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NOISE POLLUTION MONITORING AT DIFFERENT PLACES IN TANGAIL MUNICIPAL AREA, BANGLADESH

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Abstract

The study was intended to examine the noise levels at different places of Tangail Municipal Area (TMA). The Tangail municipality is an urbanized and noisy area whereas the inhabitants do not have the sufficient conceptual knowledge about noise pollution and its impacts on health and the surrounding environment. The noise levels of more than fifty different locations were measured with the help of Multi-Function Environmental Meter, Model: ST-8820, at 6:00 AM to 9:00 PM (day) and 9:00 PM to 6:00 AM (night). The sampling points were the Porabari, Santosh, Kagmari, Santikunja, Niralamor, district gate, old bus stand, different health care centers, educational institutions, industries etc., which represents the residential, commercial, mixed, industrial and silent area respectively. It was clearly revealed from the study that traffic is the predominant source of noise pollution in Tangail Municipal Area. The study identified the major effects of noise pollution including deafness, headache, stroke, anxiety and nerve damage. The study constitutes a neutral position for our future noise observatory in TMA and will therefore make it possible to better assess the impact of noise pollution.

Keywords: Deafness, Noise level, Industries, Silent area, Pollution

Introduction

Noise is defined as unwanted sound, which is the result of pressure changes in a medium (usually air), caused by vibration or turbulence. The amplitude of these pressure changes is stated in terms of sound level and the rapidity with which these changes occur. The intensity of sound is measured in sound pressure levels (SPL) and common unit of measurement is decibel (dBA). Many scientists doing research on the cause and problem of noise pollution in many cities throughout the world (Li *et al.,* 2002; Morillas *et al.*, 2005; Alberola, 2005) and have shown the scale of discomfort that noise causes in people's lives (Ali and Tamura, 2003). The inhabitants of major cities in Bangladesh are the main victims of noise pollution, which is a growing concern now a day in the country (Mollah, 2010). The main sources of noise pollution of the town include transport system, industries, construction activities, market, sound system and advertisement (Rouf and Jahan, 2007).

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Noise originates in all sorts of ways, but in general, increasing noise pollution is largely the result of the increasing population (Ahmed and Tanveer, 2010). Noise has a significant impact on the quality of life (WHO, 1980). Effects are seldom catastrophic and often only transitory, but adverse effects can be cumulative with prolonged or repeated exposure. Hearing loss due to noise pollution usually takes years to develop. Noise induced hearing loss can indeed impair the life, through a reduction in the ability to hear important sounds and to communicate with family and friends (Evans and Hygge, 2000). When combined with presbycusis i.e., hearing loss naturally occur with the age; the result is a premature impairment that grows inexorably with age. Long-lasting, high-level sounds have the most damaging characteristics to affects hearing system (Stansfeld *et al.*, 2000; Passchier and Passchier, 2000). The effects of noise on human health are divided into four categories; physical effects, such as hearing defects; physiological effects, such as increased blood pressure, irregularity of heart rhythms and ulcers; psychological effects, such as disorders, sleeplessness and going to sleep late, irritability and stress; and finally effects on work performance, such as reduction of productivity and misunderstanding (Quis, 2001; Marius, 2005). The objectives of the study were to determine the noise level at different locations of TMA; to detect the problems originating from noise pollution and to find out the highest noise level area in TMA.

Materials and Methods

Study area: Tangail is situated at the northern side of Dhaka city. The study was conducted in Tangail Municipal Area (TMA), which consists of l8 wards and 63 mahallas. The area of the town is about 35.22 km^2 (Fig. 1) and it has a total population of 1, 28,785 including 66,856 males and 61,929 females (TMAR, 2006).

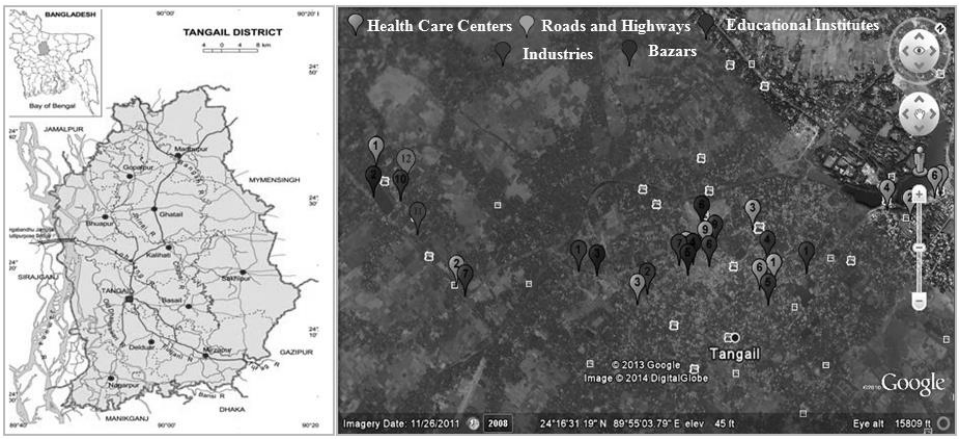

Fig. 1. Map showing the study area and sampling locations in the Tangail Municipality (Source: Banglapedia, 2008; Google Earth).

Data Collection: The noise levels of more than 50 locations were measured through standard procedure by using the calibrated sound level meter at 6:00 AM to 9:00 PM

(day) and 9:00 PM to 6:00 AM (night) during the working days. The GPS data were collected by GPS meter (Magellan, made in USA) from the sampling locations and plotted on the Google Earth based on the GPS reading (Fig. 1). Primary data were collected from different bazars, bus stand, highways, road crossing, residential area, industrial area, hospitals, educational institutes etc. in the TMA. Apart from the primary data collection secondary data were collected from relevant journals, scientific articles, relevant reports and from the web based information.

Measurement of noise: In this study noise levels were measured by a sound level meter (Multi-Function Environmental Meter, Model: ST-8820, made in China), which consists of a microphone that converts the pattern of sound pressure fluctuations into a similar pattern of electric voltage, amplifiers and a voltage meter that is normally calibrated to read in decibel.

Average Noise level (L): The noise levels are to be logarithmically averaged. Average of L_1, L_2, ..., L_n = L (say).

$$L = 10 \times \log10 ([10^{L_1/10} + 10^{L_2/10} + ……..+10^{L_n/10}] / N)$$

Where,

L= Average noise level, dBA

$L_{1,\ 2,\ ….., n}$ = Observed noise levels from 1 to n^{th} observation, dBA

N= Total number of observed noise level (Patel *et al.,* 2013).

Day-night equivalent noise levels (Ldn): The day-night equivalent noise levels of a community can be expressed as -

$$Ldn, dBA = 10 \times \log_{10} [15/24 (10^{Ld/10}) + 9/24 (10^{(Ln + 10)/10)}]$$

Where, Ld = day equivalent noise levels (6AM - 9 PM), dBA

Ln = night equivalent noise levels (9 PM - 6 AM), dBA

The day hours in respect to assessment of noise levels, is fixed from 6 AM - 9 PM (i.e. 15hrs) and night hours from 9 PM - 6 AM (i.e. 9 hrs). A sound level of 10 dBA is added to Ln due to the low ambient sound levels during night for assessing the Ldn values (Patel *et al.,* 2013).

Field and population selection: A questionnaire was prepared considering the possible aspects of noise pollution. Interviewing method was applied to collect information and randomness was strictly ensured for better output. Data were collected from the students, teachers, drivers, traffic police, passengers, doctors, daily labors and the local people of different places in TMA to identify the cause and effects of noise pollution as well as remedial or controlling measure.

Result and Discussion

The noise level of sensitive places such as health care centers was measured inside the health care centers whereas the highest average noise level was found 89.7 dBA at *General Hospital* and the lowest was 63.8 dBA at *Aysha Khanom Memorial Hospital* during day time (Fig. 2). The average noise level of all the health care centers during the day time was recorded as 76.1 dBA (Table 1). The result of the study revealed that all the values of noise levels were exceeded the day noise level (35 dBA) (WHO, 1980), which is probably due to all the health care centers are situated very near to rush traffic area.

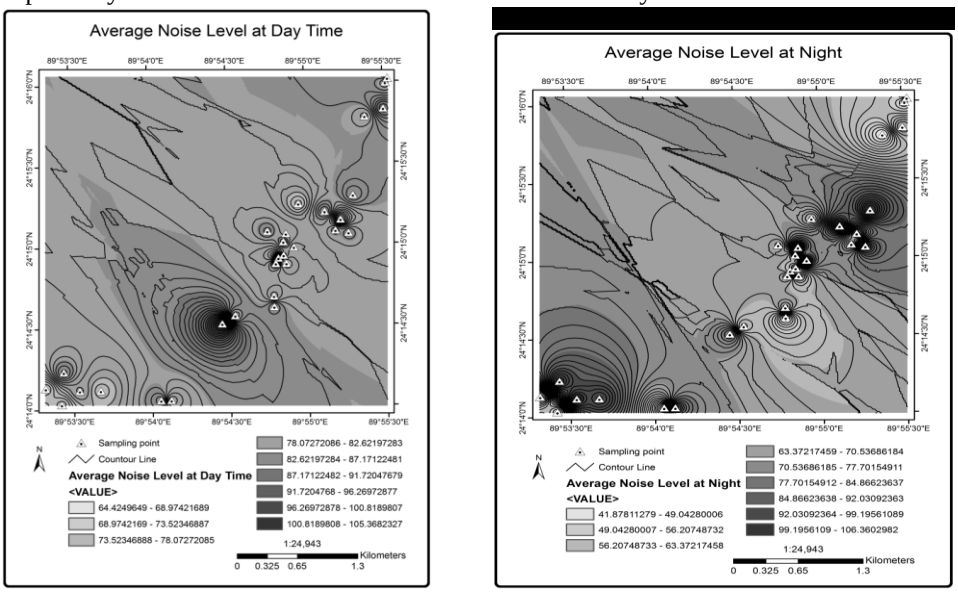

Fig. 2. Average Noise level map at various stations of TMA.

Table 1. Noise level at different health care center in TMA

Sl No.	Health care centers	Average Noise level (L): (dBA)		Ld	Ln	Ldn
		Day	Night			
	Sheba Clinic and Hospital	72.2	59.2	82.35	61.75	80.53
1	General Hospital	89.7	68.1			
2	Dhaka Clinic	75.6	61.3			
3	Apollo Hospital	71.4	52.6			
4	Dhaleswari Hospital	79.7	57.4			
5	Sonia Nursing Home	80.3	48.2			
6	Aysha Khanom Memorial Hospital	63.8	60.2			
Mean ± Standard deviation		76.1 ± 8.2097	58.1 ± 6.3848			

Noise levels inside the class room of 13 educational institutes were measured during the class time and after the class time respectively. During class time the highest noise level (86.2 dBA) was recorded in *Shahin school coaching* and the lowest noise level (76.3

dBA) was recorded in *Santosh Jhannobi Govt. School* (Fig. 2). The study showed that the noise level after the class time of most of the institutes was observed higher than that of during class time (Table 2). The result of the study revealed that all the values of noise levels during and after class time was exceeded the day time noise level of 35 dBA (WHO, 1980) (Table 6).

Table 2. Noise level at different Educational Institute in TMA

Sl.No.	Educational institutes	During class(dBA)	After class(dBA)
1	Sristy School	86.1	106.4
2	Sristy College	82.5	102.7
3	Sristy College Academy	79.6	96.7
4	Shahin School Coaching	86.2	104.5
5	Shibnath School	84.1	98.6
6	M. J. Mahmudul Hasan College	79.4	95.2
7	Mawlana Mohammad Ali College	78.1	94.8
8	Korotia Sadat College	76.5	98.4
9	Bindu Basini Boys School	81.6	102.9
10	Santosh Rani Dinmoni Govt. School	80.2	104.1
11	Santosh Jhannobi Govt. School	76.3	100.2
12	IB Govt. Children School	85.3	101.8
13	Kagmari Govt. School	83.3	98.62
Ld		82.64	101.73
Mean ± Standard deviation		81.5 ± 3.44	100.4 ± 3.68

During the study period the noise level inside the seven industries in TMA was measured (Table 3) (Fig. 2). The result of the study identified that noise levels of these industries were exceeded the standard levels (75 dBA and 90 dBA) as defined by the DoE, 1997 and WHO, 1980 respectively (Table 6).

Table 3. Noise level at different industries in TMA

Sl No.	Industries	Average Noise level (L): (dBA)		Ld	Ln	Ldn
		Day	Night			
	Baby Stand Saw Mill	105.4	82.3			
1	Santikunja Soap Factory	78.4	71.2			
2	Alauddin Textile Mill	102.7	96.3			
3	Kagmari Rice Mill	79.4	70.3			
4	Jamuna Bread and Biscuit Factory	93.5	81.7	99.07	88.20	100.68
5	A One Bread and Biscuit Factory	85.3	65.4			
6	Barnali Bread and Biscuit Factory	87.3	72.4			
Mean ± Standard deviation		90.3 ± 10.6960	77.1 ± 10.4632			

The noise level of roads and highway in TMA was measured at 5 meters away from the source (Table 4). The average highest and lowest noise level was found at *Ashikpur* bypass (95.9 dBA) and *Santosh* (73.2 dBA) respectively during the day time (Fig. 2).

This is because in *Santosh* the numbers of vehicles were lower than that of *Ashikpur* bypass. The study showed that most of the recorded values were much higher than the standard values of DoE, 1997 (50 dBA) (Table 6).

Table 4. Noise level at different roads and highways in TMA

Sl. No.	Roads and highway	Land use type	Average Noise level (L): (dBA)		Ld	Ln	Ldn
			Day	Night			
1	Santosh	Residential	73.2	42.3	90.46	61.21	88.45
2	Kagmari Mor		85.9	41.5			
3	Shanti Kunja Mor	Mixed	85.1	43.1			
4	District Gate		80.7	45.8			
5	New Bus Stand		86.4	62.4			
6	Old Bus Stand		83.8	63.6			
7	Korotia bypass		91.9	55.3			
8	Jamurki bus stand		93.9	49.1			
8	Nirala Mor	Commercial	85.4	51.6			
10	Rabna bypass	Industrial	93.9	68.2			
11	Ashikpur bypass		95.9	65.1			
	Mean ± Standard deviation		86.92 ± 6.682	53.45 ± 9.975			

During the study period noise levels at six bazars of TMA was measured whereas the highest noise level was recorded in *Park bazar* and the lowest was in *Porabari (*Fig. 2*)*. The figures were 84.5 dBA and 71.3 dBA respectively (Table 5). The study depicted that the reason behind lower noise levels in *Porabari* and *Santosh* were the less number of vehicles whereas in other places it was found significantly higher.

Table 5. Noise level at bazars in TMA

Sl. No.	Bazars	Average Noise level (L): (dBA)		Ld	Ln	Ldn
		Day	Night			
1	Porabari	71.3	43.5	80.52	57.02	81.49
2	Santosh	73.5	52.1			
3	Baby stand	81	57.2			
4	Pachani	82.6	51.4			
5	Choyani	77.1	49.3			
6	Park	84.5	63.2			
Mean ± Standard deviation		78.33 ± 5.247	52.78 ± 6.763			

Table 6. Comparison of noise level of TMA with the standard level

Sectors	Present study		Bangladesh standard (dBA)			WHO standard (dBA)		
	Night	Day	Night	Day	Average	Night	Day	Average
Hospital	58.1	76.1	n/a	n/a	n/a	20	35	27.5
Class room	91		n/a	n/a	n/a	30	40	35
Industry	77.1	90.3	70	75	72.5	80	90	85
Residential area	41.9	79.5	40	50	45	n/a	n/a	n/a
Mixed area	53.2	87	50	60	55	n/a	n/a	n/a
Silence Area	55.3	67.7	35	45	40	n/a	n/a	n/a
Commercial Area	51.6	85.4	60	70	65	n/a	n/a	n/a

Note: Day time (6:00 AM to 9:00 PM), Night time (9:00 PM to 6:00 AM) and the region within the radius of 100 meter from the school and hospital is called the silence zones/ area. (DoE, 1997; WHO, 1980).

Among the health care centers, Islam *et al.* (2013) found the highest noise level 85.5 dBA at general hospital in the year 2011 whereas this study showed that the noise level is increased to 89.7 dBA at the same place. In addition, this study found the highest noise level at shahin school coaching during the class time (86.2 dBA) and after the class time (104.5 dBA) whereas the conducted by Islam *et al.*, found the highest noise level at town govt. school during the class time (82.2 dBA) and after class time (103.5 dBA). Moreover, among the industries Islam *et al*., found the maximum noise level (103.8 dBA) at *Sapon Timber and Saw mill* but this study recorded the highest noise level at *Baby Stand Saw Mill*. This is because *Baby Stand Saw Mill* is situated very close to the rush traffic. In this study the highest noise level was found at ashikpur bypass (98.2 dBA), which exceeded the previous study as well as acceptable noise level defined by WHO, 1980. Furthermore, among the bazars, Islam *et al.*, found the highest noise level at *park bazar* (82.3 dBA) and this study demonstrated that the noise level of *park bazar* is increased to 84.5 dBA in the year 2013. This study concluded that the noise level at different places in TMA is increasing day by day mainly due to the increasing number of motor vehicles.

The results of the survey conducted in TMA in 2013 identified road traffic as the major source of noise pollution (50%) followed by Easy bike (20%) and rickshaw (15%) (Fig. 3). The study also identified the major effects of noise pollution including deafness (35%) followed by both headache and stroke (20%), anxiety (15%) and nerve damage (10%) (Fig. 3). In terms of controlling the noise pollution in a significant way the study identified different measures such as adopting new technologies (35%), driving experience (30%) and public awareness (25%) (Fig. 4).

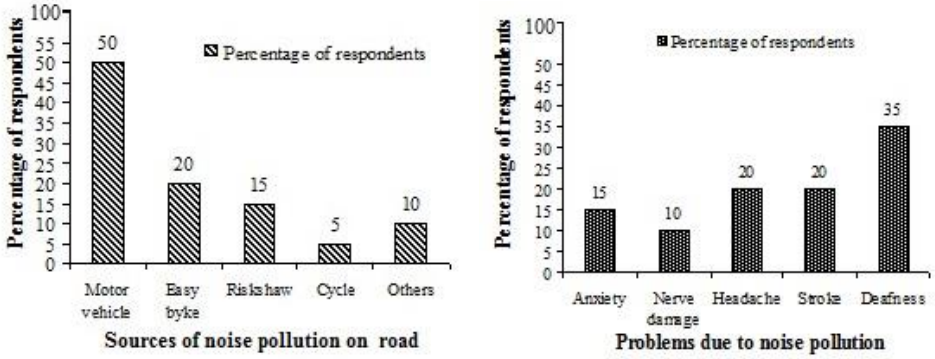

Fig. 3. Sources and effects of noise pollution in TMA.

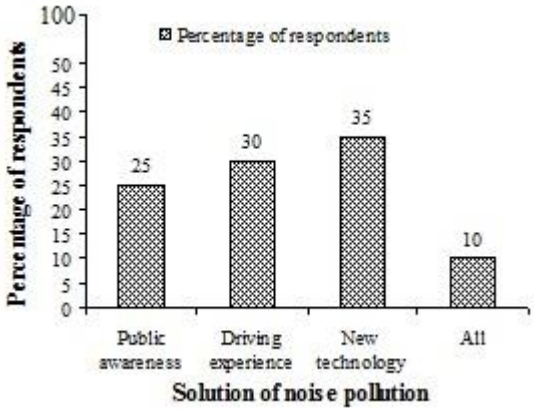

Fig. 4. Control of noise pollution.

Conclusion

Noise pollution is emerging as one of the major environmental problems in Tangail Municipal Area. Often neglected, noise pollution adversely affects the human being leading to deafness, headache, stroke, anxiety and nerve damage. The indiscriminate exposure of noise pollution in TMA becomes one of the main problems for the pregnant, old man, children as well as others. Either unintentionally or accidentally, every one contributes to noise pollution. This is because most of our day-to-day activities generate some noise. The people staying in noisy area especially above 70 dB should take precautionary measures in order to avoid noise induce hearing loss and other associated health impacts. As noise level is increasing day by day in different places of TMA, therefore, this study recommends different activities to reduce noise pollution such as by relocating educational institutes and hospital to a sound environment, review of environmental polices related to noise pollution, penalties for rules breaking and rising awareness of the people and drivers.

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