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Original Article

Prevalence of Occupational Noise Induced Hearing Loss among Textile Industry Workers of Bangladesh.

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Abstract

Background: Occupational noise exposure remains a major public health concern, particularly in the textile industry, where workers are continuously exposed to high-intensity noise. Noise-induced hearing loss (NIHL) is one of the most prevalent occupational health hazards, often leading to irreversible hearing impairment and reduced quality of life. Objective: This study aims to determine the prevalence of NIHL among textile industry workers in Bangladesh and identify associated risk factors to inform workplace safety strategies. **Methodology:** This cross-sectional study was conducted in the Department of Otolaryngology, Monno Medical College and Hospital, Manikganj from March 2023 To February 2024 among 185 textile worker's exposed to occupational noise levels exceeding 85 dB. Participants underwent pure-tone audiometry to assess hearing impairment. Data were collected through structured questionnaires and analyzed using SPSS version 26. **Results:** NIHL prevalence was 58.38%, with a significant association with age ($p < 0.001$). Workers aged 38–47 years had the highest prevalence (80.95%). Bilateral hearing loss was most common (69.44%), with 4000 Hz being the most affected frequency. The highest risk was observed among loom shade workers (95–100 dB). **Conclusion:** The high prevalence of NIHL underscores the need for stricter noise control measures, mandatory hearing protection, and regular audiometric screening in the textile industry. Strengthening occupational health policies is crucial to safeguarding worker well-being.

Keywords: Noise-induced hearing loss; occupational noise; textile industry; audiometry; workplace safety

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Introduction

Noise is one of the most pervasive environmental pollutants in industrial workplaces, persisting as a significant concern since the advent of the industrial revolution. It remains the most ubiquitous pollutant in industrial settings, posing widespread risks to workers' health[1]. The industrial environment, particularly the textile sector, is among the highest-risk settings for noise-induced hearing loss (NIHL) due to continuous exposure to high-frequency noise from weaving machines [2]. Studies have reported noise levels in textile mills ranging from88 to 99 dBA, with weaving rooms often exceeding 95 dBA[3]. Repeated exposure to noise levels above 85 dB causes gradual hearing loss, with louder sounds accelerating this damage[4-5]. Globally, the prevalence of NIHL varies widely, with industrial populations exhibiting rates between 37% and 59.7% depending on the sector [6].

In developing countries like Bangladesh, industrial growth has led to increased noise exposure among workers, particularly in the textile industry, which employs a significant portion of the population[7]. A 2024 study in Bangladesh reported a 14.5% prevalence of NIHL among

textile workers, linked to prolonged working hours[8]. Among the adverse effects of occupational noise exposure, NIHL is particularly concerning. NIHL is a sensorineural hearing impairment caused by prolonged exposure to excessive sound levels. It typically begins with damage to higher-frequency hearing, ranging from 3,000 to 6,000 Hz, and gradually progresses over time[9]. This condition, though largely preventable, is the second most common type of sensorineural hearing loss after presbycusis, and its impact is especially pronounced in occupational settings[10]. Occupational hearing loss remains the leading cause of preventable sensorineural hearing impairment among adults, with noise being the most ubiquitous industrial pollutant[1]. Noise exposure in the workplace not only contributes to hearing loss but also significantly impacts non-auditory health, including sleep disturbances and psychological stress. Chronic noise exposure has been linked to poor sleep quality, hypertension, and reduced cognitive function, highlighting the need for preventive measures in industrial settings[11].

The consequences of occupational noise extend beyond auditory damage. Long-term exposure to high noise levels can increase stress, which negatively affects workplace productivity. Moreover, noise exposure is associated with various health problems, such as hypertension and cardiovascular diseases, underscoring the necessity of addressing these risks. Effectively managing noise in the workplace is essential for safeguarding both employees' physical health and overall work performance[12]. Occupational health and safety services in Bangladesh are still in the process of development. The occupational health and safety framework in Bangladesh, governed by the Factory Act of 1965 and the Factory Rule of 1979, lacks standard noise regulations, leaving workers vulnerable to excessive noise exposure[8]. Given the critical health implications of occupational noise exposure, particularly in the textile industry, this study aims to evaluate the prevalence of NIHL among textile workers in Bangladesh.

Methodology

Study Settings and Population: This cross-sectional study was conducted among workers employed in textile industries to assess the effects of occupational noise exposure. The research was carried out at department of Otolaryngology, Monno Medical College and Hospital, Manikganj Bangladesh. Data collection for the study was completed over one year period between March 2023 and February 2024. The target population included workers. The target population included workers exposed to noise levels exceeding 85 dB in their work environment. Total 185 participants who meet the inclusion and exclusion criteria were participated in this study. Participants were included if they were aged above 18 years, individuals with normal hearing status at the time of employment, workers who spent at least 16 hours in a noise-free environment before assessment and participants with at least five years of exposure to occupational noise. Participants with a history of middle ear diseases were not eligible. Participants with history of viral infections or drug therapies causing sensorineural hearing loss were not eligible.

Study Procedure: Data were collected through structured interviews conducted by trained data collectors. Each participant completed a questionnaire that addressed self-reported demographic information, such as age, gender, and monthly income, duration of service in the industry, department and sound history, number of patients with hearing loss, and characteristics of the hearing loss. To ensure clarity and reliability, the questionnaire was pretested prior to formal data collection. Audiometricians handled the audiometric hearing test section.

Measurement of Sound Levels: Environmental sound intensity levels were measured across various locations using a sound level meter. Participants underwent pure tone audiometric testing using a calibrated audiometer. The device was used to assess frequencies ranging from 125 Hz to 8000 Hz and sound intensity levels between -10 dB and 120 dB for each ear individually.

Statistical Analysis: All data were displayed in appropriate tables or graphs based on their relevance, with accompanying descriptions provided for clear interpretation. The data analysis was performed using SPSS version [26]. Descriptive statistics were reported as means and standard deviations for normally distributed data, and frequency with percentages for categorical variables. A p-value of less than 0.05 was considered statistically significant, indicating meaningful associations between variables.

Ethical Consideration: Participants were informed about the purpose and nature of the study and provided written consent before participation. They were allowed to withdraw from the study at any time without any consequences. Ethical approval for the study was obtained from a recognized review board.

Results

The study included textile industry workers with a mean age of 30.9 ± 6.1 years. The majority (54.59%) were aged 18-27 years, followed by 29.73% in the 28-37 age group. Males comprised 60.54% of the participants, while females accounted for 39.46%. Regarding monthly income, most workers (58.92%) earned between 4000-8999 Taka, while only 1.62% earned 24,000 Taka or more (Table 1).

Most of the participants had 5-10 years of experience (44.32%) and 19.46% had over 35 years. 80.54% worker worked in the loom shade department, where noise levels ranged from 95-100 dB. Other departments included drawing frame (8.65%, 77 dB), finishing (5.95%, 81-85 dB), preparation (3.78%, 85-87 dB), and sizing (1.08%, 85-87 dB) (Table 2).

About 58.38% participants were affected by hearing loss. The prevalence of hearing loss among textile workers was significantly associated with age ($p<0.001$). The highest prevalence was observed in the 38 to 47 age group (80.95%), followed by 28 to 37 years (74.55%). In contrast, only 46.53% of workers aged 18 to 27 had hearing loss. Gender-wise, hearing loss was more common among males (62.5%) than females (52.05%), though the association was not statistically significant ($p = 0.09$) (Table 3).

Among the 108 participants with hearing loss, the highest number of participants (69.44%) experienced bilateral hearing loss. A noise-induced notch was present in 58.33% of cases, with 44.44% having notches in both ears. The most affected frequency was 4000 Hz (47.22%), followed by 6000 Hz (42.59%) and 3000 Hz (10.19%) (Table 4).

Table 1: Demographic Characteristics of the Study Population (n=185)

Variable	Frequency (n)	Percentage
Age (years)		
18-27	101	54.59
28-37	55	29.73
38-47	21	11.35
>47	8	4.32
Mean±SD	30.9+6.1 years	
Gender		
Male	112	60.54
Female	73	39.46
Monthly income in Taka		
4000-8999	109	58.92
9000-13999	52	28.11
14000-18999	14	7.57
19000-23999	7	3.78
2400 and above	3	1.62

Table 2: Work-related information of the study population (n=185)

Variables	Frequency	Percent
Work Experiences		
5 to 10 Years	82	44.32
11 to 15 Years	6	3.24
16 to 20 Years	2	1.08
21 to 25 Years	25	13.51
26 to 30 Years	20	10.81
31 to 35 Years	14	7.57
More Than 35 Years	36	19.46
Department (sound intensity in dB)		
Drawing frame (77)	16	8.65
Finishing (81–85)	11	5.95
Loom shade (95–100)	149	80.54
Preparation (85–87)	7	3.78
Sizing (85–87)	2	1.08

Table 3: Prevalence of Hearing Loss among Textile I ndustry Workers by Age and Gender

Variable	Have hearing loss (n=108)		Normal hearing (n=77)		P value
Age Group (years)					
18-27 (n=101)	47	46.53	54	53.47	<0.001
28-37 (n=55)	41	74.55	14	25.45	
38-47 (n=21)	17	80.95	4	19.05	
>47 (n=8)	3	37.50	5	62.50	
Gender					
Male (n=112)	70	62.5	42	37.5	0.09
Female (n=73)	38	52.05	35	47.95	

Table 4: Hearing Loss Characteristics among Participants (n=108)

Variable	Frequency	Percent
Side of hearing loss		
Left	18	16.67
Right	15	13.89
Both	75	69.44
Presence of notch		
Yes	63	58.33
No	45	41.67
Side of notch		
Right	25	23.15
Left	35	32.41
Both	48	44.44
Frequency at which notch present		
3000Hz	11	10.19
4000Hz	51	47.22
6000Hz	46	42.59

Discussion

Occupational noise-induced hearing loss (ONIHL) is a major public health issue, especially in industries like textiles, where workers face prolonged noise exposure. Despite safety regulations, ONIHL remains prevalent, leading to permanent hearing impairment and reduced quality of life. Textile workers often experience noise levels exceeding safe limits, resulting in communication difficulties, cognitive issues, and economic consequences. This study explores ONIHL prevalence in textile workers to identify risk factors and support preventive strategies for better workplace safety and health. The demographic analysis revealed that the majority of participants were young adults (mean age: 30.9 ± 6.1 years), with a predominance of male workers (60.54%). This could be attributed to job distribution within industries, where men typically operate machines that generate higher noise levels, while women work in quieter areas. This may account for the higher prevalence of NIHL among males. This result aligns with the findings of a study That the high prevalence of workers in the lower-income category (4000–8999 Taka, 58.92%) reflects socio-economic challenges that may limit access to healthcare and protective measures[13]. The findings align with global trends, where textile workers often belong to economically vulnerable groups and are at heightened risk for occupational health hazards[14].

Work-related factors, particularly prolonged exposure to high-intensity noise, emerged as significant contributors to NIHL. The majority of workers (44.32%) had 5–10 years of work experience, with a considerable proportion (19.46%) exceeding 35 years of exposure. The loom shade department, characterized by the highest noise levels (95–100 dB), accounted for the largest proportion of workers (80.54%), reinforcing the link between chronic noise exposure and auditory damage. These findings support existing literature emphasizing the cumulative impact of noise exposure duration and intensity on hearing impairment[15]. Additionally, this pattern aligns with a study conducted in the United States, which reported NIHL prevalence rates of 75% among workers aged 20–29 years, 89% among those aged 30–39 years, and 100% among workers over 40 years in the construction industry 16. The prevalence of noise-induced hearing loss (NIHL) among textile industry workers was determined to be 58.38%. Globally, NIHL prevalence ranges between 37% and 59.7% [17]. The prevalence of hearing loss was markedly high (58.38%), with a significant age-related increase ($p<0.001$). Workers aged 38–47 years exhibited the highest prevalence 80.95%), suggesting a cumulative effect of noise exposure. Notably, the lower prevalence in workers over 47 years (37.50%) may indicate a "healthy worker effect," wherein individuals with severe hearing loss may have exited the workforce earlier. Gender differences were not statistically significant ($p=0.09$), implying that both male and female workers are equally susceptible to NIHL under similar exposure conditions. Our findings are comparable with the results of Abraham et al [15]. This study found that 69.44% of workers had bilateral NIHL, with a higher prevalence in the right ear. Similar findings have been reported in other studies [13]. The high rate of bilateral NIHL may be due to the uniform distribution of excessive noise in the workplace. Additionally, 58.33% of workers with NIHL exhibited a notch, with 44.44% affected in both ears and 47.22% at 4000 Hz, followed by 42.59% at 6000 Hz. These results differ from a study on musicians in the United States, where 45% had a notch, with 78% at 6000 Hz, 22% at 4000 Hz, and 2% at 3000 Hz [18]. The variation may be due to differences in noise exposure levels. Addressing this occupational health challenge through evidence-based strategies will enhance worker safety, productivity, and overall quality of life.

There are limitations of the study. Being conducted in a single region, it does not account for variations in noise exposure across different industrial settings. The cross-sectional design prevents establishing a causal relationship between noise exposure and hearing loss. Self-reported data on noise exposure and hearing protection use may be inaccurate due to recall bias.

Conclusion

This study highlights a significant prevalence of occupational noise-induced hearing loss (NIHL) among textile industry workers in Bangladesh, with higher risks associated with prolonged exposure and increased age. The findings emphasize the urgent need for workplace interventions, including the implementation of noise control measures, mandatory hearing protection programs, and regular audiometric screening to prevent further hearing damage. Additionally, occupational health policies in Bangladesh should be strengthened to enforce noise exposure regulations in industrial sectors. Addressing these concerns will improve worker safety, productivity, and overall quality of life.

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