



A STUDY ON EFFECTS BETWEEN TOBACCO CONSUMPTION AND SENSORINEURAL HEARING LOSS

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ABSTRACT

Background: It is a severe public health issue that smoking has become such a pervasive habit. Smoking is another factor that raises the chance of hearing loss. The purpose of the present study is to assess the effect of smoking on hearing loss in a population without other confounding factors. **Materials and Methods:** this prospective cross sectional study was conducted in the otorhinolaryngology Outpatient department of Trichy SRM medical college hospital and research institute over a period of 5 months. A total of 46 participants were selected with history of smoking/ tobacco addiction or history of hearing disability and data was collected using structured questionnaire. PTA was recorded and otoscopic findings were evaluated. Data was then entered in MS Excel and statistical analysis was done using SPSS software version 21. **Results:** The mean age of the study participant was 44.00 ± 10.18 years, majority of the study participants belongs to the age category of more than 40 years. Majority had moderate hearing loss. There is no statistically significant seen between age category with types of hearing loss with the p value shows 0.115. Tobacco chewing was reported among 5 (50%) cases in mild hearing loss and 15 (48.4%) cases in moderate hearing loss. There is no significance difference seen between tobacco chewing with types of hearing with the p value shows 0.473. **Conclusion:** Most of tobacco chewers had hearing deficiency and majority had moderate hearing loss which is negative in 256, 512 Hz tuning forks and positive in 1024 Hz tuning fork. Thus, it is important to spread awareness about the harmful effects of tobacco among the general public in order to prevent its detrimental effects.

KEYWORDS

tobacco, pure tone audiometry (PTA), smokers, hearing loss, tuning fork.

INTRODUCTION

It is a severe public health issue that smoking has become such a pervasive habit. Cigarette smoke is a complex combination of chemical compounds, some of which are bound to particles and others which are free in the gaseous state^[1,2]. More than 4000 chemical components may be present in cigarette smoke, according to recent research. Approximately 1.3 billion people worldwide smoke tobacco on a regular basis^[3]. Various illnesses are triggered by a variety of chemical types found in cigarette smoke^[1,2,4]. Despite an increase in tobacco usage worldwide, the epidemic of illnesses linked to tobacco use has barely started. The majority of tobacco's negative effects on human health do not surface for years or even decades after consumption begins.

One of the most crucial social communication instruments is hearing. Hearing loss can result from a number of environmental causes in addition to ageing^[5]. Communication issues such as delayed speech development, learning problems, and social and emotional disorders are brought on by hearing loss. Hearing loss can be caused by a number of factors, including genetics, birth problems, infectious illnesses, chronic ear infections, the use of ototoxic drugs, loud exposure, head injuries, ageing, and more^[6]. Smoking is another factor that raises the chance of hearing loss.

The World Health Organization (WHO) reports that smoking is the greatest cause of mortality, accounting for the deaths of 5 million people worldwide each year from cancer, heart disease, and respiratory conditions^[7]. India is home for 10.7% of all individuals who presently smoke tobacco, 2% of women, and 19% of men, according to the Global Adult Tobacco Survey 2016–17 (GATS–2)^[8].

Besides various tobacco related diseases, it was found that the likelihood of hearing loss was 1.69 times higher among current smokers than among non-smokers^[9]. Similar evidence of a causal link between smoking and hearing loss was found in meta-analysis studies conducted in Japan and Korea^[10,11]. Later in contrast, there was no correlation between hearing loss and smoking according to the Framingham and Baltimore investigations. Studies have shown that smoking might hasten the age-related hearing loss (presbycusis)^[10,12]. Therefore, these ideas on disputes were presented in order to carry out this research. The purpose of the present study is to assess the effect of smoking on hearing loss in a population without other confounding factors.

AIM AND OBJECTIVE

- To find the direct relationship between tobacco consumption and hearing loss among various age groups.

MATERIAL AND METHODS

The prospective cross sectional study was conducted in otorhinolaryngology Outpatient department of Trichy SRM medical college hospital and research institute. The study was conducted over a period of 5 months. Forty six participants in all age group with in the study duration were included in the study. The study participants included in the study were Patients attending in otorhinolaryngology Outpatient department of Trichy SRM medical college hospital and research institute, with history of hearing disability and tobacco consumption.

Inclusion Criteria

- Patients addicted to smoking and consumption of any tobacco related products was taken as subjects and included in the study.
- History of hearing disability.

Exclusion Criteria

- Patients not willing for the study and those who have other comorbidities and personal habits are excluded from the study.

Sampling Method

As per convenient sampling patients those who fulfilling the inclusion criteria with consent were taken into the study. Data collection was done by principal investigator (Post graduate in otorhinolaryngology) using structured questionnaire. Structured questionnaire contain name, age, sex, address, local examination: Ear- Otoscopic Findings/Tuning Fork Test, Nose/Throat, Investigations: otoendoscopic findings, basic history taking, and pure tone audiometry. Mild hearing loss is PTA between 26 to 40 db loss, moderate hearing loss is PTA between 41 to 70 db loss and severe hearing loss is PTA more than 70 db loss. The principal investigator has interviewed the selected respondents by conversational interview technique, where if required the respondent were offered clarification on the asked questions. An Informed and written consent was obtained in Tamil language from all the subjects prior to their participation in the study. In case if the respondents are illiterate, a left thumb impression were obtained, for whom additional witness signature of literate was obtained. Interview was conducted in a closed environment where privacy to be ensured. Data were collected after patients have consulted the specialist doctor for their treatment. A detailed history

was taken and thorough clinical examination was done in all the subjects. Statistical Analysis: the collected study data were entered in Microsoft Office Excel 2013 and analyzed using SPSS 21 software. Continuous variables like age and PTA was expressed as mean and standard deviation. Description of categorical variables like age category, gender, History of previous ear diseases, Tobacco chewer, History of hard of hearing, affected side, affected Ear, Otoscopic findings, Tuning fork test 256 Hz, Tuning fork test 512 Hz and Tuning fork test 1024 Hz duration of hearing loss was expressed as frequency and proportion.

Test Of Significance

Chi square test will be used in order to compare two categorical variables, one way ANOVA was used to compare more than three groups of mean. All the tests were two-tailed, with results considered statistically significant if the p-value was less than 0.05.

Ethical Consideration

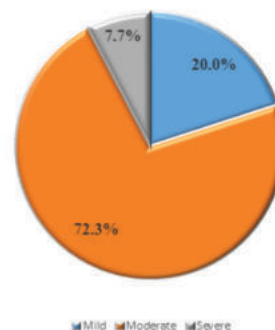
Ethical principles such as respect to the patient, beneficence and justice were strictly adhered. The approval to conduct the present study was obtained from the "Institutional Ethics Committee "(IEC). Informed written consent was obtained from all the study participants before administering questionnaire, after explaining the risks and benefits in a language comfortable to them.

Table 1: Basic Characteristic Of The Study Population (n=46)

Basic Characteristic	Number	Percentage (%)
Mean Age + SD	44.00 + 10.18	
Age Category		
< 40 years	20	43.5 %
> 40 years	26	56.5 %
Sex		
Male	33	71.7 %
Female	13	28.3 %
History of previous ear diseases		
Yes	16	34.8%
No	30	65.2 %
Tobacco chewer		
Yes	25	54.3%
No	21	45.7 %
Nicotine Dependence		
No nicotine dependence	0	0%
Low nicotine dependence	1	2.2%
Low – moderate nicotine dependence	38	82.6%
High nicotine dependence	7	15.2%
Pattern of tobacco consumption		
Beetle nut	3	6.5 %
Smoking	20	43.5 %
Smoking and beetle nut	2	4.3 %
Smoking and tobacco chewing	6	13.0 %
Tobacco	6	13.0 %
Tobacco and beetle nut	9	19.6 %
History of hard of hearing		
< 5 years	17	37 %
> 5 to 10 years	17	37 %
> 10 years	12	26.1%
Mean years of hard of hearing	8.35 + 4.56	
Affected side		
Single side	22	47.8 %
Double side	24	52.2 %
Total	46	100%

The mean age of the study participant was 44.00 ± 10.18 years, majority of the study participants belongs to the age category of more than 40 years which is 56.5%. Out of 46 patients, 33 (71.7%) cases were males and 13 (28.3%) were females. Around 16 (34.8%) patients had previous history of ear disease and 25 (54.3%) were tobacco chewers. In the history of hard of hearing duration, 17 (37%) had less than or equal to 5 years of hard of hearing, 17 (37%) had more than 5 to 10 years history of hard of hearing and 12 (26.1%) had more than 10 years of hard of hearing. Out of 46 patients, 22 (47.8%) had single side hard of hearing and 24 (52.2%) had double side hard of hearing.

Figure 1: Types of Hearing loss distribution among study participants



Among 46 patients, 10 (20.0%) patients had mild hearing loss, 31 (72.3%) had moderate hearing loss and 5 (7.7%) had severe hearing loss.

Table 2: Comparison Between Basic Characteristic With Types Of Hearing Loss (n=46)

Basic characteristic	Mild Hearing loss	Moderate Hearing loss	Severe Hearing loss	P value
Age category				
< 40 years	5 (50.0%)	15 (48.4%)	0	0.115
> 40 years	5 (50.0%)	16 (51.6%)	5 (100%)	
Gender				
Male	9 (90.0%)	21 (67.7%)	3 (60.0%)	0.328
Female	1 (10.0%)	10 (32.3%)	2 (40.0%)	
Affected side				
Single ear	5 (50.0%)	17 (54.8%)	0	0.074
Both ear	5 (50.0%)	14 (45.2%)	5 (100%)	
History of previous ear disease				
Yes	3 (30%)	9 (29%)	4 (80%)	0.080
No	7 (70%)	22 (71%)	1 (20%)	
History of hard of hearing				
< 5 years	5 (50%)	12 (38.7%)	0	0.200
> 5 to 10 years	3 (30%)	12 (38.7%)	2 (40%)	
> 10 years	2 (20%)	7 (22.6%)	3 (60%)	
Tobacco chewer				
Yes	5 (50.0%)	15 (48.4%)	1 (20%)	0.473
No	5 (50.0%)	16 (51.6%)	4 (80%)	
Total	10 (100%)	31 (100%)	5 (100%)	

Mild hearing loss was equally seen in age category of less than 40 years and more than 40 years which is 5 (50%) patients in each category. Moderate hearing loss was observed highly in age category more than 40 years which is 16 (51.6%) and All the 5 (100%) patients of severe hearing loss observed only in age category of more than 40 years. There is no statistical significant seen between age category with types of hearing loss with the p value shows 0.115. Mild, Moderate and severe hearing loss was highly seen in males which is 9 (90.0%), 21 (67.7%) and 3 (60.0%) respectively. Types of hearing loss was highly seen in males when compare to females and the difference is not significant with the p value shows 0.328. Mild hearing loss was equally seen in single and both ear with 5 (50%) patients each. Moderate hearing loss was seen around 17 (54.8%) cases in single affected side and 14 (45.2%) cases in both side involvement. Severe hearing loss seen only in both ear involvement patients. History of previous ear infection was reported among, 3 (30%) patients in mild hearing loss, 9 (29%) patients in moderate hearing loss and 4 (80%) cases in severe hearing loss. The previous history of ear infection was equally distributed in types of ear infection with the p value shows 0.080. Out of 10 patients in mild hearing loss, 5 (50%) patients had history of hard hearing less than or equal to 5 years, 3(30%) cases had history of hard hearing more than 5 to 10 years, 2 (20%) cases had history of hard hearing more than 10 years. Out of 5 patients in severe hearing loss, 2(40%) cases had history of hard hearing more than 5 to 10 years, 3 (60%) cases had history of hard hearing more than 10 years. History of hard of hearing was equally distributed in mild, moderate and severe hearing loss with the p value shows 0.200. Tobacco chewing was reported among 5 (50%) cases in mild hearing loss, 15 (48.4%) cases in moderate hearing loss and 1(20%) case in severe hearing loss. There is no significance difference seen between tobacco chewing with types of hearing with the p value shows 0.473.

Table 3: Comparison Between Affected Ear, Otoscopic Findings, Tuning Fork Test 256 Hz, 512 Hz And 1024 Hz With Types Of Hearing Loss (n=70)

Basic characteristic	Mild Hearing loss	Moderate Hearing loss	Severe Hearing loss	P value
Affected Ear				
Right	8 (61.5%)	20 (42.6%)	5 (50.0%)	0.470
Left	5 (38.5%)	27 (57.4%)	5 (50.0%)	
Otoscope findings				
Healed TM	2 (15.4%)	3 (6.4%)	2 (20.0%)	0.392
Normal	10 (76.9%)	29 (61.7%)	5 (50.0%)	
Retracted , dull	0	7 (14.9%)	0	
Small perforation	0	1 (2.1%)	0	
TS patch	1 (7.7%)	7 (14.9%)	3 (30.0%)	
Tuning fork test 256 Hz				
Positive	4 (30.8%)	0	0	0.001
Negative	9 (69.2%)	47 (100%)	10 (100%)	
Tuning fork test 512 Hz				
Positive	12 (92.3%)	1 (2.1%)	0	0.001
Negative	1 (7.7%)	46 (97.9%)	10 (100%)	
Tuning fork test 1024 Hz				
Positive	13 (100%)	38 (80.9%)	0	0.001
Negative	0	9 (19.1%)	10 (100%)	
Mean PTA	30.31 ± 5.66	52.87 ± 9.58	79.90 ± 5.47	0.001
Total	13 (100%)	47 (100%)	10 (100%)	

Note: In total both year affected was taken as separate count.

Among 13 affected ears in mild hearing loss, 8 (61.5%) right ear was affected and 5 (38.5%) left ear was affected. Out of 47 ears in moderate hearing loss, 20 (42.6%) right ear as affected and 27 (57.4%) left ear was affected. Among 10 moderate hearing loss, 5 (50%) right ear was affected and 5 (50%) left ear was affected. There is no difference observed between affected ear and types of hearing with the p value shows 0.470. In Otoscopic finding healed tympanic membrane was observed among 2 (15.4%) in mild hearing loss, 3 (6.4%) in moderate hearing loss and 2 (20.0%) in severe hearing loss. Normal Otoscopic finding was seen in 10 (76.9%) in mild hearing loss, 29 (61.7%) in moderate hearing loss and 5 (50.0%) in severe hearing loss. One patient in moderate hearing loss had Small perforation. Otoscopic finding was equally seen in mild, moderate and severe hearing loss with the p value shows 0.392. Only four (30.8%) ears with mild hearing loss had a positive tuning fork test at 256 Hz. Tuning fork test 256 Hz was observed positive only in mild hearing loss when compared to moderate and severe hearing loss and the observation is significant with the p value shows 0.001. Tuning fork test 512 Hz was observed positive in 12 (92.3%) ear in mild hearing loss and 1 (2.1%) ear in moderate hearing loss. Positive tuning fork test 512 Hz was seen highly in mild hearing loss when compared to moderate and severe hearing loss with the p value shows 0.001. Tuning fork test 1024 Hz was observed positive in all 13 (100%) ears in mild hearing loss and 38 (80.9%) ears in moderate hearing loss. Positive tuning fork test 1024 Hz was seen highly in mild hearing loss when compared to moderate and severe hearing loss with the p value shows 0.001. The mean pure tone audiometry among mild hearing loss was 30.31 ± 5.66 Hz, in moderate hearing loss was 52.87 ± 9.58 Hz and in severe hearing loss was 79.90 ± 5.47 Hz. The mean pure tone audiometry was high in severe hearing loss when compared to moderate and mild hearing loss and it was statistically significant with the p value shows 0.001. The mean pure audiometry among moderate hearing loss was high when compared to mild hearing loss and low in severe hearing loss and the difference is significant with the p value shows 0.001.

DISCUSSION

Smoking is a well-known risk factor for many health issues. Nicotine raises the blood's carbon monoxide levels, which causes haemoglobin to change into carboxy-hemoglobin. Carboxy-haemoglobin damages the cochlea's hair cells and decreases the oxygen supply to the organ. Cells in the hair experience oxidative damage as a result of cigarette toxins. Nicotine directly induces atherosclerosis in the blood arteries feeding the cochlea through its vasospastic activity^[13-15]. Numerous studies also indicate that the degree of hearing loss strongly correlates with age and the number of years of cigarette use^[10,12]. However, they also advocated for greater study on this topic. In this study we have examined the hearing thresholds of smokers of various age groups.

The mean age of the study participant was 44.00 ± 10.18 years,

majority of the study participants belongs to the age category of more than 40 years which is 56.5%. According to Noorhassim and Rampal, ageing and smoking together have a multiplicative influence on the development of SNHL. Smoking is a significant risk factor for SNHL, as demonstrated by several previous studies, including Itoh et al.^[16], Rosenhall et al.^[17], Helzner et al.^[18], and Fransen et al.^[12]. The Cunningham et al. study unequivocally establishes that smoking causes high-frequency sensorineural hearing loss^[19]. A study conducted in India by Kumar et al.^[20] came to a similar conclusion that smoking and sensorineural hearing loss are directly related.

Among 46 smokers, majority (72.3%) had moderate hearing loss and only 5 (7.7%) had severe hearing loss. History of hard of hearing was equally distributed in mild, moderate and severe hearing loss with the p value shows 0.200. These findings are in line with early clinical research that found smokers have worse hearing sensitivity than nonsmokers^[21-23], with animal studies indicating cochlear damage from smoking^[24], and with population-based self-reported data from the Health Interview Survey^[25].

In the present study hearing threshold was assessed using pure tone audiometry. The mean pure audiometry among moderate hearing loss was high when compared to mild hearing loss and low in severe hearing loss and the difference is significant with the p value shows 0.001. Similarly smokers and non-smokers have significantly different Air Conduction and Bone Conduction thresholds at all frequencies in both the right and left ear, according to Shetty A et al.^[26] study, with a p-value of 0.001.

The association between smoking cigarettes and hearing loss varied with age, particularly in middle-aged and older males. The current study showed that all the 5 (100%) patients of severe hearing loss observed only in age category of more than 40 years. There is no statistical significance seen between age category with types of hearing loss with the p value shows 0.115. This is congruent with a research conducted by Sumit et al. among Bangladeshi population^[27]. The percentage of elder smokers (>40 years) who had hearing loss at 1, 4, 8, and 12 kHz frequencies was 14.6, 39.0, 68.3, and 92.7%, compared to 5.1, 10.3, 35.9, and 76.9% for nonsmokers.

The risk of hearing loss increased with age and years of smoking. It may be because the harmful effects of tobacco smoking are fully apparent only after years or even decades of tobacco smoking. Similar to this, Wang et al.^[28] discovered that the relationship between current smoking and speech-frequency hearing loss was significant in people under the age of 70 but not in people above the age of 70. In males, the association between smoking cigarettes and hearing loss varied with age, particularly in middle-aged and older guys^[29].

While assessing the relationship between smoking status and hearing loss in males and females, males had higher hearing loss when compared to females. This is consistent with the study by Wang et al.^[29] conducted among Chinese population, showing significant speech-frequency and high-frequency hearing loss in males (p<0.001), but not in females (p>0.05).

A few of the study limitations may include a small sample size, a cross-sectional study design, and a single-centered study. A prospective study might be used to get around this. Despite these limitations important information we obtained to assess the hearing and smoking status of the study participants.

CONCLUSION

Results of the present study concluded that there is a correlation between smoking and sensorineural hearing loss. It also showed that most of tobacco chewers had hearing deficiency and majority had moderate hearing loss which is negative in 256, 512 Hz tuning forks and positive in 1024 Hz tuning fork. Thus, it is important to spread awareness about the harmful effects of tobacco among the general public in order to prevent its detrimental effects.

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