

EFFECT OF NOISE ON HEART RATE

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ABSTRACT

Objective: The objective of the study was to observe the effect of short-term noise on heart rate.

Material and Methods: One Hundred and seventeen (117) medical students were selected as subjects. Subjects having normal resting heart rate and blood pressure were included in the study. Subjects with hearing defect were excluded from study. Auditory acuity was confirmed by audiometry before the start of experiment for each subject. A noise of a 90 dB intensity and 4000Hz frequency was produced for 10 minutes. Heart rate was recorded before, during and after exposure to noise.

Results: Heart rate increased in 104 (88.9%) subjects, with an average rise of 8.938 ± 1.037 . In 73 subjects (70.19%) it came back to basal level within 02 minutes. Increase in heart rate was observed in more number of males as compared to females; however, the difference was statistically insignificant.

Conclusion: Heart rate increases during exposure to noise.

Key Words: Noise, Heart rate.

INTRODUCTION

Noise is often defined as “unwanted sound” but this definition is subjective because of the fact that one man's sound is another man's noise. Perhaps a better definition of noise is “wrong sound in the wrong place at the wrong time¹. Some authors have also defined noise as any audible acoustic energy that adversely affects the physiological or psychological well being of the people². The term noise is commonly used to describe sounds that are disagreeable or unpleasant, produced by acoustic waves of random intensities and frequencies³. Noise may be continuous, intermittent, impulsive or explosive and may be steady state or fluctuant. Some familiar examples of noise are the jingling of keys, clapping of hands, the report of a gun, the roar of street traffic, and the noise of aircrafts etc.³

Noise has become a very important “stress factor” in the environment of man.¹ The term “Noise Pollution” has been recently coined to signify the vast cacophony of sounds that are being produced in the modern life, leading to health hazards.¹

Noise pollution is becoming a serious problem, but recognition of the problem is not universal. Noise is undoubtedly irritative and

increases or produces anxiety. It has been suggested that excess noise affects child development and reading skills⁴. Effects of noise exposure have been recognized for centuries but generally ignored⁵.

Noise has many effects on the exposed population⁶. A number of temporary physiological changes occur in the human body as a direct result of noise exposure. These are: a rise in intracranial pressure, an increase in heart rate and breathing and an increase in sweating¹. General symptoms such as giddiness, nausea and fatigue may also occur. Noise interferes with sleep. Noise is also said to cause visual disturbances such as narrowing of pupils, altered color perception and reduced night vision¹.

Main objectives of this study were to see the effect of short-term noise (10 minutes) on heart rate and to study the duration for which the rise in heart rate is sustained i.e. to see that after how much time the heart rate comes back to basal level, if it rises.

MATERIAL AND METHODS

This prospective study was conducted at Khyber Medical College, Peshawar. One hundred and seventeen (117) medical students (both male

HEART RATE (RESTING)

Sex	Frequency n=117	Mean Heart Rate per Minute	Std. Dev.
Female	56	75.750	+ 8.563
Male	61	77.836	+ 8.224

Table 1

and female) were selected as subjects, in simple random manner.

The inclusion criteria were the following:-

- i) Age range: The subjects were 18-23 years old.
- ii) Blood pressure:- The subjects with normal blood pressure were chosen for the study.⁷
- iii) Heart Rate: The resting heart rate was taken as from 60-80 beats per minute.⁸ The subjects having abnormal hearing were excluded from the study. The audiometer was used to test the auditory acuity of each subject.

The following material was used for the study:

Audiometer (Model Amplaid-151, made in Italy), Mercurial sphygmomanometer (Model YAMASU, Made in Japan), Stethoscope (Littman type, made in U.S.A.).

The research was performed in soundproof room. For this purpose, Audiometry room of ENT OPD, Khyber Teaching Hospital, Peshawar was used. The subjects selected for the study were themselves control group by exposing them to experimental condition, without production of noise.

The following procedure was adapted after careful selection of the subjects:

Heart rate was checked in the sitting position just before the start of procedure by radial pulse.⁸ Headphone of audiometer (Model Amplaid-151, made in Italy) was applied to the ears of the subject for 10 minutes. No noise/sound was

QUANTITATIVE ANALYSIS OF RISE IN HEART RATE

Subjects	HR
Maximum Rise (Male)	20
Maximum. Rise (Female)	12
Maximum Fall (Male)	2
Maximum Fall (Female)	4
Average Rise (Male)	10.3991.785
Average Rise (Female)	6.1240.968
Average Rise (Both Sexes)	8.9381.037

Table 3

EFFECT OF NOISE ON HEART RATE (HR)

	Number of Subjects n = 117	Percentage
HR increased	104	88.89
HR decreased	4	3.43
HR not affected	9	7.69

Table 2

produced during this. The heart rate was checked after 1,5 and 9 minutes after the start of application of headphones. The same procedure was repeated after production of noise as follows:-

Sound of 90-dB intensity was produced for 10 minutes, at the frequency of 4000Hz. The heart rate was checked after 1,5 and 9 minutes after the start of production of noise. Heart rate was checked after stopping exposure to noise; In cases heart rate was raised after exposure to noise, it was checked at three minutes interval, till it returned to normal.

The data was analyzed by using ANOVA test.

RESULTS

In this study, 117 subjects were selected, out of which 61 (52.14%) were male and 56(47.86%) were female. The average age of the subjects was 21.04(1.375) years. Resting heart rate of the subjects is given in table 1.

Number of subjects in whom heart rate was affected is given in table 2.

The heart rate was found to increase in 57 male (93.44%) and 47 female (83.93%) subjects. It decreased in 3 female (5.36%) and 1 male (1.64%) subjects and there was no effect in 5 female (8.93%) and 4 male (6.56%) subjects.

Quantitative analysis of rise in heart rate is summarized in Table 3.

Once the heart rate was increased, it took some time to come back to the resting value. (Table 4)

TIME TAKEN BY THE HEART RATE TO COME TO BASAL LEVEL

	Number of Subjects (n=104)	Percentage
2 Min	73	70.19
5 Min.	20	19.23
8 Min.	7	6.73
11 Min.	1	0.96
> 11 Min.	3	2.88

Table 4

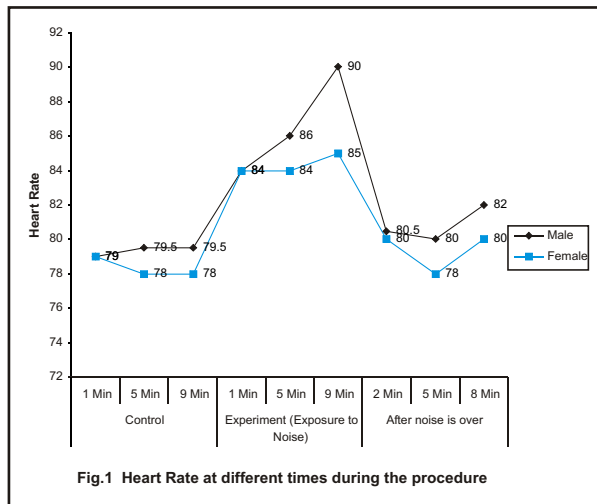


Fig.1 Heart Rate at different times during the procedure

The average heart rate at different times in male and female subjects is shown in Fig.1.

DISCUSSION

In 1970, Occupational Health Safety and Health Act established occupational noise exposure standards; an employee may receive in a working day⁹. According to this standard 90 dB is the maximum permissible noise level of exposure, without the use of ear protectors for 8 hours per day.

It can be seen from Table 2 and 3 and Fig.1 that heart rate increased in most of the subjects, although it decreased in few subjects and not affected in few subjects. The rise in heart rate was found to be statistically significant. The increase in heart rate was observed in more number of males as compared to females; however, the difference was statistically insignificant. When the heart rate was analyzed only in those subjects in whom the heart rate increased, it was seen that the average rise in heart rate was 13.45. ($p < 0.005$). Similar studies have been performed in different parts of the world at different times and it was found that results are comparable to most of the studies in most respects performed elsewhere in the world.¹⁰⁻²¹

Gitanjali B and Anath R¹¹ studied the effect of background noise during sleep and they found significant increase in heart rate even during sleep. Lusk SL *et al*¹⁰ studied the effect of exposure to noise on systolic and diastolic blood pressure and heart rate in auto assembly plant workers. Workers wore ambulatory blood pressure monitors and personal noise dosimeters during one work shift. After adjustment for covariates of cardiovascular function, systolic and diastolic blood pressure, along with heart rate, were shown to be significantly positively associated with noise exposure.

The average increase in heart rate after acute exposure to noise was found to be 10.8 +/- 1.1 beats per minute in a study performed by Holand *et al*¹². Tomie *et al*¹⁷ observed the similar effect by exposing two groups of pilots to 73db and 93 db noises. Increase in heart rate was more significant in group exposed to 93 db noise. They also found that the effect was also related to type and duration of noise.

The actual mechanism responsible for increase in heart rate is not yet completely understood but a few facts are known. Evans GW *et al* (2001)¹⁹ observed that there is increased 8-hour overnight urinary cortisol in children living in noisy environment.

Peripheral vascular resistance increases and baroreflex sensitivity is not suppressed during intermittent noise exposure¹⁸. Fisher-Ld *et al*²² proved that rise in heart rate in rats due to noise exposure was sympathetically mediated. There is increased urinary excretion of epinephrine, nor-epinephrine, dopamine and cortisol in the subjects exposed to high levels of noise²³. Bergomi-M *et al*²³ also detected impairment of some sensory functions. Based on all these preliminary findings it may be suggested that noise may be related to a marked activation of the neuroendocrine system, resulting in increase in and heart rate.

Finally, in order to prevent or at least minimize the health hazards due to noise exposure, it is recommended that maximum allowable duration of exposure to noise should be reviewed and strictly followed; legislation for control of noise should be constituted and strict policy be adapted to enforce the concerned laws; efforts should be made to control the noise at the source. Considerable amount of noise is generated by traffic from running engines, air turbulence and frictional contact of vehicles' tires with the ground. When noise levels at different busy locations in Peshawar were studied by Akhtar NH³, it was found that average road traffic noise levels in Peshawar were between 87-98.5 dB, the most frequent level being above 90 dB. Efforts should also be made to control the transmission of noise and to protect the exposed persons; there should be permanent arrangements for regular measurements of noise levels at different locations in cities and factories and health education regarding noise control should be given due importance.

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