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Physical and Cardiovascular Implications of Noise Pollution prevailed in Thoothukudi the Industrial City, Tamilnadu, India.

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Abstract: The aim of the present study was to assess the biological implication of noise pollution that is prevailed in Thoothukudi city, a major port city, head quarters of Thoothukudi District, located in the east coast of India. Some physical problems such as the Body pain, Head ache, Sleeplessness and Cardiovascular problem such as the Blood pressure of the individuals living along the road side were observed using a standardized questionnaire and the Sphygmomanometer. A total of 109 people including both sexes, reside on the road side of heavy Traffic zones of Thoothukudi turned up to this experiment. The result of this study showed that the general body pain and head ache were more common among people and both the systolic and diastolic, pulse pressure and arterial pressure were also increased among the observed cases irrespective of sex and age of the individual. The increased Blood pressure among the people may resulted in other type of cardiovascular complications in their part of the life.
Keywords: Noise pollution, Blood pressure, Sphygmomanometer, Pulse pressure, Mean arterial pressure.

Introduction

Noise pollution is becoming increasingly more severe in industrial cities and the cost of alleviating it in future years is expected to be insurmountable[1]. Prevalence of noise is implicated in various illness of human and it is responsible for increased morbidity associated with modern life style. Non-auditory physical health effects that are biologically plausible in relation to noise exposure and annoyance from noise exposure include changes in blood pressure, heart rate, and levels of stress hormones[2,3]. Elevated workplace noise and other noise in the environment can cause hearing impairment, hypertension, ischemic heart disease, annoyance, sleep disturbance, and decreased work performance[4-6]. Changes in the immune system and birth defects have been attributed to noise exposure, but evidence is limited[7].

Some noise experts have investigated the acute affects of short term loud noise on blood pressure and other cardiovascular parameters. Most of the studies have shown a rise in systolic and/or diastolic blood pressure[8], while some of the research scientists observed negative association between blood pressure and noise[9,10]. Hypertension is a very important public health issue because hypertension is a major risk factor for premature death and disability from heart attack, heart failure, stroke, and many other afflictions[11,12]. High blood pressure or hypertension is the most important and ubiquitous risk factor for heart attack and stroke, the leading causes of death worldwide. People's occupation, working environment, and their dietary habit have

varying impact on their blood pressure[13-17]. The high level noise caused by heavy machines is one of the most important effects on the human health[18-21].

The operators who operate machines spend most of the working hours under high level noise. Depending on the level and duration of noise effect, the physiologic and psychological health problems can be observed on the employees, who work in an environment with high level of noise for long period of time[22,23]. The previous studies and observations indicated that the most common physiologic health problems are hearing impairment, high blood pressure, heart diseases, and breathing problems, while the psychological problems may include uneasiness and nervousness[24,25]. These health problems also result in reduction in productivity and motivation of the workers depending on the level and duration of noise[26-28].

Materials and Methods

The Blood pressure of the individuals was checked before exposure to noise and immediately after the state of production of noise. The Blood pressure of the people was carefully noted using mercury type Sphygmomanometer. Blood pressures of the subjects were measured after a five-minute period of rest, with the back supported and the legs uncrossed. Constrictive clothing was removed from around the upper arm, and it was rested on a table at heart level. The blood pressure cuff was evenly and snugly applied around the upper arm above the elbow, and the stethoscope was placed over the crease of the elbow. The cuff was inflated to 15 millimeters of mercury (mmHg) above the point where radial artery pulse (the artery above the thumb at the wrist) disappears. The pressure in the cuff was then slowly released at 2 mmHg per second. The first of two consecutive sounds as cuff pressure decreases was called the systolic blood pressure the pressure to open the artery occluded with the cuff. The diastolic blood pressure was recorded at the absence of sounds with continued deflation of the blood pressure cuff. Blood pressure was generally recorded to the nearest 2 mmHg.

Result and Discussion

In order to study the impact of sound pollution on the clinical aspect of the people, the Blood pressure of the road side dwellers was observed during the peak hours of morning and evening and the observed values were represented in Table 3 and 4. The other physical disturbances that are developed among the general public was also evaluated using a standardized questionnaire and the results obtained were illustrated in Table 1 and 2. About 34.9% of the people dwelling on road side had disturbed sleep during night time and about 31.24% of people were affected by severe insomnia (Table 1). The observed Sleep disturbance among the general public during the present study mainly due to the Heavy Traffic that is playing through their living place [5,6,29] and the heavy sound generated from them while playing[30,31].

About 42% of the people were affected by severe Head ache all the time and 77.98% had general Body pain throughout the day. The other disorders observed were Neck pain (26.6%), Irritability (45.9%), and irritation of the ears (51.8%) (Table 2), all these physical disorders observed among the public are mainly due to the heavy noise pollution that is prevailed in Thoothukudi city throughout the day. When the people are repeatedly exposed to the sound pollution for years together the physical disorders may be turned to physiological and pathological disorders. The physiological impact of sound pollution on general public showed that about 41% of the road side dwellers of Thoothukudi had increased Blood pressure[3] and 21% of people had the Diabetic condition (Table 2). The main causative factors for diabetic condition and the Blood pressure observed among the public were due to the stressful noisy environment that is prevailed in the city limit. Both the Systolic and Diastolic pressure showed the increasing trended accordingly the Heart rate and Pulse pressure were also increased in most of the cases (>50%).

Table 1. The number and percentage of insomnia cases observed among the people residing near the Study Area of Thoothukudi city

S.No	Sleeping Status	Male	Female	Total (%)
1	**Sound Sleep**	9 (34.6)	28 (33.7)	33.90
2	**Disturbed**	8 (30.8)	30 (36.2)	34.86
3	**Insomnia**	9 (34.6)	25 (30.1)	31.24
Total		**26 (100)**	**83 (100)**	**100**

Table2. The number and percentage of Physical and Physiological disorders observed among the people residing near the Study Area of Thoothukudi city

S.No	Disorders	Male	Female	Total (%)
1	**Head ache**	18 (69.2)	28 (33.7)	**42.20**
2	**General Body pain**	22 (84.6)	63 (75.9)	**77.98**
3	**Neck pain**	11 (42.3)	18 (21.7)	**26.61**
4	**Irritability**	18 (69.2)	32 (38.6)	**45.87**
5	**Diabetes**	9 (34.6)	14 (16.9)	**21.10**
6	**Blood Pressure**	11 (42.3)	34 (41)	**41.28**
7	**Irritation to the ears**	14 (53.8)	43 (51.8)	**52.29**

Table 3. Shows the Blood Pressure cases observed among the people residing near Study Area during peak hours. The mean Bp observed and the percentage affected also given in the table.

Time	Sex	Normal BP 118-122/ 80-85		Low BP 113-118/ 70-75		High BP 130-138/ 93-103		Very High BP 138-145/ 103-112		Total Bp cases observed
		No	Mean	No	Mean	No	Mean	No	Mean	No
8-9am	M (n=26)	13 (50)	125.7 ±0.54 87 ±2.75	2 (7.7)	113.2 ±1.34 72.3 ±1.0	4 (15.4)	131.11 ±2.2 93.3 ±5.0	7 (26.9)	140.0 0 97.62 ±4.86	11 (42.3)
	F (n=83)	41 (49.4)	123.5 ±2.2 85.62 ±3.96	8 (9.6)	112.8 ±1.47 73.1 ±1.13	11 (13.3)	130.52 ±1.55 91.46 ±3.76	23 (27.7)	141.29 ±2.21 103.43 ±5.26	34 (41)
5-6pm	M (n=26)	13 (50)	126.1 ±0.48 87 ±2.75	2 (7.7)	113.8 ±1.51 ±73 ±1.11	4 (15.4)	134.4 ±2.95 98.5 ±3.97	7 (26.9)	143.3 ±2.82 103 ±5.63	11 (42.3)
	F (n=83)	41 (49.4)	123.7 ±2.1 85.5 ±3.98	8 (9.6)	112.9 ±1.61 74 ±1.33	11 (13.3)	133 ±2.59 97.3 ±5.89	23 (27.7)	143.4 ±2.79 104 ±5.41	34 (41)

The mean Blood pressure values indicated that among the people of Thoothukudi around 50% of them had normal Blood pressure[32-34] while the remaining 50% had the altered Blood pressure status. About 7.7% of males and 9.6% of females had low Blood pressure and 42.3% of males and 41% of females had high Blood pressure[3]. The increased Blood pressure level observed among the people are mainly influenced by the sound pollution that is prevailed in Thoothukudi. Even though there are several physical, physiological, chemical and psychological stress factors are responsible for the development of high Blood pressure among people, the high sound level in the atmosphere further aggrevated the condition (Table 3).

The mean systolic and diastolic pressure observed among the people showed a significant increase in all the areas[35-39] of study when compared to the control. The increased percentage of mean systolic pressure observed among people than the control ranged between 3% in people of Silent Zone, 5.8% in Commercial Zone and 20% in Heavy Traffic Zone respectively. The increase in systolic pressure percentage was 10% in Silent Zone, 12.9% in Commercial Zone and 33.76% in Heavy Traffic Zone respectively. In relation to the increased blood pressure, the pulse pressure and calculated mean arterial pressure also showed (Table 4) a significant increase[40-42]. Therefore it could be concluded from the observations that, the raise in the Blood pressure and other related parameters in Thoothukudi are

mainly due to the increased sound level in the atmosphere[3]. In the study area there was a positive association between the exposure of people to high noise level and high blood pressure[40]. the increased blood pressure and prevalence of noise level >80dB in the study area in due course resulted in Cardiovascular disorders among the people[43]. It was found that the people living very close to large sound producing area such as Heavy Traffic Zone, Airport, heavy duty industries and so on having been diagnosed with high Blood pressure[44-46].

The actual mechanism responsible for increase in Blood pressure and Heart rate is not yet completely understood so far. A few factors are known to explain this increase. The peripheral vascular resistance increase and banoreflex sensitivity is not suppressed during intermittent noise exposure[37]. It was proved that rise in Blood pressure due to noise exposure was sympathetically mediated in animals[47]. The increased noise level alters the hormonal system especially the adrenal system resulted in increased urinary excretion of epinephrine, nor-epinephrine, dopamine and cardisol in subjects exposed to high noise level[46,48]. The catecholamine released from adrenal medulla as a result of activation of adrenergic system, the effect of suprarenal gland steroids, angio-tensin and also the direct effect of noise on arterial wall tension influences the blood pressure and heart rate.[49] Stimulation by noise, through sympathetic nervous system, causes an elevation of blood pressure by an increase in total peripheral resistance and myocardial contractility[49]. The repeated stimulation with noise could then accelerate the development of structural vascular changes in the peripheral resistance vessels and by this mechanism create a permanent blood pressure elevation to hypertensive levels[50]. Based on all these primary findings it might be suggested that the noise may be related to marked activation of the Neuro-endocrine system, resulting in increase in Blood pressure and Heart rate.

Table 4. Mean Systolic and Diastolic Blood Pressure, Pulse pressure and Mean Arterial Pressure observed among the people of Silent, Commercial and Heavy Traffic Zones of Thoothukudi city. The percent increase in Blood pressure level is indicated in parenthesis

Parameter	Control	People of Silent Zone	People of Commercial Zone	People of Heavy Traffic Zone
No. observed	20	40	35	32
S.B.P	119.74 ±3.18	123.1 ±1.48 (3.36%)	126.4 ±2.95 (5.88%)	143.4 ±3.87 (20.16%)
D.B.P	78.0 ±4.10	82.0 ±2.75 (10.38%)	87.7 ±3.67 (12.98%)	103.1 ±4.29 (33.76%)
P.P	41.74 ±3.18	41.1 ±1.97 (-1.5%)	38.7 ±2.63 (-7%)	40.3 ±4.29 (-2%)
M.A.P	91.25 ±5.31	97.7 ±3.78 (6.59)	100.6 ±4.39 (9.89%)	116.53 ±4.73 (27.47%)

S.B.P - Systolic Blood Pressure, D.B.P - Diastolic Blood Pressure,
P.P - Pulse Pressure, M.A.P - Mean Arterial Pressure

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