age of smokers was 32.98 ± 9.27 years and non smokers was 32.29 ± 9.24 years. There was nosignificant difference in age distribution between smokers and non smokers.

**Gender distribution with respect to smoking status**

| | | Smoking | | | | | |
|---|---|---|---|---|---|---|---|
| | | Present | | Absent | | Total | |
| | | Count | % | Count | % | Count | % |
| Gender | Female | 27 | 19.4% | 100 | 27.7% | 127 | 25.4% |
| | Male | 112 | 80.6% | 261 | 72.3% | 373 | 74.6% |

Among smokers 80.6% males and 19.4% were females, among non smokers 72.3% were males and27.7% were females.

**Smoking history among subjects**

| | | Cigarette Smoking | | | | | |
|---|---|---|---|---|---|---|---|
| | | Present | | Absent | | Total | |
| | | Count | % | Count | % | Count | % |
| Cigarette smoking | No | 139 | 100.0% | 361 | 100.0% | 500 | 100.0% |

In the study 27.8 % were smokers and 72.2 % were non smokers On right ear among smokers, 3.6% had moderate conductive hearing loss and non smokers 1.1% hadmoderate and 0.8% had mild conductive hearing loss. There was no significant association between conductive hearing loss and smoking on right ear. On Left ear among smokers,3.6% had mild and 1.4% had moderate conductive hearing loss and amongnon smokers 1.7% had mild conductive hearing loss and 0.2% had moderate hearing loss. On right ear, among smokers 29% had reduced Otoacostic Emission and 71% had Otoacostic Emission,among non smokers 5.3% had reduced Otoacostic Emission and 94.7% had Otoacostic Emission. Therewas significant association between Otoacostic Emission and smoking on right ear**.** On Left ear, among smokers 27.4% had reduced Otoacostic Emission and 72.6% had Otoacostic Emission, among non smokers 8.25% had reduced Otoacostic Emission and 92.5% had Otoacostic Emission.

## Discussion

The major finding of the present study was that cigarette smoking had reduced PTA threshold indicating that smoking is related in to mild sensorineural hearing loss and reduced DPOAE amplitudes Based on results we suppose that smoking has significant influence on hearing function In 2015 , Jamal.A showed prevalence in cigarette smoking was higer amoung adult how weremale ; were aged 25-44 years (17.7%). Rani M showed The prevalence of cigarette smoking use in India was estimated to be 37 percent among The population of 15 years and above . In our study majority of subjects were in the age group 21 to 25 years (25.2%), followed by 26 to 30 years (21.6%). Among smokers and non smokers majority of subjects were in the age group 21 to 25 years (24.5% and 25.5% respectively). There was no significant difference in age distribution between two groups. S.K.Jindal et al reported smoking habite was present in 28.5% of men and 2.1% of women.In our study 27.8 % were smokers and 72.2% were non smokers. There was no significant association between conductive hearing loss and smoking onright ear. On Left ear among smokers, 4.3% had moderate and 0.7% had conductive hearing loss and non smokers. 1.1% had mild conductive hearing loss. There was significant association between conductive hearing loss and smoking on Left ear. Prem G.Nair

reported in the present study , PTA , were significantly poorer than the control group indicating pathological influence of smoking across all frequency regions.similal findings have been reported by Oliveira and Lima and Fabry et al. In the present study , among subjects with hearing loss , majority had SNHL (87% ) and only 13% had mixed hearing loss. A study done byKumar et al on 108 smokers revealed similar findings. In their study , 77.5% of smokers had SNHL and only 18.3% had mixed hearing loss. On Left ear among smokers, 17.3% had mild, 5% had moderate, 9.4% had moderately severe, 0.7% had profound and 3.6% had severe SNHL. Among non smokers, 8.6% had mild, 2.8% had moderate, 2.5% had moderately severe, 1.4% had profound and 2.2% severe SNHL. There was significant association between Sensorineural hearing loss and smoking on Left ear. Negley et al, examind distortion product OAEs ( DPOAEs ) in 20 – 30 years old smokers who smoked for 5 – 8 years and who reported essentially no history of noise exposure. DPOAEs measured and showed reduced emission amplitudes. Otoacoustic Emission, among non smokers 5.3% had reduced Otoacoustic Emission and 94.7% had Otoacoustic Emission. There was significant association between Otoacoustic Emission and smoking onright ear**.** On Left ear, among smokers 27.4% had reduced Otoacoustic Emission and 72.6% had Otoacoustic Emission, among non smokers 8.25% had reduced Otoacoustic Emission and 92.5% had Otoacoustic Emission. There was significant association between Otoacoustic Emission and smoking on Left ear**.**

## Conclusion

pathological auditory involvement is clearly evident in smokers. The pure tone audiometric finding indicated reduced hearing sensitivity. Sensorineural hearing loss was more prevalent in smokers. Mild sensorineural hearing loss occursin cigarette smokers. In our study cigarette smoking is clearly evident to effect the cochlea which can bemeasured through a decreased response in distortion product otoacoustic emissions ( DPOAE ). Audiographic measurments showed OAE is significantly more sensitive than PTA in this study.

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