

## **Frequency of hearing loss among textile industry workers of weaving unit in Karachi, Pakistan**

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### **Abstract**

**Objective:** To determine the frequency of hearing loss among textile industry workers of weaving department. To record the noise level in the weaving sections and to compare it with the international standards. To determine the awareness about the effects of noise on hearing amongst the workers and the protective measures adopted by them.

**Methods:** A cross-sectional study was carried out at weaving department of five renowned textile industries of Karachi. The study included 248 workers exposed to noise, through non-probability convenient sampling technique. Equivalent sound pressure level Leq was measured with the help of a Class-1 type digital sound level meter. Hearing status of the workers was assessed through questionnaire and clinical tests (WHISPER, RINNE'S and WEBER).

**Result:** Results showed that noise level was in range of 88.4-104 dB(A). The questionnaire results showed that: (i) 92.7% of the workers were aware that high noise level cause speech interference. (ii) 57.2% were unaware about the effect of noise on health. (iii) 54.8% used ear protection devices. (iv) 22.5% did not respond well to whisper test while 16.9% were found to have defective hearing on the basis of Rinne's test and 17.4% through Weber's test. It was observed that hearing loss was significantly associated with working experience of more than 10 years (25%) and overtime (28.8%).

**Conclusion:** The results of study establish the fact that noise level is more than acceptable limit of 85 dB(A) for 8 hours exposure stipulated by OSHA .There is an immediate need to develop and implement noise regulations in Pakistan (JPMA 59:575; 2009).

### **Introduction**

Occupational health is an important concern of the working person. Excessive occupational exposure to noise results in a well recognized occupational hearing loss and now is taken as a global problem.<sup>1</sup> To maintain social and economic development, a healthy productive worker is very critical.<sup>2</sup> A number of factors, within a person's occupational environment, can lead to or predispose him/her to develop a process of disease. The most important growing concern that is causing occupational hazard nowadays is noise.<sup>3</sup> In Canada occupational hearing loss continues to be among ten leading occupational diseases.<sup>4</sup> On deafness and hearing disorders in the U.S., statistics of year 1994 reveals that more than 28 million Americans have occupational hearing loss.<sup>5</sup> Recent statistics shows approximately 600 million workers are exposed to occupational noise worldwide.<sup>6</sup> About 9% of the total work force are continuously exposed to hazardous noise levels in Sweden.<sup>7</sup> Workers in the textile industry are often most severely affected.<sup>8</sup> An occupational noise survey carried out in Eldoret, Kenya found that the sound levels were highest in the weaving and spinning sections.<sup>3</sup> The main cause of high noise level in the weaving and spinning section are likely due to outdated old machinery, poor design and

construction and crowding of the workplace.<sup>9</sup> The most important cause of hearing impairment in Pakistan is noise and the major sources of noise are the industries.<sup>10</sup> In Pakistan there is no well defined and comprehensive regulations except Pakistan National Environmental Quality Standards (PEQS) which are meant only for motor vehicle noise and allow the maximum permissible noise emission limit of 85dB (A).<sup>11</sup> Noise induced sensory neural hearing loss in workers exposed to high noise has been reported and particularly it starts at 4khz including both lower and higher frequencies after prolonged exposure of 8 to 12years.<sup>12</sup> In industrial societies, environmental noise is the leading cause of hearing loss and also become a common stress factor in the environment of man.<sup>13</sup> Occupational health diseases are difficult to diagnose early because they often have a long latency period. A significant number of worker's ability of hearing is affected by deleterious effects of high noise level.<sup>14</sup> Among the chronic health problems, noise induced hearing loss, is one of the most common which produces gradually progressive impairment and disturb the patient's quality of life.<sup>15</sup> A well known outcome of noise exposure at work in industrial workers is the premature hearing loss.<sup>16</sup>

Noise induced hearing loss effects economy very

severely. Approximately 100 million dollars are paid annually for compensation in Sweden.<sup>7</sup> The Canadian compensation board estimated the average cost per hearing loss claim to be C\$ 14000.<sup>4</sup> Worldwide, 16% of the disabling hearing loss in adults (over 4 million daily) results due to occupational noise.<sup>17</sup> To deal with industrial noise the agencies are handicapped to take any legal action because of the absence of national standards for noise. At present no national survey has been conducted to assess noise level in the cities. However, random tests in different cities showed that the noise level in most of areas was as high as 70 - 90dB (A) which is much higher than the acceptable limits.<sup>11</sup> This grievous situation prevailing in our setting forced our minds to think and work on this topic in order to find out conditions in which workers are performing their work, to recommend the strategies and to improve the situation. Pakistan, like other developing countries has old machines with high noise level. We expect a noise level more than the maximum noise level allowed by OSHA. This study was conducted to measure the intensity of noise at various places in the industries.

### **Subjects and Methods**

This cross-sectional study was initiated in April 2007, the data was collected between July and August 2007 by convenient sampling. It was conducted in the weaving department of five textile industries situated in Karachi. Employees working in the weaving departments were included in the study because weaving department of any textile factory is one of those areas where noise levels are highest and they are at most risk of developing hearing loss. Ten percent of the total numbers of workers in the weaving department from each textile industry were included in the study. There were three shifts in one and two shifts in four, out of five industries. Workers from the morning and afternoon shifts were included in the sample due to limitation of time. Those included were 58 workers out of 600 in the weaving department (A), 40 out of 400 of industry (B), 60 out of 600 of industry (C), 30 out of 300 of industry (D) and 60 out 600 of industry (E).

The response of the human ear to sound depends both on the sound frequency (measured in Hz) and the sound pressure measured in (dB). So equivalent sound pressure was measured with the help of Class1 type digital sound level meter at 2- 4 different locations in the halls of the weaving section depending upon the size of weaving hall and the number of loom sheds in the hall. Equivalent Octave band frequency analysis was evaluated with the help of Octane filter set. Duration of exposure of workers to noise and its effects was ascertained on the basis of

response of workers to the questionnaire having 29 different questions. A clinical test i-e whisper test was done on each worker included in the sample to assess the response of the worker to the noise. Presence or absence of conductive and sensorineural hearing loss was suspected by doing Rinne test and Weber test with the help of 512 Hz frequency tuning fork.

Employees working for at least more than three years in the weaving department were included because hearing impairment appear after prolonged exposure to high noise. All the workers included in the study were males because there were no females working in the weaving department.

Data was analyzed using SPSS version 12. Cross tabulation was done between different variables of the data presented in this report and discussed in results. The student t test was applied on the numerical data and Chi-square test was applied to the categorical parameters. A p-value <0.05 was considered statistically significant. A written approval was taken from Hamdard College of Medicine and Dentistry to carry out the study. All the workers participated voluntarily in this study and an informed consent was obtained from the participants. Name of the textile industries were not disclosed instead they are mentioned as industry A, B, C, D and E because of confidentiality.

### **Result**

Based on the objectives, data was collected in four categories i.e. (i) on sound characteristics at the industry, (ii) on the subjects' exposure status, (iii) on the basis of response of the subjects' to noise, (iv) on the basis of response of the subjects' to clinical test.

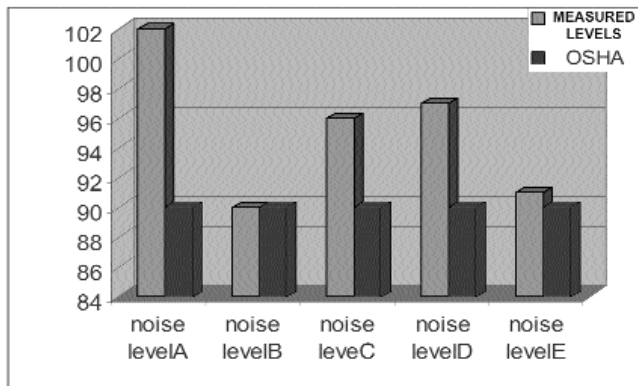
#### **1. Sound characteristic:**

Noise levels in the weaving unit of industries included in our study was in the range of 88.4-104 dB(A) with mean noise level 95.3 dB(A) and their comparison with permissible noise level recommended by OSHA as shown in Figure.

#### **2. Subjects' exposure status:**

It was noted as to how long a subject was exposed to noise in his working department (i) in a day, (ii) in a month, (iii) from overtime exposure. The results are summarized in Table-1.

The duration of work in each shift was 8 hours per day with daily break of 72 minutes, so average duration of work was 6.8 hours. Majority of the workers also worked overtime; the mean over time of the workers was 3.4 hours per day. An average daily exposure by adding mean overtime was 10.2 hours per day. This gives an average



(Student T test = 18.954 p-value < 0.000).

Figure: Comparison of noise levels in the weaving section of the industries with permissible noise level recommended by OSHA.

Table-1: Industrial sound levels related to exposure Status and overtime working.

Industries	Noise level (DB) ranges	Noise level (DB) mean	Hours at work	Mean daily break (hrs)	Hours of exposure/ day	Average overtime (hrs)
Industry A	99 - 104	102	8	1	7	1
Industry B	88.4 - 92.1	90.00	8	1	7	4
Industry C	92.8 - 98.9	96.00	8	1	7	4
Industry D	96.8 - 98.1	97.00	8	1.5	6.5	4
Industry E	89.1 - 92.2	91.00	8	1.5	6.5	4

exposure/month including (working hours + overtime exposure) as 265.2 hours/month.

### 3. Subjective response to noise:

The response of the subjects on noise environment using questionnaire are as follows: Most of the workers (92.7%) felt that noise caused interference in their speech to others as well as understanding others' speech. The awareness amongst the workers, regarding the effects of exposure to high noise levels was minimal, as only (42.7%) workers reported to be aware about these effects. This factor is very closely related to the use of hearing protection devices. A total of 63 (25.4%) workers reported that the industry had not provided any kind of protective device to them. Of the 185 (74.6%) workers who were provided hearing protection devices by the factory, 112 (45.2%) were not using them while others were not using protection devices continuously or they did not know their proper use. The protection devices, were being used by only 136 (54.8%) workers, amongst them 63 (25.4%) were using them continuously and 93 (37.5%) were using them properly. Ear plug being an effective device against high noise was reported by 188 (75.8%) workers, while some did not know any way or device to protect them and a few considered that nothing can protect them from excessive noise exposure. Seventy four (30%) workers included in the

study population experienced headache during their working hours. Due to the excessive noise, the workers used different ways to communicate with other workers during their working hours. Most of them could not communicate verbally with other workers either had to shout or use hand directions for communication. Ninety four (38%) of workers communicated through hand directions.

### 4. Response of the Subjects' to clinical test:

Hearing status of the workers was assessed through the clinical examination which revealed 56 (22.5%) workers to have defective hearing, of which 31(12.5%) workers did not respond to the whisper by both ears, 15 (6.0%) did not respond to left ear while 10 (4.0%) did not respond to right ear. A total 248 workers were examined through Rinne's and Weber's test (Clinical Method). Forty two (16.9%) workers

had negative Rinne's test among which 14 (5.6%) had negative Rinne's test on right ear and 28 (11.3%) had negative Rinne's test on left ear. Whereas 43 (17.4%) workers had lateralized Weber's test, rest of the workers responded normally to the Clinical test (i-e Rinnes and Weber's test).

### Relationship of Response to Weber's test with duration of exposure:

Longer the duration of exposure greater was the risk of developing hearing loss It was found that 19 (16%) workers who were working in the weaving section, for up to 5 years showed lateralized Weber's test, while 16 (21%) workers working for about 6-10 years had lateralized Weber's test and 15 (25.8%) had lateralized Weber's test who were working for more than 10 years with a (chi-square value of 9.35 and p value of < 0.05).

### Association of overtime with hearing of workers:

A cross tabulation between response of worker to whisper test and over time showed a significant relationship with a chi square value of 10.24 and p value 0.017. There was a higher frequency of hearing loss in workers who work overtime than those who do not because of more exposure

to noise. Thirty nine (28.8%) workers who worked overtime while 17 (15%) who did not work overtime, did not respond to whisper test.

### Response to whisper's test by the type of residence:

An association between hearing loss and residence of workers was also found in the study. Twenty out of 62 (33.3%) workers who lived in the premises of industry (hostel) had hearing problems and did not respond to whisper test while only 36 of 186 (19%) did not respond to whisper who lived away from industry premises with a chi square value of 4.42 and p value of <0.03.

### Perception of workers regarding their hearing status by their demand of repetition of words:

There were significant differences between the perception of employee regarding their hearing status and whether they asked other people to repeat their sentences with a chi-square value of 21.11 and P value of < 0.000 (Table-2).

**Table-2: Perception of workers regarding their hearing Status by their demand of repetition of words.**

How do you consider your hearing to be?	Do you request to repeat the words?		Total
	Yes	No	
Good	21	85	106
Fair	40	65	105
Poor	22	15	37
Total	83	165	248

Pearson Chi-Square = 21.114. p value < 0.000.

### Protective measures provided by the industries by the actual availability:

All five industries except one claimed that they had provided all their workers with protective devices. Whereas 25% workers of industry in industry C, industry D and industry E workers said that they were not provided with any sort of protective devices. All the workers of industry A said they had been provided with protective devices. While Industry B neither had provided protection devices nor they claimed.

## Discussion

Excessive noise exposure is a high risk for the hearing of workers. It has been noted that the weaving section has a very high sound level. In our study mean sound levels in the weaving sections were 95.3 dB (A) with a range of 88.5-104 dB (A). The similar situation were found in Jhalandar, India<sup>9</sup> which showed a range between 80 -102 dB equal to the noise in the two textile plants included in the study. Most of the studies conducted world wide show that

the weaving departments have the highest noise levels. In the study carried out in Rivatex industry, located in Kenya,<sup>3</sup> the weaving section had a noise level of 99-101dB (A) which was highest from all other departments.<sup>3</sup> A study conducted in Thailand<sup>18</sup> in a large textile mill showed average noise level in weaving section (101.3 +/- 2.7dB). In a similar study done in Tanzania<sup>19</sup> weaving section constituted the noisiest department with noise levels of 92dB - 103.8dB.

In our study 56 out of 248 (22.5%) workers were found to have some degree of hearing loss, assessed on the bases of whisper test while 42 out of 248(16.9%) were found to have defective hearing on the bases of Rinne and 43 out of 248 (17.4%) through Weber test. The study carried out in Eldoret, Kenya also observed that 60% of workers in weaving department had NIHL.<sup>3</sup> An Ethiopian study also showed that the highest prevalence of hearing loss of 71.1% was among weavers.<sup>2</sup> A study carried out in Lagos Metropolis<sup>8</sup> reported that the weaving section alone recorded the highest prevalence rate of hearing loss of 84.5 % as compared to other units.<sup>8</sup>

In a study conducted in Jordan<sup>20</sup> the prevalence of hearing loss was much higher among the workers exposed to high noise level i.e. 30% workers in the study population compared to 8% in the community who were not exposed to occupational noise.

Effect of noise on hearing not only depends upon the intensity of noise but also on the duration of exposure to the high level noise. Mean daily exposure time of workers in weaving department in the study was 10.2 hrs/day. While weaving department of textile industry in Eldoret Kenya had mean daily exposure time of 7.67 hours.<sup>3</sup> Mean daily exposure time found in our study was more than 8 hours per day (40 hour/week) which is allowed by International Standard Organization (ISO). Our study also showed that noise was a major factor which created interference in speech in 92.7%workers. While the study conducted in India showed speech interference in 70% workers.<sup>9</sup>

According to literature age related hearing loss (presbycusis) is one of the most common cause of high frequency hearing loss and its effect begins around the age of 40.<sup>21,22</sup> In our study 36% workers of age 30-40 years did not respond to whisper test as compared to study carried out in Eldoret Kenya which showed that 39.6% workers above 35 years had a threshold shift towards hearing loss.<sup>3</sup> Awareness among the workers about the ill effects of high noise exposure plays a major role in prevention of noise induced hearing loss and reducing its incidence. In the reported study, the awareness among the workers regarding the effects of exposure to high noise level was reported to be 41%. In a study carried out in India only 29% workers

reported to know the effects of exposure to high noise level.<sup>9</sup> This factor is very closely related to the use of hearing protection devices, compliance in their use comfort issues and individual attitudes about protecting themselves from noise induced hearing loss. In our study 54.8% workers used hearing protection devices out of which only 25% workers were using them continuously. An Indian study showed that only 28% workers were using hearing protection devices.<sup>9</sup> Whereas a study done in two plants in eastern Saudi Arabia<sup>10</sup> demonstrated that only 39% were using hearing protection devices. A comparatively better situation concerning personal noise protective devices was seen in a study carried out in Thailand which showed that 38.6% of weavers had used protective devices.<sup>18</sup>

### Conclusion

The presented study demonstrated that work force in the weaving department of textile industries are at high risk of developing hearing loss and other associated ailments due to excessive occupational exposure to noise.

Workers are over exposed to noise and there is little protection adopted by them. It also shows that high noise intensity levels and exposure for long duration leads to hearing loss. The efforts should be focused towards reducing the noise generated at the source by modifications in existing technologies. Textile industry workers should be educated regarding the NIHL to minimize the prevalence.

### Acknowledgement

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