

## Effect of Smoking on Auditory Acuity in Middle Aged Men of South Tamil Nadu

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### **Abstract:**

**Background:** Cigarette smoking is the most important risk factor associated with numerous potentially fatal diseases affecting people of all age groups. In developing countries, there is an increase in cigarette smoking habit. Smoke contains nitrogen oxide and carbon monoxide which are harmful gases and various other chemicals. Many studies were done to assess the effects of smoking along with other factors like aging, noise exposure and other co-morbid conditions on ear diseases and hearing.

**Aim:** The goal of the present study is to compare the auditory threshold within a group of male smokers and non-smokers, with ages between 25 and 45 years.

**Materials And Methods:** pure tone audiometry was performed to assess the auditory thresholds of 100 male smokers belonging to age group of 25-45 years and age matched non smokers. The data was statistically analyzed.

**Results:** Smokers were significantly hearing impaired than non-smokers group. The hearing impairment was noticed at all frequencies tested. Both conductive and mild sensori neural type of hearing loss are associated with smoking.

**Conclusion:** The incidence of hearing impairment unrelated to noise exposure is higher in smokers than in non-smoker young adults.

**Key Words:** Smoking, Hearing loss, Auditory thresholds.

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### I. Introduction

Exposure to smoke has been linked to diverse disease in humans, affecting the unborn to the elderly. Smoking is a noticeable public health problem. It is an addiction that has been accepted by the community despite its harmful effects. Smoke is the most dangerous component of cigarette. Smoke contains nitrogen oxide and carbon monoxide which are harmful gases. When inhaled, tar gets into lungs along with the smoke. Tar itself includes around 4000 chemicals, The problems caused by smoking are long known.<sup>[1]</sup> Cigarette smoking is the most important risk factor associated with numerous potentially fatal diseases, such as malignancies in head and neck, and lung, atherosclerosis, coronary and heart diseases, and others. Although cigarette smoking has been on the decline in most developed countries, its global use has increased by 50% in recent periods, especially because of the increase in cigarette smoking in developing countries<sup>[2]</sup>. Approximately one hundred thousand young people start smoking every day<sup>[3]</sup>. Smoking is a widespread habit and the damage caused by the inhaled substances has been increasingly studied<sup>[4]</sup>.

Ear disorders are invisible handicaps, and psychological stress incurred by the hearing disabled often goes unnoticed in healthy people. One of the greatest psychological stresses is the disruption of human communications, and this burden is said to be greater than that of visual impairment.<sup>[5]</sup>

Sharabi Y et.al conducted a retrospective cross-sectional study. The results showed that smoking increases the chance of developing hearing loss by 45% and that the deleterious effect of smoking on hearing loss is more pronounced in young subjects.<sup>[1]</sup>

The goal of the present study is to compare the auditory threshold within a group of male smokers and non-smokers, with ages between 25 and 45 years.

### II. Materials And Methods

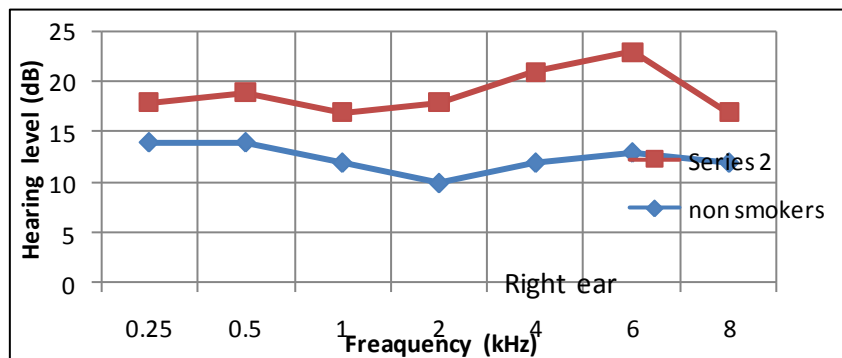
The data was randomly collected from hundred age matched smoking and non-smoking male population belonging to age group of 25-45 years. The study group was selected using the following criteria. Inclusion criteria: active smoking for 5 years or more for smoke group. Subjects who had never smoked were regarded as non-smokers.

Exclusion criteria common for both groups: persons with ear diseases, tinnitus, hearing loss, prior ear surgery, otoscopic alteration, professional exposure to high sound pressure levels, hypertension, DM, neurological disorders, visual disorders, h/o intake of ototoxic drugs and illiterates.

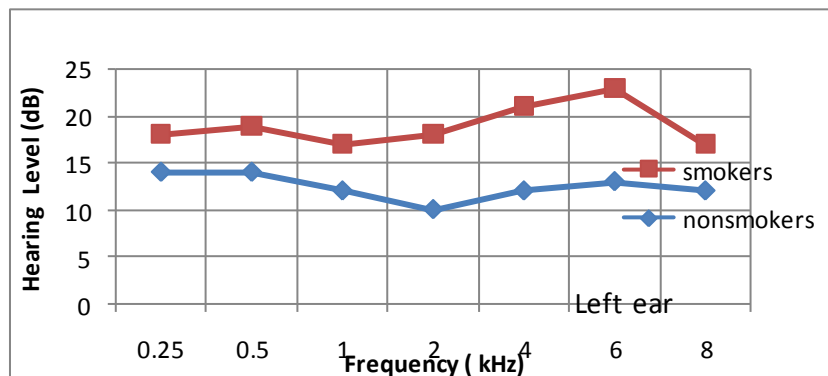
After getting Institutional ethical clearance, written informed consent was obtained from all the participants. The method is based on American Society for Speech and Hearing Association (ASHA) 2005 Guidelines for manual pure tone threshold audiometry (PTA).<sup>[6]</sup> All the subjects were subjected to Audiometric evaluation. Hearing tests were performed in a sealed, soundproof room with a calibrated clinical audiometer . An experienced audiologist, who was unaware of the subject's smoking status, conducted the test. The hearing test included pure tone audiometry for air conduction and bone conduction. The range of frequencies tested was 0.5 kHz, 1 kHz ,2 kHz, 4 kHz , 6 kHz and 8kHz.

### III. Results

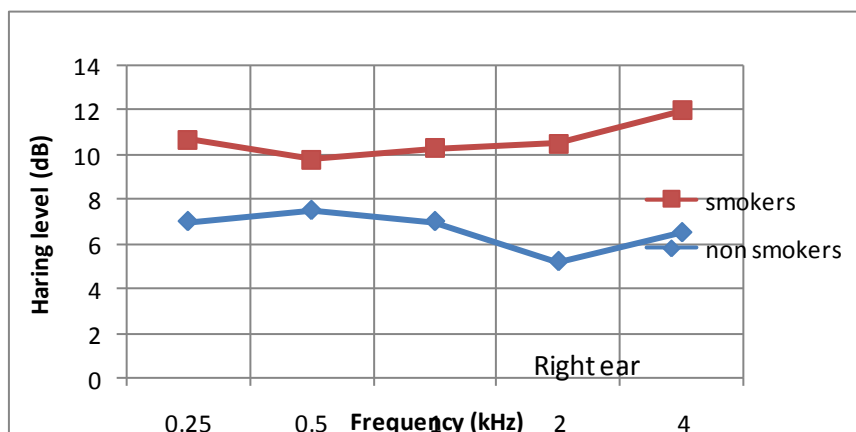
An experienced audiologist interpreted the audiograms according to the type of hearing impairment. Interpretation of an Audiogram: Conductive deafness - is indicated by raised air conduction thresholds (<25 dB) and a normal bone conduction threshold with a wide air – bone gap of 15 dB or more. Sensorineural deafness - is indicated by raised air and bone conduction thresholds (Both>25 dB) and the air bone gap does not exceed 10 dB. Mixed deafness - air and bone conduction thresholds are raised with an air bone gap of greater than 15 dB.



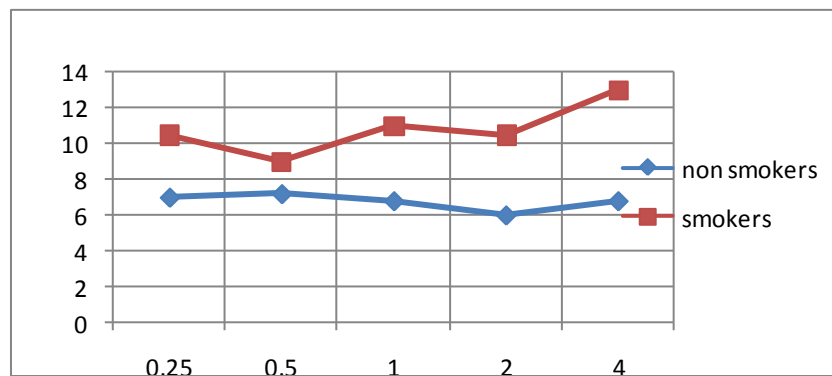
Graph 1—Comparison of mean of air conduction thresholds between smokers and non smokers in right ear



Graph 2. Comparison of mean of air conduction thresholds between smokers and non smokers in left ear



Graph 3. Comparison of mean of bone conduction thresholds of smokers and non smokers in right ear



Graph 4. Comparison of mean of bone conduction thresholds of smokers and non smokers in left ear

Table 1: Comparison of Air Conduction Thresholds between Smokers and Non-Smokers Group

	Non-Smoking		Smoking		P value
	Mean	SD	Mean	SD	
Right	12.21	1.77	18.42	2.76	<0.001**
Left	12.42	1.39	19.00	2.23	<0.001**

#### IV. Discusson

Although the link between cigarette smoking and peripheral hearing loss was established over 40 years ago, information on the effects of smoking at the cochlear and auditory central nervous system levels has become available only recently. Work on oto acoustic emissions and several tests designed to tap into structural and functional aspects of the auditory central nervous system indicate that not only are the outer hair cells of the cochlea susceptible to damage, but that smoking may affect many aspects of central auditory processing.

It has been well described that aging causes an increase in auditory thresholds because of the degeneration of cochlear sensorial organs<sup>[7-9]</sup>, and the stria vascularis atrophy is responsible for the most characteristic changes associated with aging on the human cochlea<sup>[10]</sup>. In order to rule out the influence of this factor, we chose to form groups of individuals with up to 45 years of age.

Moreover, it is known that hormonal variations can influence the values of auditory thresholds in women.<sup>[11]</sup> Aiming at neutralizing the interference of this factor also and obtaining the most comparable possible values, we made up groups of men only.

We analyzed and compared the auditory thresholds between the right ear and the left ear separately in each group.

The hearing thresholds of smokers and non-smokers group were compared. The analysis of this study indicates that there was statistically highly significant difference in air conduction thresholds between smokers and non-smokers group in both ears.

Our study did not aim to reveal the etiology of this phenomenon nor does it shed light on the mechanisms by which cigarette smoking enhances hearing impairment.

Theoretically, the literature points to several possible etiologies: for the conductive hearing loss, it might be related to a higher prevalence of rhino sinusitis or eustachian tube dysfunction among smokers<sup>[12-15]</sup>. Numerous authors have also reported on the damaging effects of the tobacco smoke on the cochlea and the increase in auditory thresholds in the low frequencies among smokers<sup>[16-18]</sup>. In smokers, abnormal increases in the levels of blood carboxy hemoglobin can damage the arterial wall. Reduction in the blood supply lead to microlesions in the vessel walls - which favor the deposit of atheromatous plaques and the development of larger lesions. These lesions reduce vessel diameter and blood flow to the area it nourishes<sup>[19]</sup>. Moreover, nicotine can have a direct oto toxic effect and cause cochlear ischemia by increasing the carboxy hemoglobin production, favoring vasospasm, promoting atherosclerosis and increasing blood viscosity<sup>[20]</sup>.

Cochlear blood flow interruption and the consequent reduction in oxygen levels are the main patho physiological mechanisms responsible for hearing loss in smokers<sup>[21]</sup>. Carbon monoxide may also act directly on cochlear metabolism and cause alterations to the action potentials generated by auditory nerve fibers. Another effect reported about the carbon monoxide on the inner ear was the metabolic exhaustion of the succinate dehydrogenase enzyme, implicated in the Krebs cycle of the inner ear cells, especially of the outer hair cells, and the oxidation of nervous structures for the production of free radicals<sup>[22]</sup>.

## V. Conclusion

In conclusion, this study demonstrates, a relationship between tobacco smoke exposure and hearing loss among middle aged men in south Tamil nadu. The limitation of the study is that these data come from a small sample with exclusive self-reported, measures of smoking status rather than objective biochemical measures. The findings indicate that exposure to tobacco smoke is independently associated with increase in the risk of hearing loss among middle aged men. These findings may have profound implications in light of the high exposure rates among adolescents and adults in the State. Future studies need to investigate the adverse consequences of this hearing loss on social development, behavioral and cognitive function, and public health costs.

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