



## Comparative Physiological study for Audiometry between Normal and Industrial Employee

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### ABSTRACT

Continuous exposure to noise of high frequency causes Noise-Induced hearing Loss (NIHL) at 4KHz. We should focus on employee's use of hearing protection devices (HPDs) rather than on controlling the noise exposure at its source. The objectives were to assess and comparison of hearing threshold in normal healthy subjects and industrial employees and also to find out prevalence of hearing loss and relationship between hearing loss and age group. Total 50 healthy subjects and 50 industrial employees of Dhaal enterprise ltd, Ahmedabad underwent a pure tone pure tone audiometry. Hearing threshold for air conduction and bone conduction in both ear at each frequency was higher in Industrial employee as compared to normal subjects. There were 20 industrial employees (40%) suffering from 4 kHz notch in right ear and 4 (8%). It was observed that the proportion of hearing impairment (mild, moderate, moderately severe and severe) in both ear increased as age increased. Mild deafness in right ear was prevalent among 13 employees (26%) and in left ear 16 employees (32%), moderate deafness in right ear prevalent among 5 employees (10%) and in left ear 4 employees (8%), moderately severe deafness prevalent among 6 employees (12%) in both ear and severe deafness prevalent among 2 employees (4%) in right ear and 1 employee (2%) left ear. In more than 60 year older industrial employees moderate hearing loss (41 to 55 db) was observed at 1000Hz, 2000 Hz, 4000 Hz and moderately severe hearing loss (56 to 70 db) at 8000 Hz in right ear. In left ear of more than 60 year older industrial employees moderate hearing loss (41 to 55 db) was observed at 2000Hz, 4000 Hz and 8000 Hz.

**KEYWORDS :** Noise-Induced hearing Loss, Hearing protection devices, Hearing threshold, Industrial employees

### Introduction:

One of the major occupational health problems that an Industrial employee faces today is Noise-Induced Hearing Loss (NIHL). Noise-Induced Hearing Loss (NIHL) usually occurs due to continuous exposure to the noise levels of 90 plus decibels emitting from the heavy machines.<sup>1</sup> Continuous exposure to noise of high frequency causes Noise-Induced hearing Loss (NIHL) at 4KHz. The hearing threshold levels that are measured in pure-tone audiometry primarily reflect the functional state of the peripheral parts of the organ. Long term exposure to extensive noise damages the hair cells, which results in a cochlear hearing loss. We should focus on employee's use of hearing protection devices (HPDs) rather than on controlling the noise exposure at its source. Discomfort, hinder to communication and highly variable noise levels, which are common in construction, can cause irregular use of HPDs. Maximum permissible noise level in work place for 8 hours shift was 90 dB, as recommended by Indian Factories Act (1948), Occupational Safety and Health Administration (OSHA) and International Organization of Standardization (ISO).<sup>2</sup>

### Aims & Objectives:

The objectives were to assess and comparison of hearing threshold at different frequency by pure tone audiometry in normal healthy subjects and industrial employees and also to find out prevalence of hearing loss in industrial employees and relationship between hearing loss and age group.

### Methodology:

The study was carried out in 50 healthy male individuals (Group 1) and 50 male industrial employees (Group 2). All 50 healthy individuals were selected from residential area in Naroda, Ahmedabad. Another 50 industrial employees were randomly selected from Dhaal textile enterprise and private ltd, Saijpur, Ahmedabad. After taking consent all 100 subjects underwent a pure tone audiometry in a quiet environment by qualified technicians, audiologists, or physicians. Audiometric air conduction tests were performed by presenting a pure tone to the ear through an earphone. The duration of the presented tone was 1–3 seconds..

When the subject hears the tone, the tone is reduced by 10 B till subject stops hearing or fails to give a response. Once this stage is reached the tone raise by 5dB. If the subject hears this tone, the sound is again decreased by 10 dB. If he does not hear it, the tone was again raised by 5 dB. Subjects lower than 15 year age and female subjects were excluded.

**Data analysis:** Data were analyzed by using SPSS version 16.0 for Windows. Line plots were used to depict the hearing thresholds for different frequencies. Comparison of hearing threshold was assessed by using Z test.

**Result:** Age and sex matched subjects were included in the study. Mean age of healthy individuals was 37.02 year with 14.77 year SD. Mean age of industrial employees was 37.44 year with SD 12.87 year. It was found that there was no significant difference between two groups for height, weight and BMI.

**Table 1: Average hearing threshold at different frequencies for Air conduction in normal subjects and industrial employee**

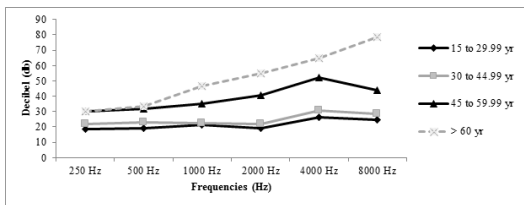
Hearing Thresholds frequencies in Hertz	Ear	Normal subject	Industrial employee	p value
250 Hz	R	21.80 + 9.83	23.50 + 13.14	1.53
	L	23.82 + 9.83	22.90 + 9.69	0.37
500 Hz	R	22.60 + 10.61	24.60 + 13.55	0.54
	L	25.60 + 9.62	24.50 + 9.44	0.35
1000 Hz	R	24.30 + 11.87	26.80 + 15.18	2.87
	L	24.50 + 10.16	24.56 + 11.13	0.30
2000 Hz	R	25.00 + 13.81	27.90 + 17.23	5.44
	L	26.30 + 10.63	26.40 + 13.02	0.67
4000 Hz	R	30.50 + 16.33	36.80 + 20.17	5.92
	L	32.70 + 14.40	33.00 + 16.38	1.41
8000 Hz	R	32.10 + 18.07	34.18 + 20.50	0.57
	L	35.10 + 17.83	36.80 + 18.97	0.21

**Table 2: Average hearing threshold at different frequencies for Bone conduction in normal subjects and industrial employee**

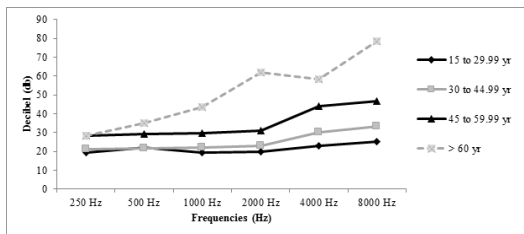
Hearing Thresholds frequencies in Hertz	Ear	Normal subject	Industrial employee	p value
<b>250 Hz</b>	R	14.20 ± 10.42	12.90 ± 11.16	0.35
	L	14.20 ± 8.41	14.10 ± 8.61	0.97
<b>500 Hz</b>	R	16.70 ± 11.14	14.80 ± 11.95	0.50
	L	14.30 ± 9.42	15.00 ± 8.98	0.52
<b>1000 Hz</b>	R	17.00 ± 11.87	16.60 ± 13.61	0.66
	L	15.40 ± 8.62	16.30 ± 10.73	0.64
<b>2000 Hz</b>	R	17.60 ± 11.79	17.30 ± 14.99	0.44
	L	16.10 ± 10.12	17.80 ± 12.98	0.13
<b>4000 Hz</b>	R	21.30 ± 14.42	23.30 ± 16.98	0.43
	L	21.40 ± 13.70	24.60 ± 15.97	0.12

**Table 3: Degree of hearing loss in Industrial employees**

Degree of Hearing loss	Right ear	Left ear
<b>Normal</b>	24 (48%)	27 (54%)
<b>Mild</b>	13 (26%)	16 (32%)
<b>Moderate</b>	5 (10%)	4 (8%)
<b>Moderately severe</b>	6 (12%)	6 (12%)
<b>Severe</b>	2 (4%)	1 (2%)
<b>Total</b>	50	50



**Figure 1: Comparison of Right ear Audiogram of Industrial employees between different age groups**



**Figure 2 : Comparison of Left ear Audiogram of Industrial employees between different age groups**

It was observed that the proportion of hearing impairment (mild, moderate, moderately severe and severe) in both ear increased as age increased i.e. it was 12.5%, 50.0%, 92.3% and 100% among 15 to 29 years, 30-44 years, 45 to 59 and more than 59 years respectively.

**Discussion:** In our study total 100 male subjects were included, out of which 50 were healthy individuals and 50 were industrial employees. Mean age of healthy individuals and industrial employees was 37.02 year with 14.77 year SD and 37.44 year with SD 12.87 year respectively. Hearing threshold for air conduction and bone conduction in both ear at each frequency was higher in Industrial employee as compared to normal subjects but it was not statistically significant ( $p > 0.05$ ). In right ear audiogram, Mild hearing loss (26 to 40 db) was found in industrial employees at 4000 Hz and 8000 Hz frequencies. Where as in left ear mild hearing loss (26 to 40 db) was found in industrial employees at 8000 Hz frequencies in industrial employees. There were 20 industrial employees (40%) suffering from 4 kHz notch in right ear and 4 (8%) in left ear however, it is lower than reported incidence in Study carried out by RK Ranga.<sup>3</sup>

Mild deafness in right ear was prevalent among 13 employees (26%) and in left ear 16 employees (32%), moderate deafness in right ear prevalent among 5 employees (10%) and in left ear 4 employees (8%), moderately severe deafness prevalent among 6 employees (12%) in both ear and severe deafness prevalent among 2 employees (4%) in right ear and 1 employee (2%) left ear. Higher prevalence was observed by Chadha et.al. (50.0%).<sup>4</sup> It was observed that the proportion of hearing impairment (mild, moderate, moderately severe and severe) in both ear increased as age increased i.e. it was 12.5%, 50.0%, 92.3% and 100% among 15 to 29 years, 30-44 years, 45 to 59 and more than 59 years respectively. In study carried out by Rupendra Ranga, number of noise induced hearing loss (NIHL) was 02 (12.5%) in 16-25 years, 01 (6.25%) in 25-30 years, 10 (50%) in 31-35 years, 14 (77.7%) in 36-40 years, 02 (20%) in 41-45 years, 06 (60%) in 46-50 years, whereas it was 3 (30%) in age group of >50 years.<sup>5</sup> In more than 60 year older industrial employees moderate hearing loss (41 to 55 db) was observed at 1000Hz, 2000 Hz, 4000 Hz and moderately severe hearing loss (56 to 70 db) at 8000 Hz in right ear. In left ear of more than 60 year older industrial employees moderate hearing loss (41 to 55 db) was observed at 2000 Hz, 4000 Hz and 8000 Hz.

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