

Noise Induced Hearing Loss among Factory Workers of Dharan Industrial Area

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Abstract

Background: Hearing loss is the most common sensory loss accounting for 250 million population of world out of which 16% is attributed from occupational exposure to loud noise, ranging from 7% to 21% in different parts of the world. The prevalence of noise induced hearing loss is more common among factory workers than general population. There are limited reports regarding occupational noise from developing country like Nepal.

Method: A cross sectional study was done in Dharan Industrial Area between February 2014 to May 2014. Twenty different industries operating inside the premises of industrial area were categorized into four major categories as per the nature and types, such as: Metal, Plastic, Food and Chemical based industries. Measurement of the sound was done in two phases. Pure tone audiometry of the exposed and non-exposed population was done.

Results: Total 104 workers were included from 20 different factories; out of them 80 workers were exposed to loud noise and 24 were non-exposed who acted as the control. The frequency of hearing loss among exposed population was 38.8% and it was 12.5% among non-exposed and the difference was statistically significant. In exposed population hearing loss was 7.7%, 40.5% and 60.9% in age groups of 15- 30, 31- 45 and > 46 years respectively and the difference was statistically significant. Population working longer duration had more chance of noise induced hearing loss and the difference was significant.

Conclusion: Population working in noise producing factory has high risk of developing noise induced hearing loss and the risk increases in older people and in people who works for long duration.

Key words: Factory workers, industries, noise induced hearing loss

Introduction

Any unwanted sound not carrying any sorts of information and interfering with physical and psychological aspects of life is termed as noise.¹

Noise induced hearing loss is defined as reduced auditory acuity after exposure to loud noise.² Daily exposure to sound of more than 85dB is associated with hearing loss and louder noise increases this process. Permissible exposure limit to noise is 8 hrs at 85 dB, 4 hrs at 90 dB, 2

hrs at 95 dB, and 1hr at 100 dB.^{3,4}

Hearing loss is the most common sensory loss accounting for 250 million population of world out of which 16% is attributed to the occupational exposure to loud noise, ranging from 7% to 21% in different parts of the world.^{5,6,7}

Consequences of hearing impairment include inability to interpret speech sounds, often producing a reduced ability to communicate, delay in language acquisition, economic and educational disadvantage, social isolation and stigmatization.³ Though there are enough

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literatures of occupational hearing loss in developed world, there are sparse studies in developing world like Nepal. We conducted the study to find out the prevalence of noise induced hearing loss among factory workers of Dharan Industrial Areas.

Material and Methods

The study was conducted in an Industrial Area between February 2014 to May 2014. It was a cross sectional study. Permission from 20 different factories were taken for the study. Ethical clearance was obtained from institutional ethical review board and consent from both employer and employees obtained prior to the study. The present study was conducted in 20 different industries operating inside the premises of an industrial district including cross section within the general areas of the industrial district area. All the 20 different industries are categorized into four major categories as per the nature and types such as Metal, Plastic, Food and Chemical based industries. Measurement of the sound was done in two phases.

The following inclusion and exclusion criteria were applied in the study.

Inclusion criteria:

- Adult population (15- 60 year).
- Person who are exposed to loud noise (> 85 dB) at least 8 hour a day for period of > 5 years.

Exclusion criteria:

- Person with hearing loss prior to the factory work
- Person with conductive hearing
- Person with systemic illness.

Detailed clinical history and physical examination including meticulous otological assessment was carried out in all the subjects

according to Proforma. Complete birth and developmental history was taken to exclude congenital and other causes of acquired hearing loss. Detail drug history was taken, especially the ototoxic drugs. Past history of ear trauma and head injury was taken to rule out the prior hearing loss.

Pure tone audiometry was done on each case or control/ participant in a quiet room. Audiological assessment of all cases was carried with ARPHI 500 MK II S portable pure tone audiometer. A single trained audiologist and a clinician carried out screening audiological examination in a quiet room inside the factory but away from the machine. Calibration of the pure tone audiometer was done regularly. Severity of hearing loss was graded on the basis of frequency of 500, 1000, 2000, 4000, 8000; Hz Graph was plotted on the basis of PTA finding. Hearing threshold of cases were compared with those of control group. All the findings were filled up in preformed Proforma.

A measurement of noise was taken with a calibrated Lutron SL- 4001 digital Sound Level Meter. The sound level of factory and screening room were measured prior to the study. The sound of screening room was 30 dB.

The data were analyzed using SPSS version 16. Mean and standard deviation of variables in both case group and control group were also calculated. χ^2 test and logistic regression were used to analyze the data. Comparison of hearing loss was done in between case and control, in different age groups and duration of exposure. Logistic regression was applied to find odd ratio of noise induced hearing loss among cases and controls.

Results

We included 104 factory workers from 20 different factories of Dharan Industrial Area. Out of them, 80 people were exposed to occupational noise and 24 people were not exposed to the loud noise. Around 80% of the workers were male which reflects the nature of

our society where male do more outside works (figure 1). The most common age group was between 15- 45 years which represents the population strata of our country where higher number of younger population are present (figure 2).

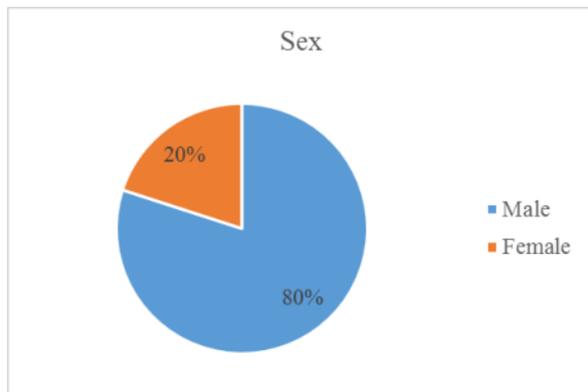


Figure 1. Sex Distribution

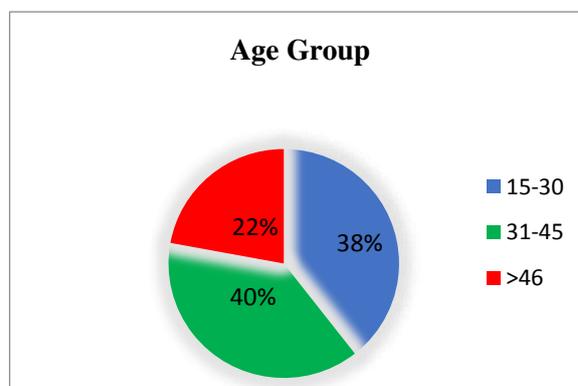


Figure 2. Age Group Distribution

Noise Induced Hearing loss among Exposed vs. Non-exposed to loud sound:

We include total 104 workers and out of them, 34 had noise induced hearing loss, thus, prevalence of NIHL in our study was 32.7%.

Prevalence of noise induced hearing was 38.8% among people who were exposed to loud noise and 12.5% people who were not exposed, and chance of having noise induced hearing loss among exposed population was almost nine times to those who were not exposed (Table 1).

Table 1: Frequency of noise induced hearing loss exposed vs. non-exposed.

Exposure	Frequency	Noise induced Hearing Loss		Odd ratio	P value
		Yes	No		
Exposed	76.9% (80)	38.8% (31)	61.2% (49)	9.255	< 0.01
Non-exposed	23.1% (24)	12.5% (3)	87.5% (21)		

Age vs. Noise induced hearing loss:

The study showed the noise induced hearing loss among the group of 15- 30 year was 7.3%, in the age group 30- 45 was 42.5% and among > 46 years, the prevalence of noise induced hearing loss was 60.9%. The difference was statistically significant.

Table 2

Age in years	Noise induced hearing loss		P value
	Yes	No	
15- 30	7.7% (3)	92.3% (36)	< 0.001
31- 45	40.5% (17)	59.5% (25)	
> 46	60.87% (14)	39.1% (9)	

Duration of Work

Workers were divided into three groups according to duration of exposure. Persons exposed to 5- 10, 10- 15 and > 16 years were grouped as 1, 2 and 3 respectively. The workers who were exposed more than 15 years were more likely to develop noise induced hearing loss and the difference was significant (Table 3).

Table 3

Duration in Years	Noise Induced Hearing Loss		P value
	Yes	No	
5- 10	23.3% (7)	76.7% (23)	< 0.05
10- 15	28.3% (13)	71.7% (33)	
> 15	50% (14)	50% (14)	

Discussion

Industrial noise is a major cause of hearing loss among workers due to continuous exposure to high frequency sounds emitting from the machines. Noise of any type may be irritating at low intensity and damages hearing at high intensity.⁸⁻¹³ The current study found that occupational noise can cause increased hearing thresholds. Present study showed that 38.8% of the workers were having NIHL compared to age matched controls where only 12.5% of the population had hearing loss, the difference being statistically significant. Similar results were seen by Morata et al among rotogravure printing workers where the prevalence of NIHL was found to be around 49%, however, a study by Moselhi et al. among 114 workers showed the prevalence of NIHL to be around 9.6%.⁸ Industrial noise exposure can damage the stereo cilia of the hair cells of the basilar membrane; when excessive, these effects might lead to cell death. Avoiding noise exposure usually stops the progression of the damage.³ Hidayat et al. reported incidence of NIHL to be around 17.20% on textile factory workers with 10 years working period and 46% with 15 years working period.¹⁴ In the present study, mean hearing loss was seen in 23.3% among workers who were exposed to noise for less than 10 years, 28.3%

among workers who were exposed for 10- 15 years and 50% among workers who were exposed for more than 15 years. Ertem et al. found that mean hearing loss among cotton textile and carpet mill worker's was found to be as 29.07 dB, 33.41 dB and 33.77 dB in category 5- 10 years, 11- 15 years and 16- 20 years respectively.¹⁵ Ketabi et al found the mean hearing loss on factory workers to be 37 and 56 in 11- 15 years and 16- 20 years group of exposure to noise.¹⁶ Our study shows that the mean hearing loss was found to be around 7.3%, 42.5% and 60.9% among the workers aged 15- 30 years, 30- 45 years and more than 45 years respectively. The results indicate as the age increases, the chances of hearing loss due to noise exposure also increases. In our study, we found that most of the workers were not using hearing protectors. They complained that it caused discomfort, interference with hearing speech and warning signals, and they had belief that there was no control over an inevitable process of hearing loss. In such scenario, adequate education about the importance of wearing hearing protectors was given. The screening room at factory site was not ideal room for audiometric evaluation though time to time calibration was made. Temporary thresh hold shift tried to rule out by allowing 16 hours

of noise free period to factory workers but totally couldn't be ruled out.

Recommendation

NIHL is preventable, health education and public awareness about NIHL should be advocated. Protective measures against noise should be mandatory in noise producing factory as factory workers in Nepal are at risk of NIHL.

Conclusion

Noise induced hearing loss is only preventable but not curable. Regular medical examination of workers in all industries is mandatory. Workers need to use protective equipment while working in factories having high level of noise exposure. Appropriate medical education should be provided to both workers and the management staff in order to prevent this occupational disease.

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