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# Effect of noise pollution on hearing capacity of workers in Jute Mills of Chittagong City

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**A survey and assessment of noise level with its impact on mill workers were conducted in two Jute Mills of Chittagong city. These industries are highly noise producers; the workers of such mills are highly prone to noise pollution effect, especially hearing problems. Higher noise level in different working sections of the Jute Mill was recorded which includes the siren played, noise from the main entrance, mill's gate and inside the factory. These high levels of noise are much higher than standard and acceptable noise level. The hearing loss of mill workers were determined by producing artificial noise from various distances (5 to 200 feet) and the listening power of different workers was measured. Workers having longer working periods (from 6 months to 2, 5, 10 and 20 years) were not able to hear noise as compared to a normal or less working period person (6 months or new). The experiment suggests that the workers are obviously affected by high noise production of the mills and gradually losing their ability to listen.**

**Key words:** Noise pollution, hearing loss, jute mills.

## INTRODUCTION

Sound is a form of energy which gives the sensation of hearing and is produced by longitudinal mechanical waves in matter including solid, liquid and gases and transmitted by oscillations of atom and molecules of matter. It is produced when an object vibrates, alternatively compressing and ultimately expanding the air. Although, there is always sound in nature, we do not hear all of them (Bhouyain, 2001). Sound is a kind of energy and the unit used to measure the intensity of sound level is called dBell. Bell is named after Alexender Graham Bell. Man has a limitation of hearing sound. They cannot hear the sound below 1 dB and above 140 dB is harmful for them (Jenkins et al., 1979). When any sound is produced in the environment which is above the limit of human normal hearing capacity, it is called noise pollution (Bhouyain, 2001). According to Martini (1996), the definition of hearing loss is not the same for everybody and the different degrees of hearing loss are divided into categories. The most common categories of hearing loss are mild, moderate, severe and profound

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hearing losses.

**Mild hearing loss**

On average, the quietest sounds that people can hear with their better ear are between 25 and 40 dB. People who suffer from mild hearing loss have some difficulties keeping up with conversations, especially in noisy surroundings.

**Moderate hearing loss**

On average, the quietest sounds heard by people with their better ear are between 40 and 70 dB. People who suffer from moderate hearing loss have difficulty keeping up with conversations when not using a hearing aid.

**Severe hearing loss**

On average, the quietest sounds heard by people with their better ear are between 70 and 95 dB. People who suffer from severe hearing loss will benefit from powerful hearing aids, but often, they rely heavily on lip-reading even when they are using hearing aids. Some also use sign language.

**Profound hearing loss**

On average, the most quiet sounds heard by people with their better ear are from 95 dB or more. People who suffer from profound hearing loss face difficulty in hearing and rely mostly on lip-reading, and sign language.

According to Canadian Centre for Occupational Health and Safety (CCOHS), noise exposure can cause two kinds of health effects. These effects are non-auditory and auditory effects. Non-auditory effects include stress, related physiological and behavioural effects, and safety concerns. Auditory effects include hearing impairment resulting from excessive noise exposure. Noise-induced permanent hearing loss is the main concern related to occupational noise exposure. The main auditory effects include:

***Acoustic trauma***

Sudden hearing damage caused by short burst of extremely loud noise such as a gunshot.

***Tinnitus***

Ringing or buzzing in the ear.

***Temporary hearing loss***

This is also known as temporary threshold shift (TTS) which occurs immediately after exposure to a high level of noise. There is gradual recovery when the affected person spends time in a quiet place. Complete recovery may take several hours.

**Permanent hearing loss**

Permanent hearing loss, also known as permanent threshold shift (PTS), progresses constantly as noise exposure continues month after month and year after year. The hearing impairment is noticeable only when it is substantial enough to interfere with routine activities. At this stage, a permanent and irreversible hearing damage has occurred. Noise-induced hearing damage cannot be cured by medical treatment and worsens as noise exposure continues.

Though sound pollution is a serious matter, at the same time it is a threat to human health (Cohen et al., 1973; Green et al., 1982; Smagowska, 2013; Murphy and King, 2014). None or very few works has been performed on this aspect (Bhouyain and Uddin, 2012). All industrial areas are generally situated near residential areas in Bangladesh. Moreover, people established industries near the residential areas without considering about their future pollution problems. So, noise pollution is becoming a daily problem nowadays, and every day in newspaper editorial column, is this aspect is written. Therefore, an attempt was taken to measure the sound and observe its impact on the human health.

The main objectives of the present study are as follows:

1. To identify the sources of noise pollution in Chittagong.
2. To investigate the magnitude and intensity of sound in the mill area.
3. To identify any adverse effect on hearing faced by the workers of the mill.
4. To find out the relationship between noise pollution and its impact on hearing capacity.
5. A case study was conducted on randomly selected 12 workers of Amin Jute Mills Ltd and 12 workers of Gul Ahmed Jute Mills Ltd to evaluate the adverse effect of noise on hearing.

## MATERIALS AND METHODS

Chittagong is the second largest city of Bangladesh with a substantial, self-sustaining economic base. Different types of industries have grown there due to different reasons. Moreover, there are specific zones for industrial and residential growth in Chittagong. All mills and factories produce noise. It is also true for jute mills as well. When the machine runs it produce sound which is undesirable for the workers. Gradually, after many years of working

**Table 1.** Sound level of different sampling points in May, June, July, August, September and October, 2013.

| Spot | Amin Jute Mills Ltd. | | | | | | | | | Gul Ahmed Jute Mills Ltd. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | May(dB) | | | June (dB) | | | July(dB) | | | August (dB) | | | September (dB) | | | October (dB) | | |
| | Max | Min | Avg | Max | Min | Avg | Max | Min | Avg | Max | Min | Avg | Max | Min | Avg | Max | Min | Avg |
| Main gate | 80 | 76 | 78 | 81 | 75 | 78 | 81 | 75 | 78 | 85 | 70 | 77.5 | 85 | 75 | 80 | 89 | 75 | 82 |
| Mill gate | 92 | 86 | 89 | 92 | 85 | 88.5 | 90 | 88 | 89 | 91 | 85 | 88 | 90 | 87 | 88.5 | 92 | 85 | 88.5 |
| Inside the mill | 103 | 97 | 100 | 102 | 99 | 100.5 | 102 | 96 | 99 | 105 | 100 | 102.5 | 102 | 102 | 102 | 104 | 100 | 102 |
| Sound of siren | 108 | 105 | 106.5 | 108 | 108 | 108 | 109 | 108 | 108.5 | 109 | 108 | 108.5 | 108 | 106 | 107 | 108 | 105 | 106.5 |

they face hearing problems and may even turn deaf. During the present study, noise level was measured in Amin Jute Mills by sound level meter, once in every month from May to July, 2013; and in Gul Ahmed Jute Mills from August to September, 2013. The measuring spots were main gate (entrance of the mills), entrance of the factory in the mills, inside the mills and near the siren.

#### Amin Jute Mills Ltd.

Amin Jute Mills established in 1953, is a state owned Jute Mills. The total area of the jute mills is about 110 acres and has 4 units though one is already closed. Total workers are 5200 where male and female workers are 4917 and 283, respectively. Therefore, ratio of male and female is 17:1. Though, the main gate is located far away from the mill, there is always high sound when the machines run.

#### Gul Ahmed Jute Mills Ltd.

Gul Ahmed Jute Mills is located at Kumira, Sitakundu, Chittagong and was established in 1966. The total land area of this jute mills is about 51.48 acres. It has 1357 workers among them, 1217 are male and 140 female.

#### Measurement technique

Noise level was measured by a sound measuring meter (Sound Measuring Meter, Auto Ranging, TERMARS, IEC-61672, Made in Taiwan). Hearing capacity of worker was determined by producing different intensity of sound from a definite spot by using hand mike. Ten workers were selected from each mills of different working periods (6 months, 2, 5, 10 and 20 years) and 5 groups were made according to their working period, that is, two persons in each group. Then, another group of two normal persons (without working experience) were selected and added together with 10 workers of five groups. They were used as controll. The workers were placed in definite distance (5, 10, 20, 50, 100 and 200 feets) from where the sound (70, 90, 105 and 107 dB) were produced. Then, the responses of the workers were recorded whether they heard or not with yes or no marking. The study was conducted on Amin Jute Mills Ltd. and Gul Ahmed Jute Mills Ltd. separately and in every month a total of 12 different workers were selected for the study.

## RESULTS AND DISCUSSION

The average maximum and minimum noise level of different spots in different months are shown in Table 1. Table 2 shows the response data of randomly selected workers exposed to different sounds in different distance. Hearing capacity of workers with different working experience in two mills is shown in Table 2. The data on the table represents different intensity of sound at different sampling spots in different months from May to October, 2013.

### Amin Jute Mills Ltd.

During the study period, maximum and minimum noise level were recorded as 80 and 76 dB in main gate in the month of May (Table 1). In June, maximum and minimum noise levels were recorded as 81 and 75 dB in main gate (Table 1). In July, maximum and minimum noise levels were recorded as 81 and 75 dB in the main gate (Table 1). Average noise levels were 78, 78 and 78 dB in the month of May, June and July in Amin Jute Mills Ltd (Table 1).

In Mill gate, maximum and minimum noise level were recorded as 92 and 86; 92 and 85 and 90 and 88 dB in the month of May, June and July in Amin Jute Mills Ltd. (Table 1). Average sound levels were 89, 88.5 and 89 dB in the month of May, June and July in Amin Jute Mills Ltd (Table 1). Inside the mill of Amin Jute Mills Ltd, maximum and minimum noise level were recorded as 103 and 97; 102 and 99; 102 and 96 dB in the month of May, June and July (Table 1). Average sound levels were 100, 100.5 and 99 dB in the month of May, June and July inside the mill of Amin Jute Mills Ltd (Table 1).

Sound of siren in Amin Jute Mills Ltd. maximum and minimum sound level were 108 and 105 dB; 108 and 108 dB; and 109 and 108 dB in the month of May, June and July (Table 1). Average sound levels were 106.5, 108 and 108.5 dB in the month of May, June and July sound of siren in Amin Jute Mills Ltd (Table 1).

During the second experimental study at Amin

**Table 2.** Data showing hearing capacity of workers with different working experience in different sound level.

| Amin Jute Mills Ltd | | | | | | | | | Gul Ahmed Jute Mills Ltd | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Months | Sound level | Distance | Working period | | | | | | Months | Sound level | Distance | Working period | | | | | |
| | | | Normal | 6 months | 2 years | 5 years | 10 years | 20 years | | | | Normal | 6 months | 2 years | 5 years | 10 years | 20 years |
| | | 5 Feet | Y | Y | Y | Y | Y | Y | | | 5 Feet | Y | Y | Y | Y | Y | Y |
| | | 10 Feet | Y | Y | Y | Y | N | N | | | 10 Feet | Y | Y | Y | Y | N | N |
| May | 70 dB | 50 Feet | Y | Y | Y | Y | N | N | Aug | 70 dB | 50 Feet | Y | Y | Y | Y | N | N |
| | | 100 Feet | Y | Y | N | N | N | N | | | 100 Feet | Y | Y | Y | N | N | N |
| | | 200 Feet | Y | N | N | N | N | N | | | 200 Feet | N | N | N | N | N | N |
| | | 5 Feet | Y | Y | Y | Y | Y | Y | | | 5 Feet | Y | Y | Y | Y | Y | Y |
| | | 10 Feet | Y | Y | Y | Y | N | N | | | 10 Feet | Y | Y | Y | Y | N | N |
| June | 90 dB | 50 Feet | Y | Y | Y | Y | N | N | Sept | 90 dB | 50 Feet | Y | Y | Y | Y | N | N |
| | | 100 Feet | Y | Y | N | N | N | N | | | 100 Feet | Y | Y | N | N | N | N |
| | | 200 Feet | Y | N | N | N | N | N | | | 200 Feet | Y | N | N | N | N | N |
| | | 5 Feet | Y | Y | Y | Y | Y | Y | | | 5 Feet | Y | Y | Y | Y | Y | Y |
| | | 10 Feet | Y | Y | Y | Y | Y | Y | | | 10 Feet | Y | Y | Y | Y | Y | Y |
| July | 105dB | 50 Feet | Y | Y | Y | Y | Y | N | Oct | 107 dB | 50 Feet | Y | Y | Y | Y | Y | N |
| | | 100 Feet | Y | Y | Y | Y | N | N | | | 100 Feet | Y | Y | Y | N | N | N |
| | | 200 Feet | Y | Y | N | N | N | N | | | 200 Feet | Y | Y | N | N | N | N |

Jute Mills Ltd in the month of May, as shown in Table 2, in 70 dB sound production, the workers having 6 months working period heard all sounds except from 200 ft like the normal persons. But 2, 5, 10 and 20 years workers did not hear the sound from 200 and 100 ft away, respectively, whereas, 20 and 10 years working experience workers did not hear the sound from 10 and 50 ft away. From 5 feet, all the workers heard the sound.

Similarly, in Amin Jute Mills Ltd., during the month of June as shown in Table 2, in 90 dB sound intensity, the worker having 6 months working experience heard all the sounds except from 200 ft but 2, 5, 10 and 20 years workers did not hear from 200 and 100 ft, respectively. From 5 ft, all the workers heard the sound.

Lastly, in the month of July (Table 2), in 105 dB sound production, all the workers heard all sounds like normal persons, 5 and 10 ft away. But 2, 5, 10 and 20 years workers did not hear from 200 and 100 ft, respectively.

More or less similar results were also observed in Gul Ahmed Jute Mills Ltd. during the present study in August, September and October, 2013 (Table 2).

## Gul Ahmed Jute Mills Ltd

In Gul Ahmed Jute Mills Ltd. at the main gate, the maximum and minimum noise level were recorded as 85 and 70 dB; 85 and 75 dB and 89 and 75 dB in the month of August, September and October (Table 1). The average sound levels were 77.5, 80 and 82 dB in the month of August, September and October in Gul Ahmed jute Mills Ltd (Table 2).

In the same mills, in the Mill gate, the maximum and minimum noise level were recorded as 91 and 85; 90 and 87; 92 and 85 dB in the month of August, September and October (Table 1). Average noise levels were 88, 88.5 and 88.5 dB in the month of August, September and October in Gul Ahmed Jute Mills Ltd in mill gate (Table 1).

Inside the mill of Gul Ahmed jute Mills Ltd, the maximum and minimum noise level were recorded as 105 and 100; 102 and 102; 104 and 100 dB in the month of August, September and October (Table 1). Average noise level were 102.5, 102

**Table 3.** Limit of standard level of noise allowed by the Bangladesh Environmental Conservation act. 1997.

| S/N | Category of areas | Standard determined at day (in dB) | Standard determined at night (in dB) |
|---|---|---|---|
| 1 | Silent zone | 45 | 35 |
| 2 | Residential Area | 50 | 40 |
| 3 | Mixed area. (mainly residential also used for commercial and industrial purposes) | 60 | 50 |
| 4 | Commercial area | 70 | 60 |
| 5 | Industrial area | 75 | 70 |

and 102 dB in the month of August, September and October inside the mill of Gul Ahmed Jute Mills Ltd (Table 1).

Sound of siren in Gul Ahmed jute Mills Ltd. maximum and minimum noise level were recorded as 109 and 108; 108 and 106; 108 and 105 dB in the month of August, September and October (Table 1). Average noise levels were 102.5, 102 and 102 dB in the month of August, September and October for noise of siren in Gul Ahmed Jute Mills Ltd (Table 1).

During the second experiment in Gul Ahmed Jute Mills Ltd., it is observed that in the month of August (Table 2) in 70 dB sound, workers with 6 months working experience heard all sounds except from 200 ft; but 2, 5, 10 and 20 years workers did not hear from 200, 100, 10 and 10 ft, respectively. From 5 ft, all workers heard the sound and from 200 ft, no worker could hear it.

Similarly, in the month of September (Table 2), in 90 dB sound, workers with 6 months working experience heard all sound except from 200 ft but 2, 5, 10 and 20 years workers did not hear from 100, 100, 10 and 10 feet, respectively. From 5 ft, all workers heard the sound.

In the same mill during the month of October (Table 2), in 107 dB sound intensity, the worker having 6 months working experience heard all sounds but 2, 5, 10, 20 years workers did not hear from 200, 100, 100 and 50 ft, respectively. From 5 ft, all workers heard the sound and from 200 ft, no worker could hear it except 2 years workers.

So, from the study it is clear that in both mills in all sampling point, the intensity of sound is higher both inside and outside the mills (mills entrance). The intensity of sound is so high that it always exceed the limit of standard level of Bangladesh Environmental Conservation Act 1997, shown in Table 3 (Bhouyain, 2001).

Similar study also conducted by Mohammadizadeh (2015) in flour factory and showed similar effect of hearing loss in Lamerd City. He also concluded that this loss is permanent and irreversible. Yongbing and Martin (2013) concluded that hearing loss and tinnitus are most common effect of noise pollution in China. Basner et al. (2014) stated that hearing loss leading to inability to understand speech in everyday situation can have a severe social effect. Present investigation suggests extending the study on other mills such as steel mills, paper mills, dying mills, garments industries, etc. These mills produce more noise than the jute mills. So, it is utmost necessary to take immediate measures to save the workers from such pollution hazard.

Again, from the earlier mentioned study, it may be concluded that with the working age, the workers of these two mills lost their ability to hear; as a result, the older worker could not hear sound from a 10 ft distance. Same result was recorded in both mills during this study.

If engineering and work practice controls do not reduce employee's exposure to workplace noise to acceptable levels, employees must wear appropriate hearing protection. It is important to understand that hearing protectors reduce only the amount of noise that gets through to the ears. Some types of hearing protection include:

1. Single-use earplugs are made of waxed cotton, foam, silicone rubber or fiberglass wool. They are self-forming and, when properly inserted, they work as well as most molded earplugs.
2. Pre-formed or molded earplugs must be individually fitted by a professional and can be disposable or reusable. Reusable plugs should be cleaned after each use.
3. Earmuffs provides a perfect seal around the ear. Glasses, facial hair, long hair or facial movements such as chewing may reduce the protective effect of earmuffs.

## Conclusion

Noise pollution is a serious but neglected issue in Chittagong City and other big cities of Bangladesh. It causes health hazard. From the present study, it has been observed that sound level was above the permissible limit in Amin Jute Mills and Gul Ahmed Jute Mills. So, necessary actions are needed to be taken by the concerned authorities (Department of Environment (DoE) and others) to reduce the sound level. The findings

of this study should be taken into consideration by the decision makers in formulating policies and guidelines regarding the control of noise pollution and the hearing problem of mill workers. The Government and their authorized organizations like DoE should also provide all necessary supports to them and must take immediate measures to overcome the problem. This is the proper time to build social movement and create extensive awareness against sound pollution like other environmental pollution. Prevention is better than cure is a wise saying. So this is the right time to control the noise pollution.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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