

Cardiovascular Parameters as an Appraisal to the Stress Caused Due to Clamorous Work-place Environments in Metal Machining Units

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Abstract: Noisy work-places are one of the undesired by-products of the desired operations during metal machining processes. The present study was designed so as to assess the effects of noise on the cardiovascular systems of workers exposed to clamorous work environments at metal machining units. A total of 100 workers were included in the study. The study results show significant changes in various cardiovascular parameters namely systolic blood pressure, diastolic blood pressure, pulse pressure, mean arterial pressure and heart rate. It also indicates that this stress due to noise is a contributing factor to many cardiovascular ailments ranging from hypertension to myocardial infarction. The remedial measures to safeguard the employees from these effects of noise are also discussed.

Keywords: Clamor, cardiovascular parameters, remedial measures.

I. INTRODUCTION

Noise is the third major contemporary world pollution, which ranks after the atmospheric pollution and water pollution^[1]. Noise by definition is unwanted sound produced through natural causes such as wind, volcanoes & oceans as well as manmade sources automobiles, machines, explosions etc^[2]. In Metal machining units sound is stemmed by machinery used and is an unnecessary by-product of the desired action. In the work environment, disturbing sounds not only affects the hearing of employees but also have physiological and psychological implications^{[3][4]}. In addition to hearing loss, prolonged exposure to high noise is known to cause fatigue, stress, anxiety, depression, loss of concentration, reduced

productivity, headaches and various cardiovascular ailments^[5].

The study was carried out at Sangamner; a city which is located in the district of Ahmednagar, Maharashtra in India. According to the 2011 census the population of Sangamner is 61,958 out of which about 3000 people work at various metal machining units of the city. Even though the population of workers in the city is so high, no work has been done to evaluate the effects of noise on the workers, therefore this present study was aimed at evaluating the effects of the high intensity noise on the cardiovascular system of workers working at metal machining units of Sangamner.

Researches have proved the effectiveness of various remedial measures that can be applied to reduce or even eliminate the harmful effects of noise.

II. MATERIALS AND METHODS

In the present study a total of 100 subjects were analyzed. Out of them 25 were control cases and the rest 75 were the workers of the machining units in Sangamner who were exposed to high intensity sound for almost 8 hours a day; six days a week.

Almost equal number of males and females were selected. The subjects were of the age group 35-45 years.

The control class consisted of general population of Sangamner who were not exposed to high sound intensities. All the subjects were healthy and did not possess any history of myocardial infarction, hypertension or congenital heart diseases.

The sound intensity was measured with a calibrated sound level meter (LEUTERON SL-4001) shown in fig 1. The meter has a measuring range of 30dB-130dB and has a resolution of 0.1dB. Same meter was used for measurement of sound intensity produced during forging, machining on the lathe and grinding respectively.

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The subjects were allowed to relax in supine position and then their blood pressure both diastolic and systolic and heart rate were measured with Multi Para Monitor (DASH-2000 by General electronics) shown in fig 2. The blood pressure readings were measured in the units of mm of Hg. The pulse pressure and the mean arterial pressure were calculated with the formulae^{[6][7][8]} stated below,

$$PP=SBP-DBP$$

$$MAP=DBP+(1/3*PP)$$

Where, PP: Pulse Pressure; SBP: Systolic blood Pressure; DBP: Diastolic blood Pressure; MAP: Mean Arterial Pressure.

The initial readings were taken on 1st March 2013 and the final readings were taken on 1st August 2013. The readings were then tabulated and analyzed for statistical parameters using Microsoft excel.



Fig1: Sound level meter



Fig 2: Blood pressure and heart rate measuring device

III. RESULTS

Equal number of subjects were considered for every source of noise i.e. 25 subjects were considered for forging, operations on lathe and grinding. Table 1 shows the intensity of noise produced by each source and as recorded by the noise level meter. Table 2 shows the average normal values of all the cardiovascular parameters recorded^{[6][9]}.

Table 1: Recorded sound intensity values

Sr. No.	Source of noise	Intensity
1	General	80 dB
2	Forging	105 dB
3	Operations on the Lathe	98 dB
4	Grinding	89 dB

Table 2: Average normal values of cardiovascular parameters in adults.

Sr. No.	Cardiovascular parameter	Normal values
1	Diastolic Blood Pressure	120
2	Systolic Blood Pressure	80
3	Pulse Pressure	40
4	Mean Arterial Pressure	67
5	Heart Rate	80

Table 3: Mean values of all the cardiovascular parameters.

Parameter	Control	Forging	Lathe	Grinding
Heart rate	78.64	94.04	91.64	84.88
Diastolic BP	78.08	84	84.32	82.64
Systolic BP	117.28	129.76	127.92	126.56
Pulse pressure	39.20	45.76	43.6	43.92
Mean arterial pressure	91.15	99.25	98.85	97.28

Table 4: Overall effect of the noise

Parameter	Increase	Decrease	No effect
Diastolic BP	59	0	41
Systolic BP	64	4	32
Pulse pressure	47	20	33
Mean arterial pressure	40	38	22
Heart rate	21	0	79

Table 3 shows the mean values of all the parameters and thus the deviation from the values that of the control class can be made out from the table. The overall effect of the noise is shown in table 4. It shows the total number of subjects who reported an increase, decrease or no effect of noise on their cardiovascular parameters. The study shows that the diastolic blood pressure increased in 59% of the cases and 41% cases reported a no change while the systolic blood pressure had 64% subjects showing an increase, 32% decrease and 4% cases showed no change in the cardio-vascular parameters .47% cases showed an increased pulse pressure with 20% showing no change and rest 22% with a decrease in pulse pressure. Mean arterial pressure dipped for 40%, showed no change in 38% and a decrease for 22%.

IV. CONCLUSION

The statistical analysis of the data shows that noise produced due to various machining operations has a significant effect on diastolic blood pressure, systolic blood pressure, pulse pressure, mean arterial pressure and heart rate. The study shows the changes in the cardiovascular parameters over a period of six months; this implies that the effects due to these noise levels over years can be deleterious and can lead to various cardiovascular ailments like hypertension, myocardial infarction and may even be fatal in nature.

Serious efforts should be made to safeguard workers against noise produced by machines. It is required that effective ways are devised to safeguard the health of the workers as well as to reduce the noise of the machinery. Research can also be done on creating better working environments for heavy metal industries.

V. REMEDIAL MEASURES

Workplace noise proves to be a potential health hazard which needs immediate concern. Measures include:

- 1.Reducing the intensity of the noise at the source^[11].
- 2.Reducing the transmission of noise^[12]
- 3.Providing workers with hearing protection devices^[10]

The transmission of noise can be reduced by installing sound absorbing panels to the walls and ceilings of the unit. The hearing protection devices are also a very efficient way to safeguard the workers for example the use of earplugs can help reduce the reception intensity of sound by almost 15dB to 30dB^[5].

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