



THE EFFECT OF NOISE POLLUTION ON HEARING IN MARBLE FACTORY WORKERS OF AJMER, RAJASTHAN: A CASE STUDY

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ABSTRACT

Introduction: The noise pollution is defined as the unwanted sound which is released into the environment. Noise induced hearing loss in an increasingly prevalent disorder that result from exposure to high intensity sound, especially over a long period of time. **Materials & Methods:** The present study has been conducted in the Department of Physiology and E.N.T. in a group of 60 subjects with 30 marble factory workers and 30 normal individuals. **Results:** Audiometric values were consistently lower in Normal than in marble factory workers. The differences were statistically significant among both sexes and that too for the parameters of Right and Left ear. **Discussion and conclusion:** In this study mild hearing loss was 20%, moderate hearing loss was 16.67%, moderately severe hearing loss was 36.67% and severe hearing loss 26.66%. This study also concludes that the presence of impact noise is more Hz to hearing irrespective of the duration of exposure but in workers exposed to continuous noise, the duration of exposure had a more prominent effect on the hearing loss.

KEYWORDS: NIHL (Noise induced hearing loss). Pure tone audiometric testing.

INTRODUCTION

The Noise pollution^[1] is defined as the unwanted sound which is released into the environment. It is measured in the units of decibels and is denoted by the dB. The noise which is more than 115 dB is tolerant. Noise induced hearing loss in an increasingly prevalent disorder that result from exposure to high intensity sound, especially over a long period of time. These sounds can damage sensitive structure in inner ear. NIHL can be temporary or permanent. In assessing the hearing loss due to exposure to high noise levels (90 to 130 dB). This loss of hearing due to age is known as presbycusis.

Effect of noise on marble factory workers:-

1. **Hearing loss:** - The mechanism of hearing loss arises from trauma to stereo cilia of the cochlea. cochlea are reactive oxygen species, which play a significant role in noise-induced necrosis and apoptosis of the stereo cilia.

2. **Age-related (presbycusis):**-Hearing loss more in old person than adult. Hearing loss sensitivity increase with age.
3. **Cardiovascular effects:-** The World Health Organization concluded that the available evidence showed suggested a weak correlation between long-term noise exposure above 67-70 dB and hypertension. More recent studies have suggested that noise levels of 50 dB at night may also increase the risk of myocardial infarction by chronically elevating cortisol production. Other effects of high noise levels are increased frequency of headaches, fatigue, stomach ulcers and vertigo.
4. **Cognitive development^[2]:**- Evidence has shown that when children learn in noisier classrooms, they have a more difficult time understanding speech than those who learn in quieter settings.

MATERIALS AND METHODS

The study was conducted in workers of marble factory Ajmer, patient attending outdoor of ENT Department J.L.N Hospital, Ajmer. Examination of the patient done in E.N.T OPD Department (everyday), 30 Patient choose for study those working in marble factory. They were in the age between of 21-58 years, the length of exposure to occupational noise being 1-5 years. Daily exposure being 8 hours per day and 34 hours per week.

STUDY CLEARANCE AND CONSENT: Clearance is given by ethics committee for the study (Principal, HOD-E.N.T and other members)

Informed consent is obtained from the patient

In this study the subjects were divided in the following group:-

Group: - Patients exposed to noise in marble factory (n=30).

Group: - Control group (normal individuals) (n=30).

EXCLUSION CRITERIA (Applicable to both groups):

1. Subject having ears free from disease.
2. Subject not exposed to other noises except present working condition.
3. No history of head injury with unconsciousness.
4. No history of autotoxin drugs.
5. No history of familial deafness.
6. Subjects are non smokers and non drinkers.
7. No history of familial pulmonary disease.
8. No history of any familial disease, active heart disease.
9. No history of Diabetes.
10. No history of Hypertension.

AUDIOMETRIC TESTING: All patients were examined otoscopically followed by audiometric to rule out peripheral hearing loss. Audiometric tests were including air and bone conduction threshold for pure tones in both ears.

Pure tone audiometric: An audiometer is an electronic device which produces pure tones, the intensity of which can be increased or decreased in 5 dB steps. Usually air conduction thresholds were measured for tones of 125, 250, 500, 1000, 2000, and 4000, and 8000 Hz and bone conduction thresholds

for 250, 500, 1000, and 2000, and 4000 Hz. The amount of intensity that has to be raised above the normal level is a measure of the degree of hearing impairment at that frequency

STATISTICAL ANALYSIS

All values are presented as mean \pm SD. Comparison of mean value of parameter of marble factory worker and control group was done by using chi-square test.

RESULTS

Noise induced hearing loss study done in a total number of 60 cases were suitable for analysis.

There were 30 marble factory workers (study group 17 male and 13 females) and 30 normal (control group 23 male and 7 females).

Table-Audiometric test result of marble factory worker (study group) and normal person (control group)

Male	Control (n=23) Mean (SD)	Study (n=17) Mean (SD)	P value
Right Ear	11.66 \pm 4.60	56.83(14.82)	P<0.001(HS)
Left Ear	10.03 \pm 4.94	61.32(17.99)	P<0.001(HS)
Females	Control (n=7) Mean(SD)	Study (n=13) Mean(SD)	
Right Ear	17.37 \pm 6.37	55.43(22.01)	P<0.001(HS)
Left Ear	17.85 \pm 5.98	57.86(21.49)	P<0.001(HS)
	23 male + 7 female	17male+13female	

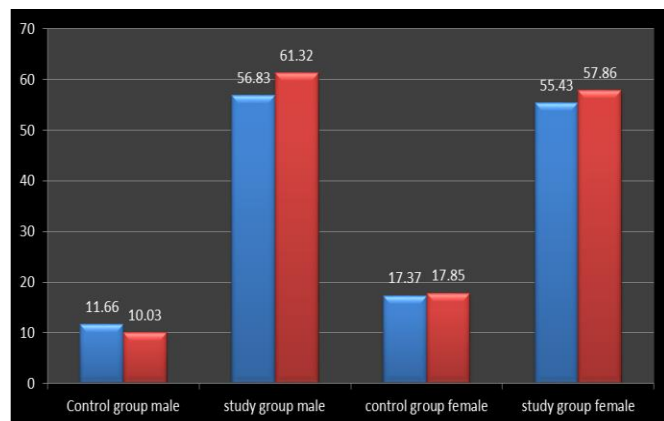


Figure 2. Comparative study between control and study group (male& female) based on audiometric testing

Audiometric values were consistently lower in Normal than in marble factory workers. The differences were statistically significant among both sexes and that too for the parameters of Right and Left ear. X axis denotes the persons was studying according to ear (left and right).

DISCUSSION

This study was undertaken to assess the pure tone audiometric test of marble factory workers and normal person who never exposed to prolonged and loud sound for continuous period. The present study measured the noise levels in marble factory. The auditory thresholds of 30 subjects exposed to noise were measured and compared with a control group. NIHL is therefore the consequence of overstimulation of the hair cells and supporting structures. Structural damage to hair cells (primarily the outer hair cells) will result in hearing loss that can be characterized by an attenuation and distortion of incoming auditory stimuli.

Prevalence of NIHL: The overall prevalence of noise induced hearing loss (percentage of workers hearing equal or more than 25 dB) exposed to noise levels of 85-110 dB has been 100%. Hessel PA^[3] (1987) and Tarter SK^[4] (1990) studied hearing impairment by audiometric examinations for factory workers of 16-65 years of age and found 56 % to be suffering from degrees of noise induced hearing loss. While in the present study deafness was found in all workers selected randomly. Swoboda H^[5] (1991) while carrying out a study on noise hazards among

pneumatic drillers found 78.9 % of the workers had evidence of NIHL. In spite of high risk of damage only 14.5 % had any complaint pertaining to hearing loss. Comparison study of both ears showed that both the ears are equally susceptible to damage to noise. The results of above studies included different criteria to determine prevalence of noise induced hearing loss like for the workers under the present study (International standards organization, 1989), criterion was adopted to determine the impairment in either ear at 500-8000 Hz. Thus the exact comparison of the results has become difficult. Kowalska S^[6] (1995) et al found that the audiometric pattern of the exposed group of deafness in the affected workers. There was maximum dip at 4000 Hz in 82 % cases. Moneim IA^[7] (1996) showed that with exposure level 110 db, the dip at 4000 Hz was prominent for all age groups, which showed that 4000 Hz dip was found in 63.8 % cases. The duration of exposure increases, increased number of workers shows 4 KHz dip, below 10 years 43.6 %, 11-20 years 75 % and 21-30 years 79.2 % had 4 KHz dip. 54 % workers between 51-55 years of age showed deafness amounting to 56-90 db. Osibogun A^[8] et al (2000) studied the hearing in textile mill workers and stated that almost all the workers, irrespective of the age and length of exposure had suffered permanent hearing damage at 4000 Hz.

Prevalence of NIHL with duration on exposure: On comparing the prevalence of NIHL with duration of exposure it has been observed that prevalence increased with increasing years of noise exposure. In present study moderately severe and severe hearing loss was noticed as the duration of exposure increased, between 21-25 years of exposure 50 % workers developed moderately severe hearing loss. Minja BM^[9] et al (2003) from U.K investigated the relationship of period of exposure and mean hearing loss for the workers under the age group of 40 years exposed to maximum noise level of 115 db to 128 db. It was seen that in 3 and 5 years period of exposure, mean NIHL were 27.2 and 38.6 %. The rate of progression depends upon the type of noise and individual susceptibility. Harger MR^[10] et al (2004) have that best indicator of susceptibility to noise induced change in the hearing level would probably be early evidence of the PTS at 4000 Hz. Most of the changes in the hearing level at 3, 4 & 6 KHz occur initially after 15 years exposure to steady state continuous noise. Further

according to them at 0.5, 1 and 2 KHz changes in the hearing level is essentially linear function of duration of exposure.

Similarly Moon IS^[11] (2007) compared different groups for duration of exposure to impulse noise and observed minimal three to four years period for NIHL to develop. Loss of hearing acuity was evident in high frequencies initially, with further exposure, the damage become more severe and spread to adjacent frequencies including those which are important for speech interpretation. The loss in all subjects was substantial at 4000 Hz. Better acuity at 8000 Hz than at 4000 Hz is typical of a noise induced hearing loss. Nandi SS^[12] et al (2008) found that hearing loss was increased after an exposure of less 3 year and remained the same up to 5 years. There was further deterioration of hearing when exposure was for more than 10 years. The rate of progression depends upon the type of noise and individual susceptibility. Chou YF^[13] (2009) and Jawed^[14] (2010), have reported that best indicator of susceptibility to noise induced changes in the hearing level would probably be early evidence of the PTS at 4000 Hz. Most of the changes in the hearing level at 3, 4 & 6 KHz occur initially after 15 years exposure to steady state continuous noise. Further according to them at 0.5, 1 & 2 KHz changes in the hearing level are essentially a linear function of duration of exposure. Chang TY^[15] et al (2011) found in their study that the median thresholds of audibility for both ears of the weavers of all age groups were or less similar to that of the control group at frequencies up to 2000 Hz with a tendency of dip starting from 3000 Hz level to other higher frequencies.

Prevalence of hearing loss in persons exposed to noise versus control group

The two groups contained similar proportions of persons of similar age groups. The results found for communicating with strangers and with family and friends were similar. With known voices difficulties occurred mainly against a noise back ground where as with strangers more weavers had difficulty at all times the controls mainly experienced difficulty in noise.

In our study, we found increase hearing threshold in marble factory workers that maximum hearing loss occur after 5 yrs continuous exposure to noise. The average hearing threshold is between 61-76 dB. Within 21-35 yrs of age the average hearing

threshold for control group was between 9-14 db as compared to exposed group with 60-66 db hearing loss. In 51-55 yrs of age the control group showed 13-17 db hearing loss compared to 54-58 dB in exposed group.

CONCLUSION

The present study has been conducted in Department of Physiology and E.N.T to observe hearing loss in marble factory workers of Ajmer. A total of 60 subjects were included in the study result were showing deafness increases with the duration of exposure. In marble factory workers NIHL was 60-66db.No significance difference of hearing threshold was recorded in Left and Right ear. In this study mild hearing loss was 20 %, moderate hearing loss was 16.67 %, and moderate severe hearing loss was 36.67% and severe hearing loss was 26.66 %. Audiometric values were consistently lower in normal than in marble factory workers. The differences were statistically significant among both sexes and that too for the parameters of right and left ear.

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CONFLICT OF INTEREST

Primary interest refer to the principal goals of profession or activity such as the health of patient, integrity of Research and duty office.

Secondary interest include not for financial purpose but motivate as the desire for professional advancement.

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