

Original Article

Prevalence of Hearing Loss among Noise Exposed Industrial Workers.

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Abstract:

Exposure to any type of noise has a potential risk. Higher the level of noise and longer duration of exposure, more the risk for hearing sensitivity and health as a whole. Occupational noise induced hearing loss (ONIHL) is a major cause of disability throughout the world. So this study was designed to know the prevalence of NIHL among the noise exposed industrial workers in Bangladesh. A prospective observational study of 377 People working at industrial environment in Jute mills at Faridpur region were studied between January 2021 to June 2021. Data collected from each respondent recorded on a predesigned data collection form. Pure tone audiometry was performed in both ears. Among 377 study population, 157(41.6%) subjects had hearing loss and 220 subjects (58.4%) had no loss. Among the workers with hearing loss, 98(62.4%) got hearing loss on both sides, 32(20.4%) on the right side and 27(17.2%) on the left side. Among them 83(52.9%) had mild hearing loss, 37(23.6%) had moderate hearing loss, 31(19.7%) had severe hearing loss and 6(3.8%) had profound hearing loss. The average duration of work in the industry was 6.94±5.64 years and majority (78.5%) had 8 hours working hour per day and 21.5% had more than 8 hours. The average sound intensity was 91.51±8.12 dB(A) with 10.9% exposed to ≤85 dB(A) and 89.1% to >85 dB(A). This study shows Noise-induced hearing loss (NIHL) as highly prevalent among noise-exposed workers in Bangladesh. Age >35 years, high noise level, exposure of more than 10 years, were significantly associated with increased risk of hearing loss. The local and national authority should focus on noise monitoring, engineering modifications of buildings and machinery, occupational safety policies, administrative controls, providing education on NIHL, periodic audiometric assessments and follow-up evaluation for hearing threshold shift. This study supported the elements for further research studies related to the employer compliance with occupational health and safety regulations to address awareness of their responsibility in minimizing hazards in workplaces.

Key words: Sensorineural hearing loss, Noise exposure, Industrial workers.

Introduction:

Exposure to any type of noise has a potential risk. Higher the level of noise and longer duration of

exposure, more the risk for hearing sensitivity and health as a whole. Occupational noise induced hearing loss (ONIHL) is a major cause of disability throughout the world¹⁻³.

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Occupational noise induced hearing loss is a major problem in the workers serving in industries, armed forces, aircrafts, ships, heavy mechanical transports, weaponry and aviation industries where there is continuous exposure to noisy environment⁴. Occupational noise exposure is likely to contribute in very high proportion of cases of sensorineural hearing loss (SNHL) in workers who are continuously exposed to high intensity noise being emitted from industrial machines⁵. Exposure to sound above a level of approximately 85 dB initially manifest as a temporary hearing loss or dullness of hearing that is known as temporary threshold shift (TTS), which may have fast resolution within first 10-15 days of the exposure⁶. However, a repeated or sustained exposure of noise to the hair cells and associated nerve fibers leads on to degenerative changes and the TTS becomes permanent threshold shift (PTS). Hearing loss can impact one's life in many ways. A ringing in the ear, called tinnitus, commonly occurs after noise exposure, and it often becomes permanent⁷. An increase in pulse rate and blood pressure, or an increase in stomach acid includes some of the negative impact of noise on health. With

the rapid development of industries and automobiles the noise hazard is increasing by many folds in Bangladesh as well as in the whole world.

According to American Academy of ophthalmology and Otolaryngology excessive noise pollution can lead onto difficulty in communication, while at work and ringing sound in the ear for several hours even after work⁸. Globally, about 16% to 24% of hearing impairments in adults are due to occupational noise. Apart from noise emitted from manufacturing and agriculture industries, lack of awareness among the workers and health professionals contributes to higher prevalence of NIHL in Asia⁹. Same study showed that 43.5% of workers being exposed to noise level exceeding 91dBA for 8 hours a day contributes to higher risk of acquiring hearing loss^{6,10}. However, there is limited or no information on the Occupational Noise Induced Hearing Loss in Bangladesh. In this study, we have conducted surveys of different Jute mills in Faridpur region to assess hearing loss in the industrial worker in relation to noise level, duration of exposure, age, sex and type of work in the factory.

Materials and Methods:

Prospective observational study was conducted among 377 people working at industrial environment in Jute mills at Faridpur region. Data collected from each respondent were recorded on a predesigned data collection form. Pure tone audiometry was performed in both ears. Main outcome measures are prevalence rate of hearing loss and relative risk of hearing loss by demographic factors and surrogates for noise exposure.

Results:

Table I : Demographic characteristics of study subject (n=377)

Characteristics	Frequency	Percentage (%)
Age in years		
20	79	21.0
21-30	126	33.4
31-40	85	22.5
41-50	61	16.2
51-60	20	5.3
>60	6	1.6
Mean±SD	31.96±12.38	
Sex		
Male	280	74.3
Female	97	25.7
Education		
No formal education	66	17.5
Primary school	178	47.2
Secondary school	106	28.1
Post secondary	27	7.2

Table I shows maximum (33.4%) were in age group 21-30 years followed by 22.5% were 31-40 years, 21% were 20 years, 16.2% were 51-50 years, 5.3% were 51-60 years and only 1.6% were >60 years. Majority (74.3%) of them were male and 25.7% were female. Education of maximum (47.2%) were primary school level followed by 28.1% were secondary school, 17.5% were no formal education and 7.2% were post secondary.

Table II: Type of work of study subject (n=377)

Type of work	Frequency	Percentage (%)
Production	259	68.7
Mechanical	88	23.3
Office Staff	15	4.0
Security guard	13	3.5
Medical Assistant	2	0.5

Table II shows maximum (68.7%) work in production section followed by 23.3% in mechanical work, 4% were office staff, 3.5% were security guard and 0.5% were medical professional.

Table III: Pre-existing ear discharge study subject (n=377)

Pre-existing ear discharge	Frequency	Percentage (%)
Right ear		
Present	5	1.3
Absent	372	98.7
Left ear		
Present	19	5.0
Absent	358	95.0

Table III shows 19(5%) worker had pre-existing left ear disease and 5(1.3%) had pre-existing disease in right ear.

Table IV: Noise exposure level of study subject (n=377)

Noise exposure level	Frequency	Percentage (%)	Mean±SD
85 dB(A)	41	10.9	91.51±8.12
>85 dB(A)	336	89.1	

Table IV shows 10.9% study population were exposed to ≤85 dB(A) sound and 89.1% were exposed to >85 dB(A). The average sound level was 91.51±8.12 dB(A).

Table V: Duration of work of study subject (n=377)

Duration of work	Frequency	Percentage (%)	Mean±SD
1-5 years	180	47.7	6.94±5.64
6-10 years	123	32.6	
11-15 years	45	11.9	
15-20 years	17	4.5	
>20 years	12	3.2	

Table V shows 47.7% workers have 1-5 years duration of work, 32.6% have 6-10 years, 11.9% have 11-15 years, 4.5% have 15-20 years and 3.2% have >20 years. The average duration of work was 6.94±5.64 years.

Table VI: Per day working hour of study subject (n=377)

Working hour	Frequency	Percentage (%)	Mean±SD
≤8 hours	296	78.5	8.96±2.26
>8 hours	81	21.5	

Table VI shows that majority (78.5%) work 8 hours or less per day and 21.5% work more than 8 hours.

Table VII: Awareness level regarding NIHL study subject (n=377)

Awareness level regarding NIHL	Frequency	Percentage (%)
Yes	117	31.0
No	260	69.0

Table VII shows 31% had awareness about NIHL level and 69% had no awareness.

Table VIII: Prevalence of hearing loss of study subject (n=377)

Hearing loss	Frequency	Percentage (%)
Present	157	41.6
Absent	220	58.4
Affected side of loss (n=157)		
Both ears	98	62.4
Right ear	32	20.4
Left ear	27	17.2

Table VIII shows 41.6% had hearing loss and 58.4% had normal hearing. Among the workers with hearing loss, 62.4% got hearing loss on ears, 20.4% on the right ear and 17.2% on the left ear.

Table IX: Degree of hearing loss of study subject (n=157)

Hearing loss	Frequency	Percentage (%)
Mild (20 - 40 dB)	83	52.9
Moderate (41 - 60 dB)	37	23.6
Severe (61 - 90 dB)	31	19.7
Profound (< 90 dB)	6	3.8

Table IX shows maximum (52.9%) had mild hearing loss, 23.6% had moderate hearing loss, 19.7% had severe hearing loss and 3.8% had profound hearing loss.

Table X shows the factors associated with hearing loss. Age >35 years and exposure of more than 10 years were significantly associated with increased odds of hearing loss. Those who were aged more than 35 years had increased odds of hearing loss (OR = 2.28; 95% CI: 1.7- 2.9) compared to workers aged 35 years or less. Exposure to noise for a period of more than 10 years (OR = 1.9; 95% CI: 1.4-2.8) had increased odds of hearing loss compared to workers who were exposed to noise over a period of 10 years or less.

Table X: Multivariate analysis of the factors associated with hearing loss

Variables	Hearing loss				OR	P value	95% CI	
	Yes		No				Lower	Upper
	no	%	no	%				
Age in years								
35	70	44.6	180	81.8				
>35	87	55.4	40	18.2	2.28	0.001	1.749	2.988
Sex								
Male	123	43.9	157	56.1				
Female	34	35.1	63	64.9	0.86	0.126	0.722	1.033
Noise level								
85	18	43.9	23	56.1				
>85	139	41.4	197	58.6	0.95	0.756	0.719	1.273
Duration of work								
10 years	107	35.3	196	64.7				
>10 years	50	67.6	24	32.4	1.99	0.001	1.421	2.800
Working hours								
8 hours	118	39.9	178	60.1				
>8 hours	39	48.1	42	51.9	0.82	0.180	0.635	1.080
Awareness level								
Yes	50	42.7	67	57.3				
No	107	41.2	153	58.8	0.97	0.773	0.807	1.173

Discussion:

Noise-induced hearing loss (NIHL) is the only type of hearing loss that is completely preventable, but it is remaining as a significant health problem with economic consequences in South East Asia countries¹¹.

The result of the study showed that the mean age of the workers was 31.96±12.38 years with the range of 12 to 66 years. This finding was consistent with other studies carried out in Myanmar with 32.42 years mean age, Ethiopia with 34.3 years of mean age and in Thailand with 33.8 years of mean age 12-14. The studies conducted in Thailand, Turkey, and India showed that most workers were within 31-40 years¹⁵⁻¹⁷.

All workers in weaving sections operated at an 8-hour work shift in the jute mills. Similarly, a study conducted in Pakistan and Myanmar showed that the duration of work in each shift was 8 hours per day with daily break of 72 minutes^{11,18}. It was also consistent with the recommended exposure limit for noise that was recommended by the NIOSH. According to Factories Act 1951, normal working hours in Bangladesh were not to exceed 8 hours a day or 44 or 48 hours (for continuous process) a week which was standardized by the International Labor Organization Law. Most workers had less than 10 years of service duration in the jute mills. This finding was also consistent with similar studies conducted in Turkey and Bangladesh^{16,19}. However, the other studies stated that more than 10 years of service duration occurred in a large proportion of workers^{14,17}.

The workers exposed to more than 85 dB(A) of noise level were within the Jute Mills. The means of noise exposure was 91.51±8.12dB(A) in the jute mills. Similar study carried out in Myanmar found that mean noise exposure was 91.94 dB(A) in the weaving section and 85.61 dB(A) in the spinning section²⁰. In addition, other studies showed that mean sound levels of weaving sections were 99.5 dB(A) in Ethiopia, 87.3 dB(A) in India and 95.3 dB(A) in Pakistan^{13,17-18}. It could be suggested that weaving sections had the highest noise level, and it might be hazardous to workers²⁰.

The prevalence, 41.6% of hearing loss in this study, it's found that more than half (50.7%) of the industrial workers are suffering from hearing impairment either due to ONIHL or other types of hearing impairments. Which was higher than 34% found the studies conducted in Ethiopia, 30.86% in Turkey, 38% found in India, 33.46% in Bangladesh, 30% in Jordan, 35% in Canada and 27.9% in Bhutan^{13,16,17,19,21-23}. These differences of hearing loss may have resulted from the use of hearing loss prevention programs for all workers whose unprotected 8-hr TWA exposures equal or exceed 85 dB(A) with assessment of noise exposure and audiometric monitoring.

Age-related hearing loss is one of the most common causes of high frequency hearing loss, and its effect began around the age of 40 years^{18,24}. In this study, the workers aged 35 years and older were 7 times more likely to have hearing loss than those who were younger than 35 years. This observed association persisted after adjusting the service duration, and it was consistent with a study carried out in Ethiopia¹³. This might be due to a phenomenon of presbycusis which was gradually loss of hearing in older age. Similar studies conducted in India, Canada, and Brazil documented that age was positively associated with hearing loss^{17,22,24}.

The workers who had less than a high school education level were at greater risk of developing hearing loss than those who had a high school education level and more. This may be due to the fact that the workers who had low education level were unable to follow safety policies, to be conscious in warning labels and instructions of machines, and to cooperate in hazard communication programs. Hearing difficulty is also an associated factor of hearing loss. It can be suggested that loud noise can damage the inner ear and impact day-to-day communication at workplaces as a result of difficulty to understand speech among workers.

A similar condition was observed in Great Britain in which high prevalence of severe hearing difficulty among noise-exposed workers was observed²⁵.

In this study, among the noise exposed workers in Jute Mills, 98 (62.4%) had right sided loss, 32 (20.4%) had both sided loss and 27 (17.2%) had left sided loss. Out of the 157 people, 83 (52.9%) had mild hearing loss, 37 (23.6%) had moderate loss and 31 (19.7%) had severe loss. Therefore, the findings of the study are in well agreement with the findings of the other research works^{5,9}. Another study regarding flour mill workers done by Mgbe et al. they found twenty six (44.33%) had right sided loss, sixteen (26.66%) had left sided loss, and nine had bilateral loss²⁶. Out of the thirty two people, 26 (50.98%) had mild loss and 6 (11.76%) had moderate loss.

Exposure to extremely loud noise for one time or exposure to loud noise for an extended period can cause hearing loss. Long periods of continuous noise exposure induce progressive and irreversible hearing loss in both ears²⁷. The rate of hearing loss was particularly higher among workers with long duration of work experience in the industries. In this study, the workers with more than 10 years of service in the Jute Mills were 6 times more likely to have hearing loss than those with 10 years and less service duration. This finding was consistent with other studies conducted in Myanmar, Ethiopia, Thailand, Bangladesh, and Jordan where long duration of employment predisposed to hearing loss among workers^{12,13,15,19,21}.

The NIHL restricted the 85 dB(A) and more noise exposure level to protect hearing loss. It was expected that the workers who were exposed to 85 dB(A) and more noise exposure levels were at greater risk of developing hearing loss than those who were exposed to less than 85 dB(A). The studies conducted in Jordan, Ethiopia and Thailand stated that noise exposure level was associated with a significantly higher prevalence of hearing loss^{11,13,15}. However, there was no significant association between noise exposure level and hearing loss in this study.

This study showed that exposure to noise for 10 years or more is associated with increased risk of hearing loss. A study in Denmark showed that the risk of hearing loss was tripled by exposure to noise for more than 20 years²⁴. The objective risk of hearing damage was significantly higher for construction workers compared with controls (OR = 1.6, 95% CI = 1.3-2.1) and increased with the duration of time employment, although the confounding effect of other factors such as age and smoking was not ruled out²⁵. Previously reported Alamaayeha et al. showed that exposure to noise for period of 10 years or more is associated with increased risk of hearing loss²⁸.

Results of this study might be generalized to elsewhere in which the workers are employed in same occupational settings. However, if the implementation of occupational safety and health regulations were different (even in other occupational settings located in different regions/ states), the study results might vary, particularly among those with diversity of demographic factors, risk behaviors, health problems, and consciousness on NIHL.

Conclusion:

This study shows noise-induced hearing loss (NIHL) was highly prevalent among noise-exposed workers in Bangladesh. Age >35 years, high noise level, exposure of more than 10 years, were significantly associated with increased risk of hearing loss. In addition, the local & national authority should focus on noise monitoring, engineering modifications of buildings and machinery, occupational safety policies, administrative controls, providing education on NIHL, periodic audiometric assessments and follow-up evaluation for hearing threshold shift. This study supported the elements for further research studies related to the employer compliance with occupational health and safety regulations to address awareness of their responsibility in minimizing hazards in workplaces.

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