Original Resear	Volume - 11 Issue - 08 August - 2021 PRINT ISSN No. 2249 - 555X DOI : 10.36106/ijar Physiology AN OBSERVATIONAL STUDY OF HEARING THRESHOLDS IN PROFESSIONAL DRIVERS
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ABSTRACT Introduction: Noise has become a very important stress factor in the environment. Drivers are the most commonly affected persons due to traffic noise. The majority of drivers remain unaware about noise induced hearing loss as this is an insidious process, leading to temporary or permanent hearing impairment, but preventable. Pure Tone audiometric test is used to determine the degree of hearing loss in noise exposed individuals.

Aim & Objective: To find the hearing threshold levels for high and mid frequency sounds for both ears in Professional drivers. To evaluate the preponderance of hearing loss between right and left ear using hearing thresholds.

Materials & Methods: This study was conducted in 100 Professional male drivers aged between 30-40 years who are working in Tamil Nadu State Transport Corporation, Madurai. Pure tone audiometry was used to measure the high and mid frequency hearing threshold levels in both ears.

Results: The mean (SD) hearing threshold for high and mid frequency sounds was significantly higher in left ear comparative to right ear with P value < 0.05. The statistically significant difference in hearing loss was observed between both ears.

Conclusion : Our study showed statistically significant higher hearing threshold for high and mid frequency sounds in left ear compared to right ear, that concludes left ear is more prone for hearing loss than the right ear.

KEYWORDS : Hearing thresholds, Noise Induced Hearing Loss, Pure Tone Audiometry.

INTRODUCTION:

Noise can be defined as unwanted, disturbing and harmful sound that impairs or interferes with hearing. Noise is the environmental as well as occupational health hazard. According to WHO, Road traffic noise is the second most environmental harmful stressor. K.D.Kryter, 1970 defined noise as "Acoustic signals which can negatively affect the physiological or psychological well being of an individual."[1]

National Institute for Occupational Safety and Health have noted that noise induced hearing loss is occurring much earlier in life. Chronic exposure to excessive noise levels of 85 dB or above leads to Noise Induced Hearing Loss (NIHL) which is irreversible but preventable. Noise induced hearing loss affects males more than females [2]. Young people are at risk of developing NIHL [3]. The hearing defect in drivers is gradual and without any alarming symptoms and awareness of their hearing disability occurs only after irreversible damage.

Ali Karimi et al, 2010 states that, 12.6% of truck drivers suffer from hearing impairment in left and right ear [4]. Diminished hearing ability is denoted as an average hearing threshold of >25dB for both the ears at selected frequencies. Understanding of acoustic information and proper communication is essential for any workers like drivers, pilots, industrial workers. Sufficient good hearing is the key element in driving profession. NIHL occurs due to the damage of stereocilia which is present in the top of hair cells in the inner ear. Loss of stereocilia is due to the formation of oxygen and nitrogen free radicals in the hair cells when they respond to intense noise [5]. Exposure to moderate intensity noise for several minutes or hours initially results in temporary threshold shift in which auditory thresholds eventually returns to its original level. Permanent Threshold Shift occurs after repeated noise exposure which causes an irreversible increase in the hearing threshold and is associated with fusion of adjacent stereocilia loss of stereocilia and death of hair cells[6].

Reduced blood flow during noise exposure leading to hypoxia and the release of reactive oxygen species in the cochlea results in NIHL[7]. In the noise exposed cochlea, calcium may participate in both hair cell and neuronal damage[8]. So dysregulation of calcium homeostasis results in noise induced hearing loss. It also causes non auditory effects like increased stress, hypertension, annoyance, and sleeping problems. Asymmetrical phenomenon is seen in NIHL. Studies over the last two decades have found that noise affects the left ear more than the right ear [9,10]. Fernandes et al.2010, in his study identified asymmetrical

hearing loss, in which 60% had greater susceptibility in the left ear [11]. Chung et al. 1983, in his study reported that, the prevalence of left sided hearing loss was 82.6% [12]. If pure tone audiometer is used in drivers at regular intervals hearing loss can be detected and prevented at the earliest.

AIM & OBJECTIVE:

To find the hearing threshold levels for high and mid frequency sounds for both ears in professional drivers.

To evaluate the preponderance of hearing loss between right and left ear.

MATERIALS & METHODS:

This cross sectional observational study was conducted in 100 professional male drivers working in Tamil Nadu State Transport Corporation. This study was conducted after obtaining Institutional Ethical clearance. Proper instructions and purpose of study was explained and test was conducted after getting informed and written consent from them.

Inclusion Criteria:

The study population were 100 professional male drivers with the age group between 30-40 years having minimum 8 years of driving exposure, and 8 hours of driving per day.

Exclusion Criteria:

Drivers above 40 years were excluded to avoid age related hearing loss. Persons with Diabetes Mellitus, Hypertension, History of Ototoxic drugs intake, middle ear diseases like CSOM, Otosclerosis and Head injury were excluded from this study.

METHODS:

A uniform questionnaire containing the basic information, health status, years of driving, hours of driving, was used to record the details of all the drivers. Clinical examination of the ear was done by an Otorhinolaryngologist which included examination for the presence of cerumen in the ear, structural assessment, mobility of the tympanic membrane, and abnormality of external auditory canal.Rinne's test and weber's test was done for all the participants to study the air and bone conduction. Hearing examination of the drivers was conducted using Pure Tone Audiometer according to the guidelines of the American Speech Language Hearing Association in sound treated room. The pure tone averages of hearing thresholds for mid frequencies 500, 1000

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and 2000 Hz and high frequencies 4, 6, and 8 kHz were calculated for both right and left ears.

The hearing threshold values obtained from the audiogram was interpreted by following WHO grades of hearing impairment.

Degree of hearing loss Mild-26-40 dB Moderate-41-45 dB Moderately severe - 56-70 dB Severe – 71-91 dB Profound ->91 dB

Statistical Analysis:

Statistical analysis was done by SPSS software version 16 and comparison between hearing threshold of two ears was done by using independent T test. The significance was drawn at p value of < 0.05

RESULTS:

Mean (SD) age for the drivers was 36 ± 2.7 . The mean (SD) height for the drivers was 162 ± 6.8 . The mean (SD) weight for the drivers was 64 ± 7 .

Mean (SD) high frequency hearing threshold for right ear was 24.4 ± 8.78 . Mean (SD) high frequency hearing threshold for left ear was 28±8.77.

Mean (SD) mid frequency hearing threshold for right ear was $21.03 \pm$ 7.57. Mean (SD) mid frequency hearing threshold for left ear was 24.5 ± 6.63 .

Table : 1	Hearing	Threshold	Of	High	And	Mid	Frequency	For
Both Ears	S.							

Hearing threshold (dB)	Right ear Mean (SD)	Left ear Mean (SD)	P value
High frequency	24.4 ± 8.78	28 ± 8.77	0.005
Mid frequency	21.03 ± 7.57	24.5 ± 6.63	0.001

P value < 0.05 is highly significant and there is a statistically significant difference in hearing threshold in left ear than right ear.



Graph: 1 Comparison Of Mid Frequency Hearing Threshold Of Right And Left Ear

Mild and moderate hearing loss is seen more in left ear when compared to right ear.

43 persons have mild hearing loss (25.1-40 dB), 4 persons have moderate hearing loss (40.1-50 dB) in left ear.



Graph:2 Comparison Of High Frequency Hearing Threshold Of Right And Left Ear

Mild, moderate and moderately severe hearing loss is seen more in left ear when compared to right ear.

54 persons have mild hearing loss (25.1-40 dB) and 6 persons have moderate hearing loss (40.1-50 dB) and 2 persons have moderately severe hearing loss (50.1-70 dB) in left ear.

DISCUSSION:

Our study showed increased hearing threshold in left ear for both high and mid frequency when compared to right ear which goes in line with the studies by Reinhard Muller et al.2017. They reported that the asymmetric pattern in NIHL is due to the left ear being exposed more to engine noise and the exhaust system and also due to head shadowing effect, the right ear is shielded from high frequency sounds. [13]. Lower frequency sounds have longer wavelengths and higher frequency sounds have shorter wavelengths and reduced amplitude. So higher frequency sounds tend to get blocked by the diameter of our head, which is called head shadow effect[14]. According to the study by Pirila T, Jounio-Ervasti K et al., 1992 a significant average inferiority of the hearing in the left ear was reported [15]. In the present study also we had a comparable result which showed reduced hearing sensitivity in the left ear, seen as increased hearing thresholds in both frequencies. This asymmetry may be attributed to the more pronounced efferent auditory system on the right side which by modification of the micromechanical properties of outer hair cells helps in adaptation and frequency selectivity thereby reducing the susceptibility of the right ear to cochlear insult explained by Nageris BI, Raveh E et al., 2007 in his study [16].

Present study showed left ear involvement is more as confirmed by more drivers with mild and moderate hearing loss in left ear when compared to right ear which coincides with the study by DY Chung et al, 1983 who stated that, left ear is the most affected and the asymmetry is a manifestation of a lateral difference in susceptibility to noise damage [12]. Pirilä T.et al, 1991 concluded that a good hearing threshold level in the right ear is the reason for the protection of right ear from noise-induced hearing loss than the left ear[17].

The present study showed the mean hearing threshold levels of both frequencies for left ear was higher as compared to right ear in Professional drivers which is similar to the study by Berg et al, 2014 who suggested that the left ear was weaker and reported left ear hearing thresholds were significantly higher than right ear thresholds [18].

CONCLUSION:

Noise pollution is emerging as an environmental problem causing negative impact on public health and welfare. Our study revealed that left ear noise induced hearing loss is more in professional drivers. To increase driver's safety and life quality hearing protection aids like ear plugs, earmuffs can be used. Limiting their exposure to excessive noise and proper, regular maintenance of their vehicles can be followed to prevent them from NIHL. The drivers have to follow 'hearing health' also as a part of their life style.

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