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EFFECT OF NOISE POLLUTION ON ARTERIAL BLOOD PRESSURE AND HEART PULSE RATE OF DENTISTS IN THEIR DENTAL OFFICES IN DUHOK CITY- IRAQ

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ABSTRACT

The aim of the present study was to assess the noise pollution and its effects on the systolic, diastolic blood pressure, and heart pulse rate for 12 dentists in their clinics chosen randomly in Duhok city, in Kurdistan region in North of Iraq. The mean age of the samples was 40 year, and the mean duration of their service was 6.5 years. The noise levels measured during operational periods in the chosen dental offices were found to be between 65 and 84.3 decibel (dB). The arterial blood pressure (systolic, diastolic) and heart pulse rate of doctors were measured before and after exposure to noise for four hours. Pearson Correlation Coefficient (R) and P-values for all measured variables were calculated. R and P-values for systolic blood pressure were -0.009, 0.977, while for diastolic were 0.104, 0.749, and finally for heart pulse rate were 0.454, 0.139 respectively.
This study shows that after four hours of work, there was no significant relation between the mean values for blood pressure (systolic, diastolic) and heart pulse rate and the sound pressure levels.
The average sound pressure level measured for dentists in their offices was 72.92 dB. This result indicated that the sound pressure level for all samples was lower than the limited threshold (85 dBA). (Abstract)

Keywords : Blood Pressure, Heart Pulse, Noise pollution, Dental Offices. (keywords)

1 INTRODUCTION

Noise pollution is one of the most important problems of the contemporary world. It occurs when there is "unwanted or disturbing sound" that is, when either sound interferes with normal activities or disrupts or diminishes one's quality of life. Noise pollution affects both health and behavior. It can cause annoyance, hypertension, high stress levels, tinnitus, hearing loss, sleep disturbances, and other harmful effects [1],[2]. Furthermore, stress and hypertension are the leading causes for health problems. Noise pollution data and its effects on human being are lacking in Iraq. Therefore regulations of noise pollution have not yet been formulated. In order to minimize the effect of noise on human's attitude and health, many studies were conducted investigating the impact of noise in several places throughout the world. In dental offices, for example, several researches were done dealing with the equipment used and their effects on blood pressure, heart pulse rate, hearing threshold and tinnitus [3],[4]. Excessive noise seriously harms human health and interferes with people's daily activities at school, at work, at home and during leisure time. It can disturb sleep, causes cardiovascular and psycho physiological effects, reduces performance and provoke annoyance responses and changes in social behavior. So noise has become a very important "stress factor" in the environment of man [5],[6].

The blood pressure can increase during exposure to noise and a number of pituitary hormones are affected by noise [2]. Many research scientists in the world have observed a significant rise in blood pressure in response to noise. High noise levels are associated with higher accident rates. Noise is measured in units of sound pressure levels called decibels, sighted sound levels (dBA). A denotes weighted sound levels closely match the perception of loudness by the human ear. Decibels are measured on a logarithmic scale which means that a small change in the number of decibels results in a huge change in the amount of noise and the potential damage to a person's hearing. Hypertension is a very common health problem. In most countries, up to 30% of adults suffer from high blood pressure [7]. Factors associated with high blood pressure are family history of hypertension, overweight and obesity, lack of physical activity, too much salt in the diet, too much alcohol consumption, stress and smoking [8]. Although the causal relationship between noise exposure and high blood pressure have not been conclusively established, the majority of and the most recent studies indicate that it does appear to affect heart rate, blood pressure and the electrocardiogram. To identify and prevent possible health related effects, workplace monitoring, eudiometry and blood pressure screenings are essential [9].

OSHA (Occupational Safety & Health Administration) sets legal limits on noise exposure in the workplace. OSHA, United State Department of Labor, requires employers to develop and implement a noise monitoring program when employees ex-

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posed to noise equal or exceed 85 dB over 8 working hours [10].

2 MATERIALS AND METHODS

This study was carried out on a sample of twelve dentists (5 females, 7 males) aged 24- 56 years, with a minimum of one year serving duration. All dentists had no history of heart disease, blood pressure, or hearing loss. The 12 dental offices are located in large buildings in different sites in the city. Data collections were carried out in the selected offices during evenings from July to October 2012. At the dental offices (clinics), the microphone of sound level meter was placed at the level of dentist's ear in order to capture sounds at the intensity they influence the operator's ears.

The tests were carried out on high speed hand pieces, low-speed hand pieces, high-volume aspirators, ultrasonic scalars, amalgamators, and background noise. The level of the noise was measured while the instrument was at different running speed every 10 minute, arterial blood pressure and heart pulse rate were taken every 30 minute. The noise level was measured using Sound Level Meter (Leybold Didactic GmbH). The sound level meter reacts to sounds in a similar way as human ear and provides an objective reproducible measurement of sound levels [11], [12]. The blood pressure (systolic, diastolic) and heart pulse rate were measured for each dentist by manual inflation blood pressure monitor, (Model HEM-412). The measurements were analyzed using the Statistical Package for Social Sciences (SPSS) version 16 and Microsoft Excel spreadsheet were used for data entry and analysis.

3 RESULTS AND DISCUSSION

The results of the sound pressure level (SPL) measurements during four working hours are shown in figure 1.The values are plotted in three graphs a,b and c (groups) . Every group includes four dental offices which depend on the ages of the dentists as follows: Group (a) dentists whom ages (24-36) year, group (b) dentists whom ages (36-46) year, group (c) dentists whom ages (46-56) year, respectively.

Fig. 1 shows that the intercepts of SPL in the four working hours was 66.29 – 78.78 dB, and the slopes of SPL approximately lies between 0.006 – 0.01. The mean values of sound pressure levels for all dental offices fluctuate around 72.99 dB with no significant change as a function of time.
The mean values of noise levels were calculated every ten minutes during four continuous hours and are shown in Fig. 2.

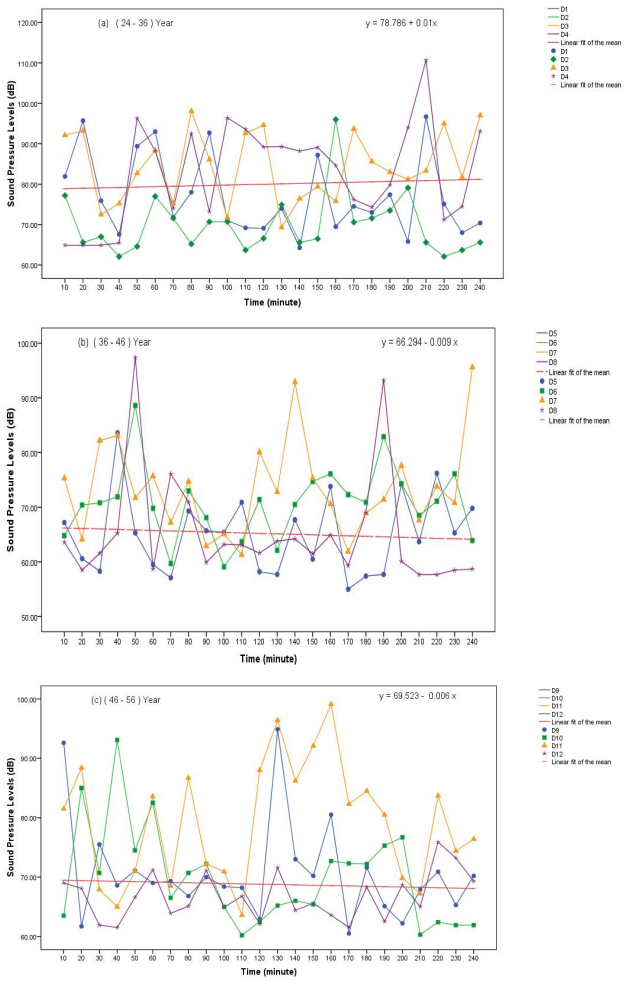

Fig. 1. The values of sound pressure levels and best linear fit of the means as a function of exposure time in all selected dental offices divided into groups of dentists as follows: group (a) 24-36 years old, group (b) 36-46) years old, and group (c) 46-56 years old.

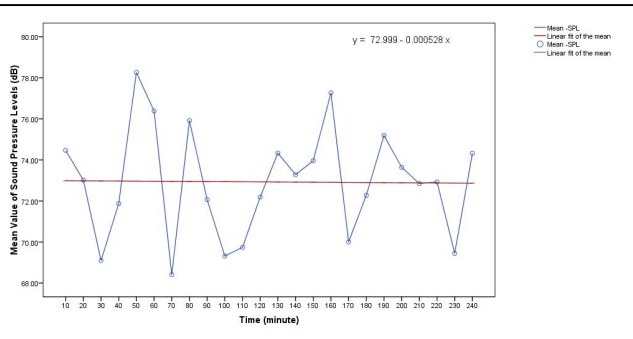

Fig. 2. The mean sound pressure levels and best linear fit of the mean as a function of time in all selected dental offices.

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Systolic blood pressure (SBP) and diastolic blood pressure (DBP) during working hours for dentists in all selected dental offices, were measured and recorded. The data of systolic and diastolic blood pressure due to noise are plotted in Fig. 3 and Fig. 4, respectively. Both figures are divided into three groups a, b, and c, every group includes four dental offices according to dentists' ages.

Figures 3 and 4 show that there are a very slight increment in the measured values of systolic and diastolic blood pressure to all groups of dentists before and after exposed to noise during working hours except the values of systolic for group ages (a) which shows a very slight decline in pressure. The degree of increment or decrement is different from one group to another according to ages of doctors.

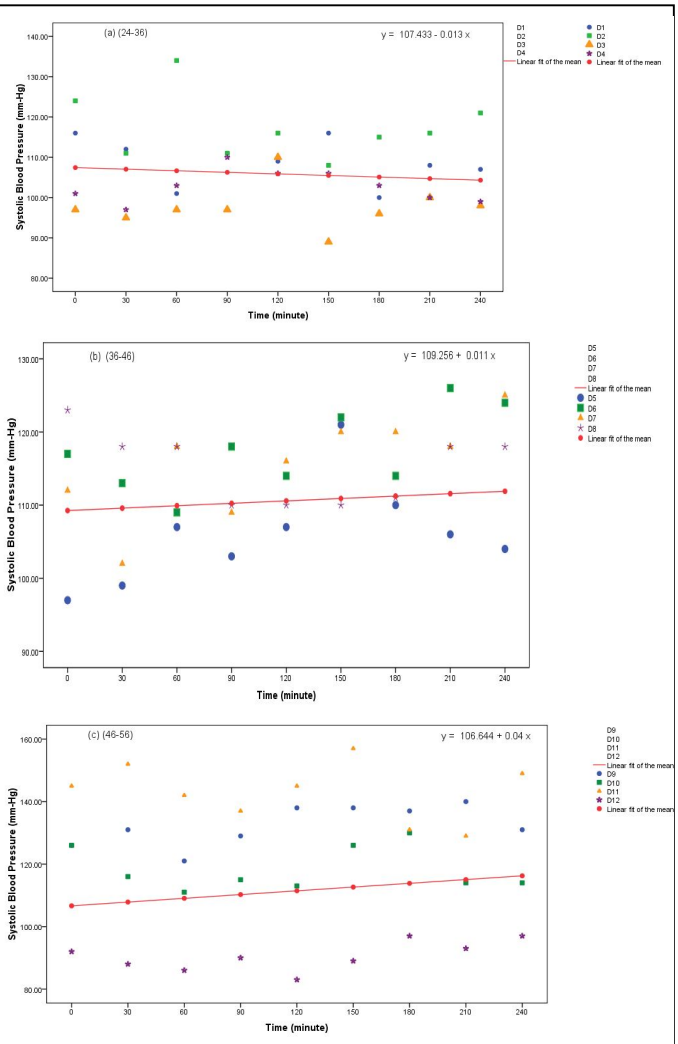

Fig. 3. The values of SBP and best linear fit of the mean as a function of exposure time in all selected dental offices divided into three groups of dentists as follows: group (a) 24 – 36 years old, group (b) 36 – 46 years old, and group (c) 46 – 56 years old.

Mean systolic and diastolic blood pressure measured for doctors in all group ages before and after exposure to noise are shown in Table 1.

TABLE 1

Age (year)	Serving Duration (year)	SBP Before Exposure to Noise (mm-Hg)	Mean SBP After Exposure to Noise (mm-Hg)	DBP before Exposure to Noise (mm-Hg)	Mean DBPAafter Exposure to Noise (mm-Hg)
24	1	116	108.142	72	68.25
27	4	124	116.5	72	76.875
34	9	97	97.75	74	70.625
35	10	101	103	64	61.25
36	12	97	107.125	68	69.125
38	15	117	117.5	75	78.375
40	17	112	116	72	75.75
40	17	123	114.125	68	69
46	25	126	133.125	89	90.75
47	24	126	117.375	73	73.125
53	18	145	142.75	94	93.375
56	29	92	90.375	59	55.875

Mean values of systolic and diastolic blood pressure of all doctors (before and after exposure to noise) as a function of doctor ages and serving duration.

The data of each group can be fitted to a linear function as shown in figures (5) and (6). The results of the fits show that the increasing rate for each group ages is different from other, figures (5) and (6) show the mean values (every 30 minute) of systolic blood pressure and diastolic blood pressure for the four doctors in each group. The slopes of systolic blood pressure of different groups' ages are as follows:

Group ages (24-36) year is – 0.011 mm-Hg, group ages (36-46) year is 0.033 mm-Hg, and group ages (46-56) year is 0.012 mm-Hg, respectively. The slopes of diastolic blood pressure of different groups ages are: Group ages (24-36) year is 0.013 mm-Hg, group ages (36-44) year is 0.018 mm-Hg, and group ages (44-56) year is 0.003 mm-Hg, respectively.

This study concludes that the measured values of these variables doctors whom ages 36 - 46 year are more affected by noise than others.

The data of sound pressure levels, systolic and diastolic blood pressure have been analyzed using the program (SPSS) software. Pearson Correlation Coefficient (R) between independent variable, mean sound pressure level and dependent variables (systolic and diastolic blood pressure) were -0.009, 0.104 respectively. P-value for SBP and DBP were 0.977, 0.749 respectively, P-values show that P > 0.05 and this result indicates that there are no significant effect between variables.

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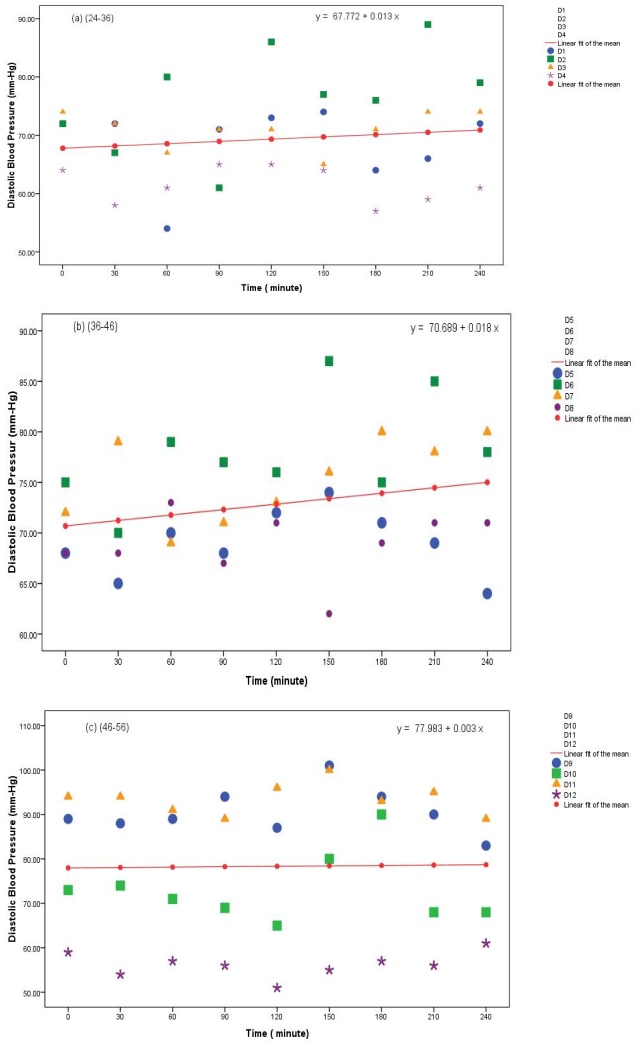

Fig. 4. The values of DBP and best linear fit of the mean as a function of exposure time in all selected dental offices divided into three groups of dentists as follows: group (a) 24 – 36 years old, group (b) 36 – 46 years old, and group (c) 46 – 56 years old.

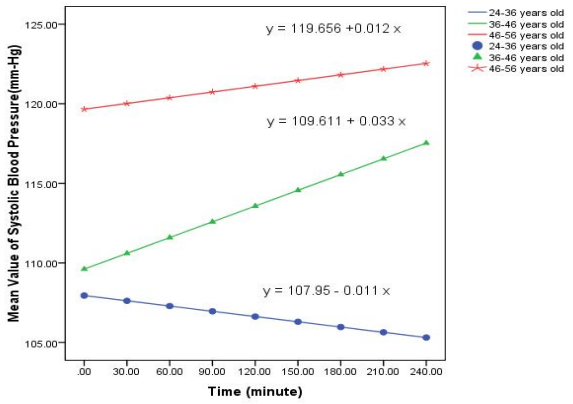

Fig. 5. The mean values and best linear fit of the mean of SBP as a function of exposure time which measured every 30 minutes for different group ages.

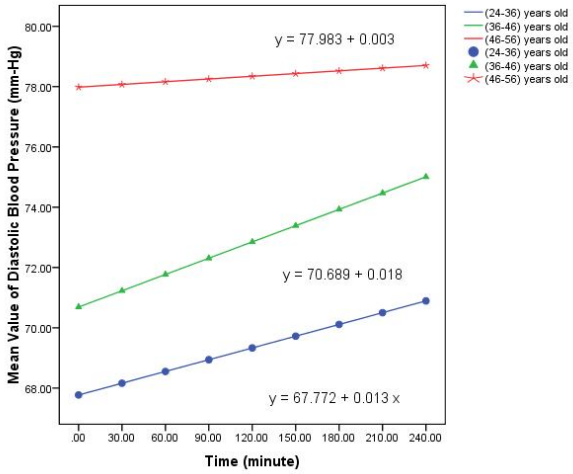

Fig. 6. The mean values and best linear fit of the mean of DBP as a function of exposure time which measured every 30 minutes for different group ages.

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Noise causes stress (hazardous to the health), and stress is a principal cause of bad health especially in a cardiovascular system. Its role as a risk factor for high blood pressure (hypertension) and this lead to heart disease by raising heart pulse rate. To determine the effect of noise on cardiovascular system, measurements of heart pulse rate to all selected doctors have been performed while under exposure to noise in their dental offices.

Measurements of heart pulse rate (HPR) to all selected dentists are plotted in Fig.7.
Fig.7 shows a slight decrease of heart pulse rate of all doctors as a function of working time. This is might be because of; there was not significant increment in the blood pressure for the dentists during working time.

The mean of the data of heart pulse rate is plotted as a function of time in Fig.8.
Fig.8 shows a negative decrease of mean heart pulse rate of all doctors as a function of time, from the graph the rate of decreasing in heart pulse rate of about -0.033 beats / minute.

R and P-value between independent variables, mean sound pressure levels and dependant variables (heart pulse rate) were 0.454, 0.139 respectively. P value is > 0.05, which mean statistically there is no significant relation between the dependant variables (heart pulse rate) and independent variables mean sound pressure levels.

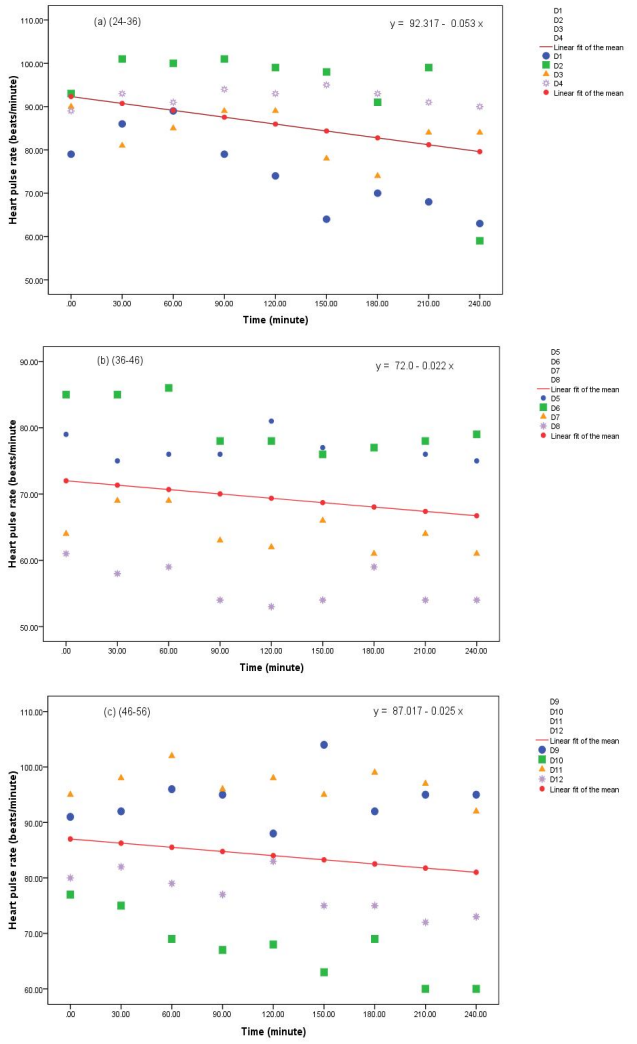

Fig. 7. The values of HPR and best linear fit to their means as a function of exposure time in all selected dental offices divided to three groups of dentists as follows: group (a) 24 – 36 years old, group (b) 36 – 46 years old, and group (c) 46 – 56 years old.

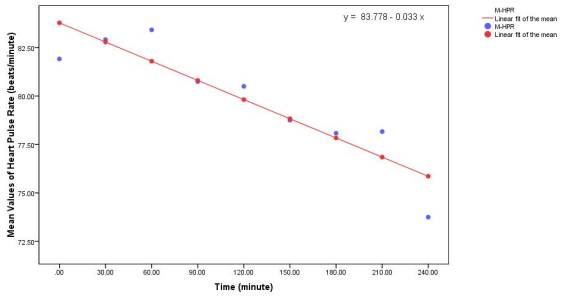

Fig. 8. The mean values of heart pulse rate (HPR) of all selected doctors as a function of exposure time.

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4 CONCLUSION

After close evaluation, the maximum noise level in all dental offices was little and less than the limited threshold, this is could be due to the new technology whether by using new equipments, tools and machines or because of the new buildings designed for protection from the noise. Moreover, this project shows that there was no statistical significant relation between noise level and blood pressure (systolic, diastolic) and heart pulse for all twelve selected dentists in Duhok city. In future, it is recommended to have larger number of samples in order to show more evidence and to investigate widely the relation between noise level and blood pressure.

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