



Effect of Harsh and Loud sound on Haematologic Parameters of Rat

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ABSTRACT

Sound, a necessity of our daily life, when becomes noise, disturbs our health and routine. All major international health Organizations consider sound pollution as an important health problem. In this study, an animal model has been used to study the effects of noise (harsh and loud sound) exposure on its haematological composition. Twelve rats of about 200g by weight (6 male + 6 female) were randomized into two groups of test and control. Animals in the test group were exposed to a 90dB of noise for 90 days, while animals in the control group were kept in normal condition. By the end of the study, blood sample was taken from each animal in both the groups and a complete blood count was performed. In animals of the test group as compared to those in the control, there was significant increase in the number of red blood cells, white blood cells and haemoglobin content. It can be concluded that noise exposure affects blood haematological parameters.

INTRODUCTION

Noise may be defined as any audible acoustic energy that adversely affects the physiological or psychological well being of the people (Kryter 1985). The term noise is commonly used to describe sounds that are disagreeable or unpleasant produced by acoustic waves of random intensities and frequencies.

Environmental pollution plays a destructive role in the daily life of industrialized communities and due to their negative impact on the society they are always under close investigation. Besides, well-known pollutants, all major international health Organizations consider sound pollution as an important health problem. In contrast to many other environmental problems, noise pollution continues to grow, accompanied by an increasing number of complaints from affected individuals. Most people are typically exposed to several noise sources, with road traffic noise being a dominant source (OECD-ECMT 19 1995). Population growth, urbanization and to a large extent technological development are the main driving forces, and future enlargements of highway systems, international airports and railway systems will only increase the noise problem. Viewed globally, the growth in urban environmental noise pollution is unsustainable, because it involves the direct and cumulative adverse effects on health. It also adversely affects future generations by degrading residential, social and learning environments, with corresponding economical losses (Berglund et al. 1999). Thus, noise is not simply a local problem, but a global issue that affects everyone and calls for precautionary action in any environmental planning situation.

Noise has become an important stress factor in the environment. Noise has many effects on exposed population. The blood pressure can increase during exposure to noise and number of pituitary hormones are affected by noise. The adverse behavioural effects of noise include annoyance, interference with performance and efficiency, and interference with communication and fatigue. There is positive association of noise with increased risk of threatened or spontaneous abortion, pregnancy induced hypertension, abnormal labour and low birth weight. A number of temporary physiological changes occur in human body as a direct result of noise exposure. These are rise in intra-cranial pressure, increase in heart rate and increase in sweating. Auditory effects of noise exposure include auditory fatigue and deafness

As a growing problem in industrialized communities, noise pollution has attracted a great deal of attention and development of standards, and regulations related to noise exposure has been a major task for all international health Organizations. A number of retrospective studies demonstrated the stimulating effect of noise pollution on humoral and cellular components of the immune system. Most of the currently available data on noise pollution; however, are the results of retrospective studies. Therefore, we conducted this study to determine the effect of noise exposure on haematologic parameters like RBC, WBC and haemoglobin in an animal model of rats.

MATERIALS AND METHODS

In the present work, twelve rats of about 200g by weight (6 male + 6 female) were used for the study. The rats were

categorized into two groups of test and control. Both the groups were kept for 30 days and then animals in the test group were exposed to a 90dB of sound for 20 minutes, three times a day, while animals in the control group were kept in normal condition away from sound. The duration of the test was 90 days. During the test, both the groups were given the same atmosphere and nutrition. By the end of the study, blood sample was taken from each animal in both the groups and a complete blood count was performed.

RESULTS AND DISCUSSION

Exposure to continuous noise of 85-90 dB, particularly over a life-time in industrial settings, can lead to a progressive loss of hearing, with an increase in the threshold of hearing sensitivity. The response to noise may depend on characteristics of the sound, including intensity, frequency, complexity of sound, duration and the meaning of the noise. As the first principle of the WHO constitution the definition of health is given as: "A state of complete physical, mental and social well being and not merely the absence of disease or infirmity". This broad definition of health embraces the concept of well-being and, thereby, renders noise impacts such as population annoyance, interference with communication, and impaired task performance as health issues.

Noise causes some immediate effects such as annoyance, distracted concentration and sleep disturbances. On the other hand it has some effects such as loss of hearing capacity, rise in blood pressure, cardiovascular problem, physiological imbalance, mental disorder and increase in number of corpuscles which result from long-term exposure. The strongest evidence for the effect of noise on the cardiovascular system comes from studies of blood pressure in occupational settings. There is some evidence from community studies that environmental noise is related to hypertension and there is also evidence that environmental noise may be a minor risk factor for coronary heart disease. Community surveys have found that high percentage of people reported headaches, restless nights and being tense and edgy in high-noise areas. Annoyance reactions are often associated with the degree of interference that any noise causes in everyday activities, which probably precedes and leads to annoyance. Noise levels have been found to be associated with annoyance in a dose-response relationship. Evans & Johnson (1998) found that maintaining task performance in noisy offices was associated with additional physiological effort and hormonal response.

The RBC, and white blood cell (WBC) counts, as well as, haemoglobin showed a significant increase in the test group as compared to the control. The change observed is summarised in Table 1 and Figs. 1-4.

The observations in the Table 1 clearly indicate significant increase in corpuscles (RBCs and WBCs) count and haemoglobin content of the test group as compared to the control. On an average an increase of 1.39 g/dL was reported in haemoglobin whereas RBCs count has increased by a number of 1.73. On the other hand WBC shows a major increase of 5.19.

Fig. 1 indicates increase in all the three parameters, but WBCs count is most significant. Fig. 2 shows increase in haemoglobin content and Fig. 3 shows increase in RBC count. Fig. 4 shows significant increase in WBC count when exposed to loud sound, i.e., noise constantly at regular intervals.

It was found earlier that noise exposure on rat affects haematologic parameters and red cell indices indicating that noise could increase the number of RBCs, WBCs as well as haemoglobin and haematocrit and decrease the measured RBC indices. These results support our findings. In our study haemoglobin, RBCs and WBCs show a clear increase. Although, the mechanisms underlying these changes are not well understood, this shows that sound definitely affects health parameters.

The increase of WBCs may be inferred as response of immune system to fight ill effects of loud sound or in other words the increased number of WBCs observed in our study might be the result of noise-induced stimulation of the humoral and cellular components of the immune system. The physiology of rat is very much similar to humans, and it may be inferred that sound pollution is dangerous for human health also. Efforts should be made to control the noise at the source, to control the transmission of noise and to protect the exposed persons. There should be permanent arrangement for regular measurement of noise levels at different locations in cities and factories and health education regarding noise control should be given due importance.

Table 1: Effect of harsh and loud sound on haematologic parameters of rat.

S.No. of rat ~	Parameters under control			Parameters after experimental period		
	Haemoglobin (g/dL)	RBC ($10^{12}/L$)	WBC (10/L)	Haemoglobin (g/dL)	RBC ($10^{12}/L$)	WBC (10/L)
1	14	7.32	6.9	15.3	8.73	11.9
2	13.3	6.58	4.8	14.6	8.33	10.1
3	13.9	6.62	4.1	15.2	8.38	9.3
4	12.6	6.23	5.6	14	8.04	11.1
5	13.6	6.46	8.5	14.9	8.35	13.8
6	12.9	6.36	6.6	14.6	8.12	11.4
Average	13.38	6.60	6.08	14.77	8.33	11.27

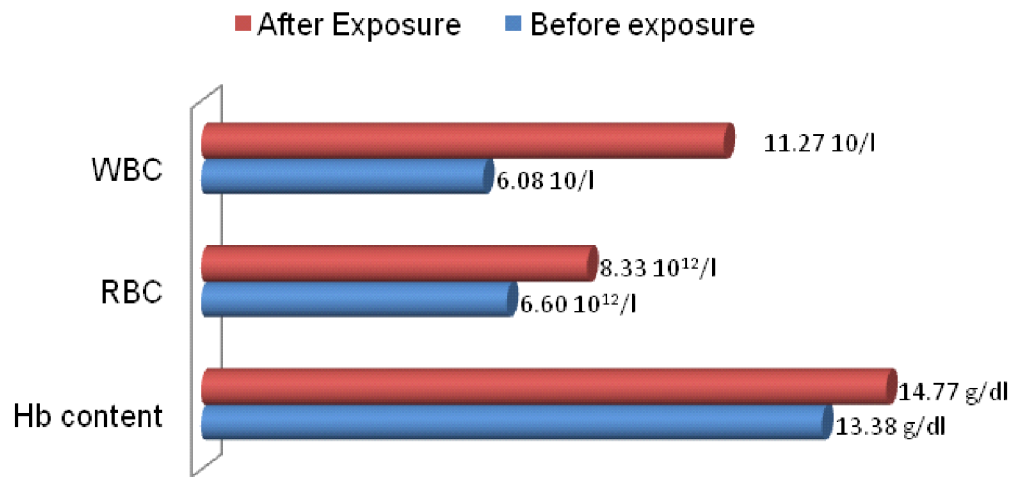


Fig. 1: Effect of harsh and loud sound on haematological parameters of rat.

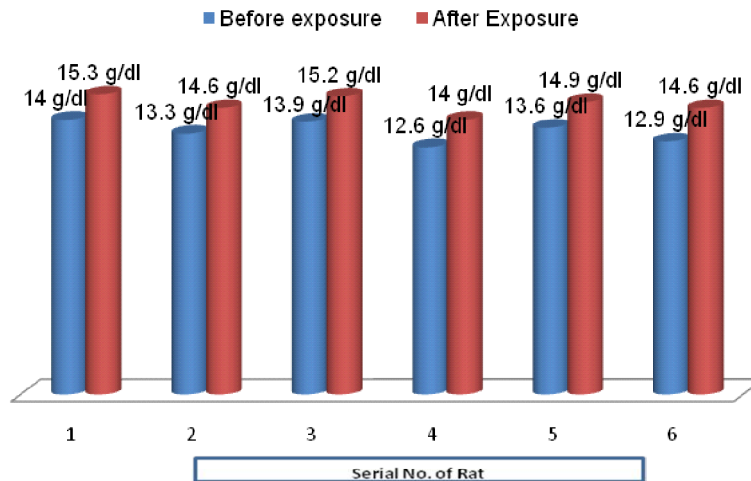


Fig. 2: Effect of harsh and loud sound on haemoglobin content of rat.

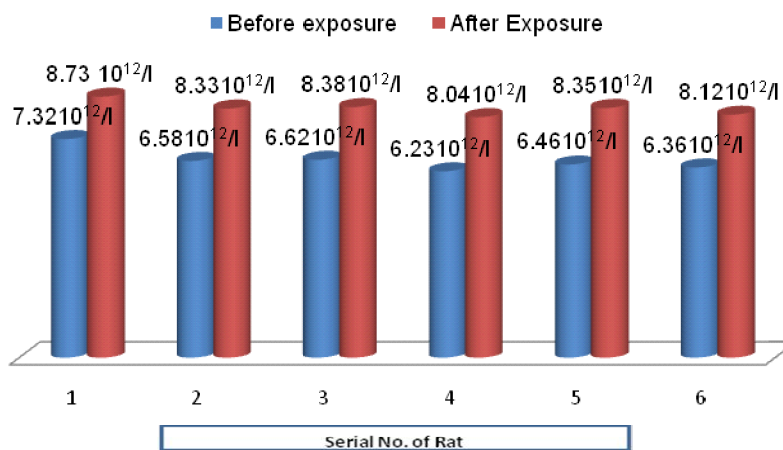


Fig. 3: Effect of harsh and loud sound on RBC count of rat.

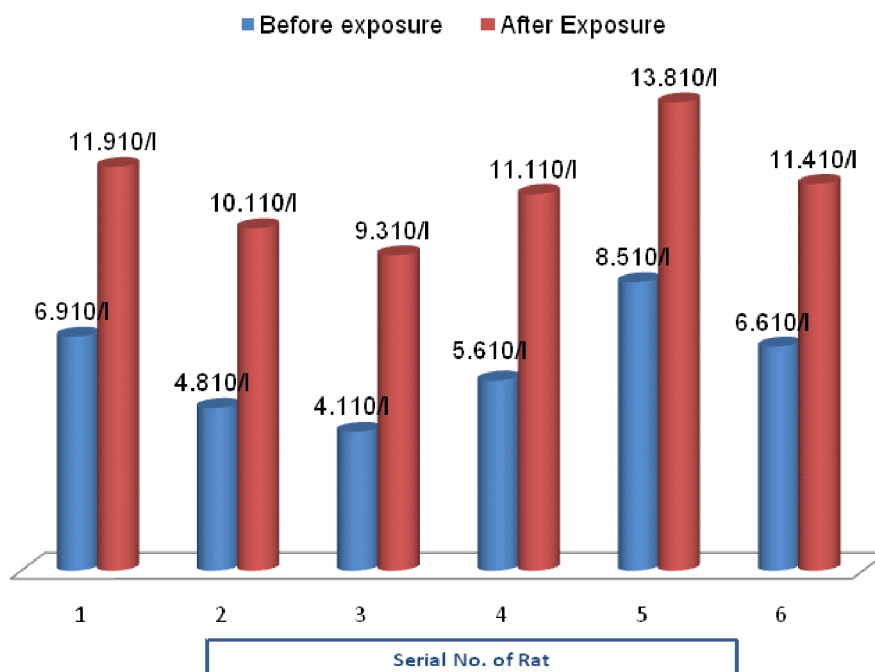


Fig. 4: Effect of harsh and loud sound on WBC count of rat.

CONCLUSIONS

Sound pollution is increasingly being recognized as a physical factor in the environment that is injurious to health. In contrast to many other environmental problems, noise pollution continues to grow, accompanied by an increasing number of complaints from affected individuals. Most people are typically exposed to several noise sources, with road traffic noise being a dominant source. Population growth, urbanization and to a large extent technological development are the main driving forces, and future enlargements of highway systems, international airports and railway systems will only increase the noise problem. One of the ill effects is

increase in number of RBCs, WBCs and haemoglobin content. Further studies are needed to shed light over the effect of noise on biological systems.

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