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Effect of Noise Pollution on Psychopharmacological and In-Life Parameter Changes in Wistar Rats

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ABSTRACT

Noise is any unwanted sound that is disagreeable and unpleasant and causes displeasure, annoyance and disturbance. The present study was undertaken to determine the effect of noise pollution on psychopharmacological changes through behavioural observation and instrumental analysis in Wistar rats. The work is initiated after obtaining permission from the animal ethics committee Madras Veterinary College. The acclimatized rats were divided into three groups as G1[control], G2[experimental] and G3[experimental]. The rats of group 2 and group 3 were exposed to noise of intensity 80dB by placing them in a specifically fabricated rat cage. Every experimental group was exposed to noise for different durations of time (group 2 was exposed for 30 minutes while group 3 was exposed for 60 minutes). Their behavioural changes and in-life parameter changes [feed, water intake and body weight gain] were observed regularly for 30 days. From the results it is evident that experimental animals showed a gradual reduction in food intake in both male and female in initial stages but males regained back to normal after the first week of treatment. During experimentation, all the animals showed hyperactivity and ferociousness which was more apparent in females when compared to males. It is quite apparent that effect of sound beyond the audible limits shows its impact on physiology and biochemistry of the experimental models. This study forms the base for further investigation on the effect of sound on brain and behaviour.

Keywords: Psychopharmacology, Wistar rats, actophotometer, motor activity.

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INTRODUCTION

The noise pollution disturbs the activity and balance of human and animal life. Noise pollution is a type of energy pollution that poses serious threat to the environment in present day world. Unlike other pollutions, the noise pollution contaminants are not physical particles, they are waves that interfere with naturally occurring waves [1]. Noise pollution is becoming omnipresent, yet unnoticed form of pollution in many countries. It is becoming hazardous to the quality of life [2]. Continuous exposure to high levels of sound, in the vicinity of 90 decibel, for a period of more than 5 years, may eventually lead to 15-20 decibels of NIPTS (noise-induced permanent threshold shift) [3]. A noisy environment can be a source of heart related problems [4]. Studies have shown that high intensity sound cause a dramatic rise in blood pressure as noise levels constrict the arteries, disrupting the blood flow. The heart rate also increases. These sudden abnormal changes in the blood increase the likelihood of cardiovascular diseases in the long run [5]. Noise results in speeding up the aging process of hearts, causing high rate of myocardial infarction incidence [12]. Exposure to loud sound can lead to elevated stress levels as well as stimulate violent behaviour [6]. It decreases the efficiency of a man. There are number of experiments which bring out the fact that human efficiency increases with noise reduction [7]. Based on the above literature the present study is undertaken to explore the effect of noise pollution on the behavioural changes of Wistar rats through observation and instrumental analysis. This type of work can enlighten the lesions in different vital organs with reference to sound pollution.

MATERIALS AND METHODS

Wistar rats weighing around 150-200 gram of both sexes were used for the present study. The research project was initiated after obtaining clearance from the animal ethics committee. The rats were divided into three groups as G1, G2 and G3 out of which G1 served as control and G2 and G3 as experimental group. Animals were fed with standard pellets and protected. A special chamber has been fabricated to expose the rats to around 80 decibels of sound for about 30 minutes for Group 2 and 1 hr for Group 3 animals. The chamber had all provisions for feed, water and aeration. There was a glass panel fixed in the chamber for viewing the activity of rats when exposed to noise during experimentation. The rats were acclimatized to the laboratory conditions for a period of 15 days. The feed and water intake and regular behaviour of rats were observed. The rats in each group was differentiated by dyeing, the dye used was picric acid. First the rats were left inside the chamber without sound to get accustomed to the interiors of the chamber during the period of acclimatization. The changes in behaviour of the rats, during the exposure to sound, immediately after exposing to sound and when left in cage after experimentation were recorded. The feed, water intake, body weight gain and behavioural changes were recorded. After the period of experimentation (30 days), the motor activity was measured using Actophotometer.

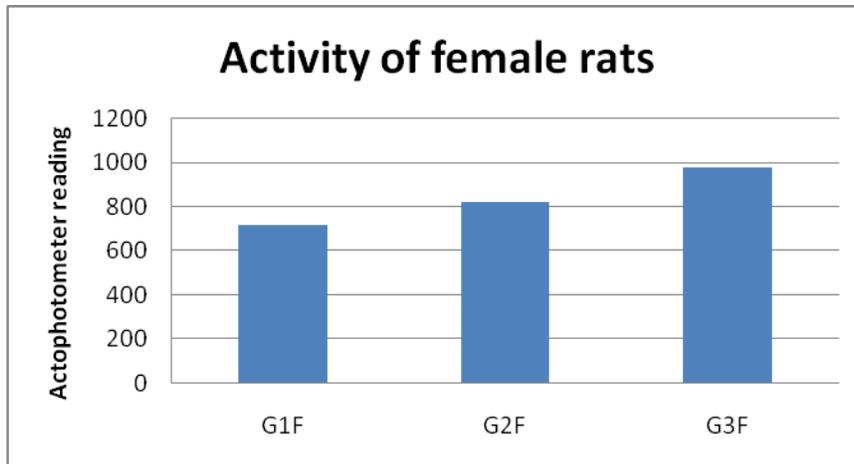
RESULTS

Animals showed ferociousness and hyperactivity during the experimentation when it is exposed to noise. Females were more ferocious when compare to males. During the dosing period animals stopped eating or drinking water but they started consuming more quantity of water after the dosing. Regarding the social behaviour of the animal it gets isolated during experimentation and it takes longer time to come back to normal. With reference to continuous motor activity [actophotometer recording] Table 1 clearly indicates that the activity of the experimental female rats showed increased activity when compared to control (graph 1) due to its hyperactivity whereas regarding male rats the activity got declined when compared to control.[Table No1, Fig No 2&3]. Regarding body weight gain the table 2 indicates that the experimental female have lost their weight when compared to control female (Fig 3) and steady increase was observed in experimental male.(Fig 4).

Table 1: Actophotometer reading

S.No.	Group	Actophotometer reading
1	Control Female (G1F)	720.5 ± 27.5
2	Control Male (G1M)	878.5 ± 26.5
3	Group 2 female	823 ± 171.13
4	Group 3 female	978.3 ± 57.4
5	Group 2 male	847.67 ± 42.76
6	Group 3 male	791.67 ± 230

Graph 1:



Graph 2:

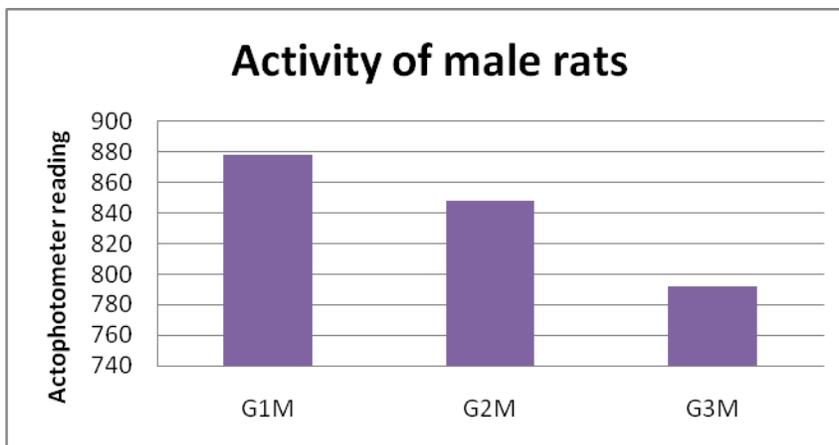
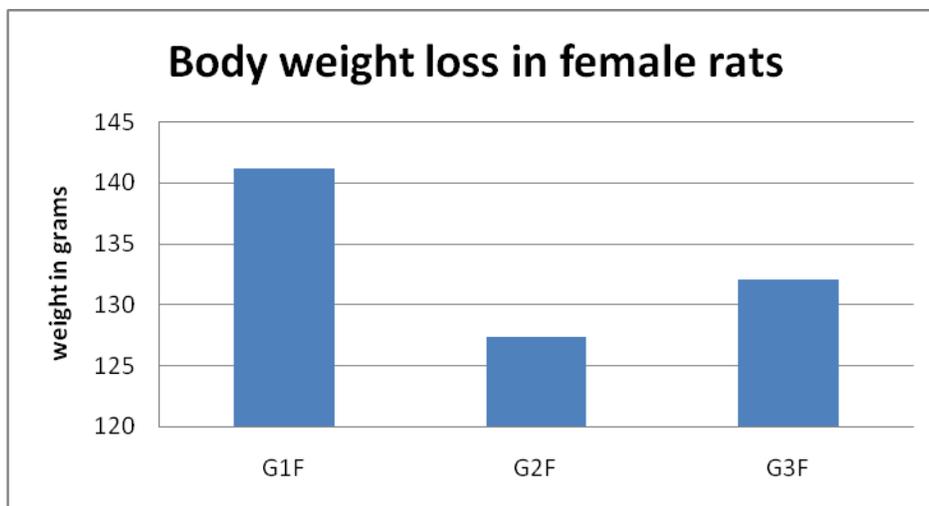


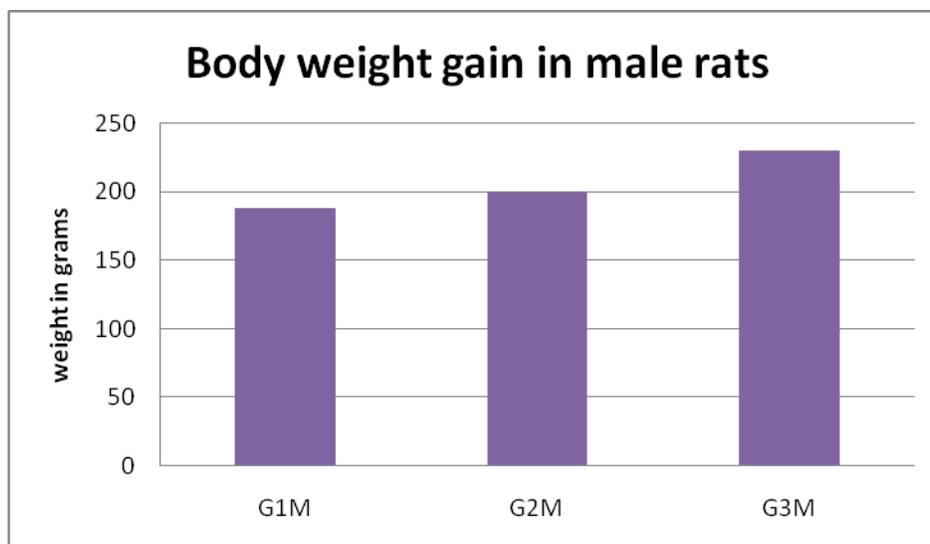
Table 2: Body weight gain and loss

S.No	Group	Body weight (in grams)
1	Control Female (G1F)	141.17 ± 2.83
2	Control Male (G1M)	188.83 ± 3
3	Group 2 female (G2F)	127.39 ± 3.98
4	Group 3 female (G3F)	132.05 ± 13.34
5	Group 2 male (G2M)	200.17 ± 26.18
6	Group 3 male (G3M)	230.55 ± 42.75

Graph 3:



Graph 4:



DISCUSSION

The present study shows marked psychopharmacological changes in the behaviour of experimental animals when it is exposed to noise of about 80 dB for different durations of time. When we look into the in-life parameters, there is a gradual reduction in food intake in both male and female in initial stages but males have picked up slowly when compared to females which is reflected in the form of body weight gain. Although there is reduction in food and water intake, experimental animals consume large volume of water immediately after exposure to sound which may be because of inhibition and stimulation of ventromedial hypothalamus and lateral hypothalamus due to the pressure exerted in cortical areas of brain. The above results are in accordance with the works [8, 9]. During experimentation; animals showed hyperactivity due to increased secretion of adrenals under the pressure of pituitary, this information is further evidenced by Pelligrini [13] and Cavatorta [10].

Regarding the voluntary activity, when it was measured through instrumental analysis (actophotometer) the experimental females showed hyperactivity, when compared to control, whereas the experimental males showed decreased activity. Both group 1 and group 2 males showed a decline in voluntary activity when compared with control [11].

Since the sympathetic part of the autonomous nervous system gets stimulated by the sound, it has resulted in inhibition of excretion and urination due to threshold on the sphincter muscles of the urethra and anal canal. When we observe the social behaviour of the animals, all the experimental animals gets isolated from other animals during the dose. Although it gets isolated, it becomes normal within 15 minutes after dosage and we observe gradual reduction in ferociousness which may be because of impairment in amygdala [14].

This study gives a clear indication about the effect of sound that is beyond the audible limits and its impact on physiology and biochemistry of the experimental models hence this

study forms the base for further investigation of electrophysiological changes in the brain with reference to noise stimulation and impact on other vital organs.

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