EFFECTS OF OCCUPATIONAL NOISE EXPOSURE ON ARTERIAL BLOOD PRESSURE OF WORKERS IN SELECTED INDUSTRIAL PLACES IN DUHOK CITY.

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ABSTRACT

Noise pollution is increasingly being recognized as a physical factor in the environment that is injurious to many aspects of health. Environmental noise induces alterations of various physiological responses in individuals exposed to it. The aim of the present study is to assess the effects of industrial noise on some aspects related to the cardiovascular system of workers exposed to industrial noise in the woodworking industry in Duhok city, Iraq. The sound levels of electrical saws can be as high as about 100 dB. The study group included 29 workers employed in the woodworking industry (Carpentry) exposed to industrial noise levels exceeding 95 dB.

In order to observe the harmful effects of the noise caused by the Occupational Noise from the Carpentry machines, a questionnaire was made for all the workers (29 persons) included in this study. The results of this study showed significant changes in systolic blood pressure, diastolic blood pressure, mean arterial pressure, pulse pressure and pulse rate in the workers in the woodworking industry. Thus this study lead to conclude that industrial noise could be possible contributing factor in the development of arterial hypertension.

KEYWORDS: *Industrial noise, systolic B.P., diastolic B.P., pulse rate*

1- INTRODUCTION

1.1 Background

We live in a time where technology gives us a lot, but also adversely affects us. One major issue due to this technology is noise pollution. Noise pollution is becoming increasingly more severe in industrial cities and the cost of alleviating it in future years is expected to be insurmountable. (Singhal et al, 2009).

The term 'Noise Pollution' has been coined to signify the vast cacophony of sounds that are being produced in the modern life, leading to health hazards. (Park and Park, 1993). The term noise is commonly used to describe 'unwanted sound', or sounds that are disagreeable or unpleasant and produced by acoustic waves of random intensities and frequencies. (Akhtar , 1996). Noise has become an important 'stress factor' in the environment of man, and it has many effects on exposed population. Excessive and unnecessary noise is disliked by almost every individual. Exposure to noise may lead to various psychological and physiological effects. (Rashid et al, 2008).

1.2 Noise Pollution in Iraq

The sources of noise in Iraq are several due to using old cars, or using huge numbers of generators for electricity production (Al-Tornachi, 2008, Yousif, 2010, Abdulkhaliq, 2012). Mainly, the noise has a relation to industrial machinery and processes such as electrical machines, drilling, carpentry, pneumatic equipment, crushing, pumps and compressors, etc.

There is a lack of available information in Iraq (including Duhok city) regarding the Noise Pollution issues, such as the level of sound at different places, as well as the relation between the occupational noise exposure and cardiovascular system (e.g. arterial blood pressure, and pulse rate). However, Al-Khawalda (1993) have investigated the effects of loud noise on blood pressure and pulse rate for workers at Textile factory in Baghdad, Iraq. It has been found that workers with eight hours average noise exposure of 85 dB had higher blood pressure than workers of noise exposure less than 85 dB.

In fact, and in order to understand or investigate the relation between noise and cardiovascular system for the industrial workers in Duhok, Iraq, there is a need to have extra information such as the working conditions, as well as the environment of work.

It is expected that, the noise production will increase to a greater extent in Iraq due to establishing more airports, extraction of oil, establishing some factories for industrialization, more crowded road traffic, etc.. Moreover, more modern electrical and mechanical facilities in our everyday life have also will be added to this dilemma. Hence, more work must be done to understand and acquire Noise Pollution issue in Iraq.

1.3 Occupational Noise

Industrial plants and factories are considered as one of noise sources, because these plants have a plenty of machines and devices such as: motors, fans, cutting machines, compressors, etc. These noise sources have considerable impacts on industrial workers. They mostly could be transferred from the interior to the outside through open windows, doors, and through building walls. And thus disturb the workers, and the neighbors of these noisy plants and factories.

The industrial noise problem is very obvious. Exposure for more than 8 hours a day to sound over 85 dB is risky. The Occupational Safety and Health Administration (OSHA) in the U.S.A, puts the occupational noise standards which guarantee the workers health. For example, if Sound Level dB = 95. The time permitted per day = 4 hour (OSHA, 2004).

Noise considered a common occupational hazard in many workplaces. This is true because most of the machines and devices nature is to emit large noise. e.g. in the woodworking industry the sound levels of saws can be as high as 106 dB (Goeltzer, et al, 2001).

1.4 Noise Pollution Effects

Environmental noise affects health physically, and mentally. There is a sufficient evidence showing that high noise levels interfere with speech and communication cause hearing difficulties, hearing impairment, blood pressure changes, heart disease, increased heart rate, metabolism, and overall oxygen consumption (Ingle, et al, 2006; WHO, 1999). Noise in the environment can cause hypertension, ischemic heart disease, annoyance, sleep disturbance, and decreased work performance (Babisch et al, 2006 ; Jakovljevic et al, 2006; Salameh, 2005). Deficits in performance can lead to accidents, headaches, etc. A study shows that in a noisy environment there is a direct relationship between the noise levels and the negative psychological effects on workers, (Goeltzer, et al, 2001). The physiological effects include auditory effects; hearing loss, hearing impairments, and non auditory effects (WHO, 1999).

Non-auditory physical health effects that are biologically plausible in relation to noise exposure and annoyance from noise exposure include changes in blood pressure, heart rate, and levels of stress hormones (Babisch et al, 2006). Also noise has many effects on the function of various physiological activities (Kryter, 1985, and Gayathri et al 2012). The noise may be related to marked activation of the Neuro-endocrine system, resulting in increase in blood pressure and heart rate (Stansfeld, 1992). The damaging effect of noise on hearing ability has been confirmed in many studies. However, a few researches have been made to determine the possible effect of noise on other body systems such as the cardiovascular system. Its role as a risk factor for high blood pressure (hypertension) has been proposed, but good evidence has so far been lacking (Powazka, and Zahorska, 2002).

1.5 Previous Studies

There is a growing evidence that noise adversely affects health in general and the cardiovascular system in particular (Rosenlund, 2001; Fong & Johnston, 2000). Many studies have been done worldwide to find out the negative effects of noise. A study performed on workers at automobile factory (Chang, et al, 2003) found a significant difference of 16 mmHg in sleep-time systolic blood pressure (SBP) existed between two exposure groups, and a marginal increase of SBP as a result of increase in occupational noise exposure.

Hanini, (2002) found that there is a strong correlation between sound pressure and arterial blood pressure (systolic & diastolic), pulse rate, and hearing threshold levels at different frequencies. Another study to determine the possible effects of Occupational noise on workers have been done (Powazka and Zahorska, 2002), where a randomly-selected group of workers in a metallurgical plant was examined. The "high" exposure workers had significantly increased systolic blood pressure levels, compared with the "low" exposure men - averages of 125 mm Hg vs. 121 mm Hg. Average diastolic pressures were the same in both groups - 80 mm Hg. A review and analysis of 43 epidemiologic studies (Van Kempen et al,

2002) concluded that a significant association between noise exposure and hypertension exists. Study by Alsheikh Ibrahim, (2012) showed that the health effects of noise depend on the noise level, e.g. workers exposed to noise more than 90 dB have a significant shift of the mean measured values (blood oxygen saturation, pulse rate, blood pressure and hearing threshold levels), if compared with workers exposed to noise less than 90 dB. However, some of the research scientists observed negative (decreased or non-significantly increased) association between blood pressure and noise (Green et al, 1991; Kristal-Boneh , 1995)

1.6 Objectives of This Study

The main aim of this study is to find out the possible relation between the occupational noise exposure and arterial blood pressure and pulse rate for the workers in the woodworking industry (Carpentry) in Duhok city, Iraq.

In Duhok city, the lack of data collected about noise effects on the cardiovascular system of workers exposed to industrial noise in the woodworking industry (especially in the factories whose noise levels are above 90 dB) is the encouraging reason to conduct this study. As a result of this investigation, some suggestions and recommendations for the workers and the owners of the factories are expected. Consequently, this will reduce noise pollution and its effects on people in every aspect of life.

2- METHODOLOGY

2.1 Study Sample

The sample of this study consisted of 29 workers in Carpentry, where all were males. The workers ages were between 15 to 44 years (with mean value of 28.7 year). The sample should satisfy the conditions: the worker should have two years at least in working the same work, the workers work about 8 hours, the workers are in normal blood pressure (BP) and heart rate (pulse rate). Normal blood pressure in this study was considered as 100–125 mm Hg (systolic) and 60–90 mm Hg (Diastolic), heart rate was from 60–100 beats per minute.

2.2 Stages of Study

Field measurements were carried out for the workers in the woodworking industry (Carpentry) in many locations in Duhok city, Iraq.

The first stage in implementing the study was to visit the selected factories (Carpentry) to inform them about the study and take the permission for doing the measurements. After taking the agreement, the next step was to gathering information about the workers.

In order to observe the harmful effects of the noise caused by the Occupational Noise from the Carpentry machines), a questionnaire was made for all workers (29 persons) included in this study. In order to fulfill the objectives of this study, regular visits were taking place to measure the sound using sound level meter (SLM). The SLM was placed where the workers spent most of their time.

This study was conducted between September and November of 2012. The measurements for the workers were taken twice a day. First in the morning before the workers begin working, and the second after 4-5 hours after the beginning of work and each measurement was repeated twice then the mean was calculated. For each worker, the blood pressure (systolic and diastolic) and pulse rate were measured and recorded. Also Mean Arterial Pressure (MAP) and Pulse Pressure (PP) were calculated from the above data using the Excel Program.

Mean arterial pressure = Diastolic BP+1/3 Pulse Pressure Pulse pressure = Systolic BP – Diastolic BP.

The obtained data were ordered and analyzed statistically using the SAS-2001 (Statistical Analysis system) program and Microsoft Excel program.

The statistics were performed for workers satisfying the following conditions:

1) Aged 15-44 years. 2) Similar work hours. 3) Healthy, no history of cardiovascular diseases or hearing difficulties. 4) Similar Body Mass Index (BMI) (kg/m^2) (i.e. mass/heights x width for worker). 5) Ready to accept the tests voluntary, no obligation was required.

2.3 Instrumentations

Sound level (SL) meter was used in this study to measure SL or to measure the noise. It has been designed to approximate the loudness level sensitivity of the human ear. It gives reproducible measurements for the sound pressure level. The SL Meter used in this study was Model SL-200 (Voltcraft). This sound level detector is a digital meter for measuring the SL in decibels (dB). Its accuracy = ± 0.5 dB at 25ºC. This device gives the readings with precision of 0.1 dB (Instructions Manual for

Sound Level Meter 2010). This SL detector complies with the European Standard EN60 651.

The blood pressure (systolic and diastolic) and pulse rate were measured for each worker by Automatic Digital Electronic upper Arm Blood Pressure Monitor (Medical Beurer, model BM34) with accuracy of ±3 millimeter Hg, and ± 5% of reading pulse rate with operating temperature range of +10ºC to 40ºC (Instructions Manual for Automatic Digital Electronic Blood Pressure 2011).

Each instrument was checked and calibration was performed when needed. e.g. Blood pressure was checked by using supine position by using mercury sphygmomanometer (Pagoda, Elite Surgical Industries). The difference in accuracy = ± 0.5 to ±1 mmHg.

3- RESULTS AND DISCUSSION

The measured Sound pressure level (SPL) , or sound levels (Noise pollution levels) in all selected industrial factories (i.e. woodworking industry -Carpentry) in Duhok city, and the number of selected workers are presented in Table 1.

Sound pressure level (SPL) is a logarithmic measure of the effective sound pressure of a sound relative to a reference value. It is measured in decibels (dB) above a standard reference level. Sound pressure level is defined as:

$$SPL\ (dB) = 20 \log (P/ P_{ref}).$$

Where P is the sound pressure and P_{ref} is the threshold of hearing pressure for human being which is 2×10^{-5} Pascal (Pa). (Stumpf, 1980).

The sound pressure levels (SPL) in all studied factories ranged from 72 to 97.6 dB with mean value of 85.8 dB. It can be observed that some of the studied factories have SPL values that don't correspond with working hours per day as the Occupational Safety and Health Act (OSHA) illustrated.

Table (1): Noise pollution levels in decibel dB at the studied factories.

Factories (Carpentry) No.	Locations in Duhok	Number of selected workers	Noise level Rang (dB)	Mean Value of Noise level (dB)
Fa	East MALTA	13	72-93	81.93
Fb	Centre MALTA	3	88.1-89.9	89.06
Fc	East BAROSHK	2	85-85	85
Fd	West MALTA	3	85.1-97.6	90.06
Fe	West BAROSHK	2	85.6-85.6	85.6
Fg	East MACEKE	2	91.1-91.1	91.1
Fm	SEMEL	2	93.7-93.7	93.7
Fn	West MACEKE	2	81.8-93.8	87.8

Table 2 shows the age composition of the subjects working in different wood factories. It shows that the maximum number of workers was in the age grouping of 21-30 years.

Table (2): The age composition of the subjects working in different wood factories.

Age (in year)	No. of Persons	Percentage
≤ 20	2	6.89%
21-30	17	58.62%
31-40	8	27.58%
41-50	2	6.89%
Total workers	**29**	

The numbers of subjects in whom the blood pressure, Pulse Rate (PR), Pulse Pressure (PP), and Mean Arterial Pressure (MAP) increased, decreased or was not affected is recorded in Table 3. The statistical analysis of the data showed that the systolic blood pressure (SBP), diastolic blood pressure (DBP), Pulse Rate (PR), Pulse Pressure (PP), and Mean Arterial Pressure (MAP) increased into 79.3 %, 79.3 %, 89.65 % 48.27 and 86.20%) of total subjects respectively.

The above parameters decreased into 17.2 %, 13.8%, 6.9%, 44.8 % and 13.8% subjects respectively.

No effect on SBP, DBP, PR , PP , and MAP was observed in 3.4 %, 6.9 %, 3.4% , 6.9%, and 0 % subjects respectively (See Table- 3).

Table (3): Effect of noise on sbp, dbp, pr, pp, and map.

Parameters	Increase	Decrease	No effect
Systolic Blood Pressure (SBP)	23(79.31%)	5(17.24%)	1(3.44%)
Diastolic Blood Pressure (DBP)	23(79.31%)	4(13.79%)	2(6.89%)
Pulse rate (PR)	26(89.65%)	2(6.89%)	1(3.44%)
Pulse pressure (PP)	14(48.27%)	13(44.82%)	2(6.89%)
Mean arterial Pressure (MAP)	25(86.20%)	4(13.79%)	0

Also, It can be seen (from Table-3) that the increase in systolic BP (due to noise), occurred in relatively more numbers (increase in 23 subjects vs. decrease in 5 subjects) and was not affected in 1 subject. The results of the diastolic BP are rather similar to those of systolic BP. The Pulse rate increased in 26 subjects. It decreased in 2 individuals, while it was not affected in 1 subject. The Mean Arterial Pressure (MAP) increased in 25 subjects. It decreased in 4 subjects.

Quantitative Analysis of rise in blood pressure (SBP, DBP), PR, PP, and MAP is summarized in Table-4.

Table (4) : Quantitative Analysis of rise in SBP, DBP, PR, PP, and MAP.

Subject	SBP (mmHg)	DBP (mmHg)	PR (beats/min)	PP (mmHg)	MAP (mmHg)
Maximum rise	14.5	14.7	29	10	12.83
Average	3.51	3.42	8.54	0.093	3.45

From Tables 4, we can see that the average systolic and diastolic blood pressure was increased by about 3.5 mmHg, while the pulse rate is increased by about 8.5 beats/minute.

It is worth to say that the arterial blood pressure is very sensitive, and can be changed for many reasons such as eat a salty meal, smoking, nervous, hereditary, and disease. Therefore, workers were asked not to eat salty food or smoke heavily before at least one hour the measures were taken place. Also the settings when taking the measurement were quiet and attention has been taken not to make the worker feel nervous or worried.

The industrial wood factories in this study can be divided into many groups according to their sound pressure levels (SPL), e.g. the first group: factories between 70-75 dB, and the second with SPL between 75-80 dB, etc. (See Table-5).

Mean values (± standard deviation) of blood pressure (systolic), before exposure (b) and after exposure (a), together with the difference of SBP before and after exposure to noise pollution level are summarized in Table-5.

Arterial blood pressure (systolic) values for all the workers according to the range of noise are given in table- 5.

Table (5): Mean values (± standard deviation) of blood pressure (systolic), before exposure (b) and after exposure (a), and the difference of SBP before and after exposure.

The Noise level group	Noise level in (dB)	SBP before (mmHg)	SBP after (mmHg)	ΔSBP=SBP after-SBP before (mmHg)
1	70-75	122.6 ± 13.0	123.9 ± 14.5	1.2
2	75-80	132.5 ± 3.5	136.3 ± 2.1	3.83
3	80-85	122.8 ± 4.3	126 ± 8.2	3.167
4	85-90	127.4 ± 6.7	130.4 ±6.1	3
5	90-95	116.7 ± 8.7	121.6 ± 10.8	4.82
6	95-100	110 ± 0	115.5 ± 0	5.5

Table 5 in above shows significantly that there is an increase in the values for the dependent variables (systolic blood pressure) as a result of increasing noise pollution levels.
There is a strong correlation between increasing noise and dependant measured values, (see Figures-1 to 3).
Since, the value of $R^2 = 0.735$. The statistical results for the dependent variables (e.g. SBP) showed that linear Pearson correlation coefficients between sound pressure level and the dependent variables are approximately equal to 0.86.
It can be seen from Figures-1 to 3 that there is an increase in blood pressure (for the workers in the woodworking industry in Duhok city) due to occupational noise.

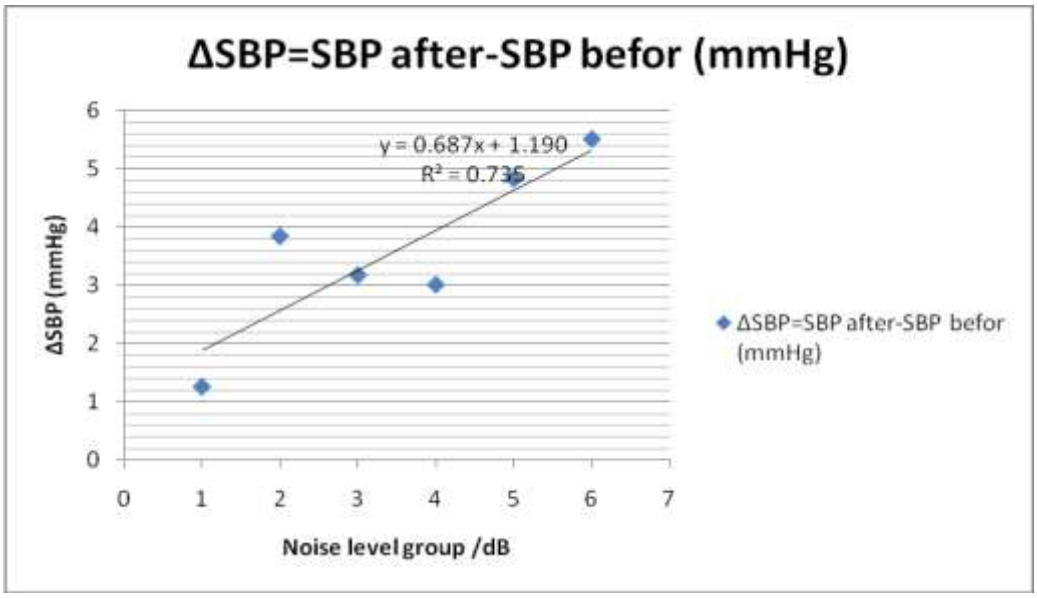

Figure-1 Noise level group Vs. The difference of SBP before and after exposure to noise level.

This study showed that the measured values are increased after exposure to noise. It can be seen that the change of the values is depending on the noise levels. The strength of the results is good as can be understood from the Pearson correlation coefficient (R=0.86).

In Fig 2, values of average of systolic blood pressure for study samples were plotted as function of sound levels groups. This figure showed that the mean values of systolic blood pressure change with different sound levels.

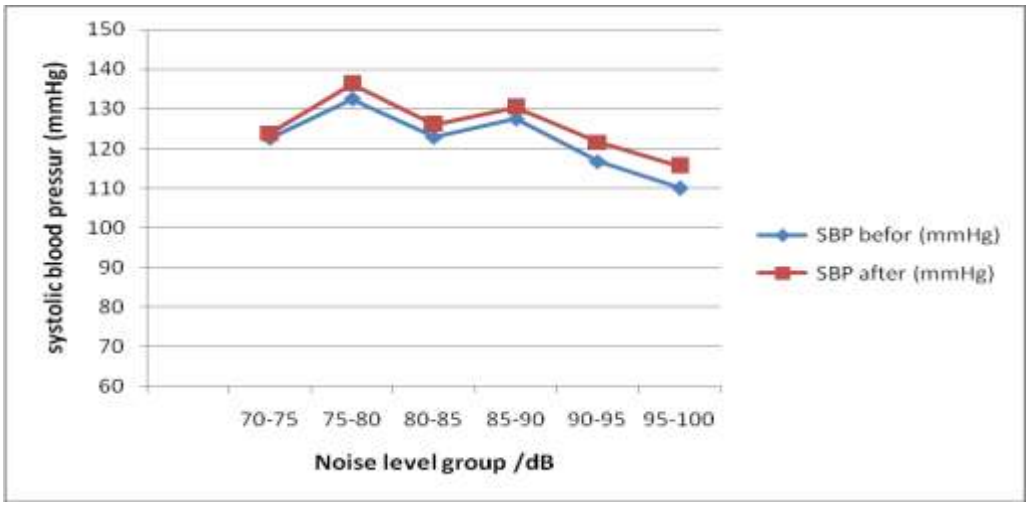

Figure-2 Values of average of systolic blood pressure according to noise pollution level (before & after) exposure.

The dependence of the mean values of diastolic pressure (DBP) of workers on sound pressure levels (SPL) in studied industrial wood factories is displayed in Figure-3

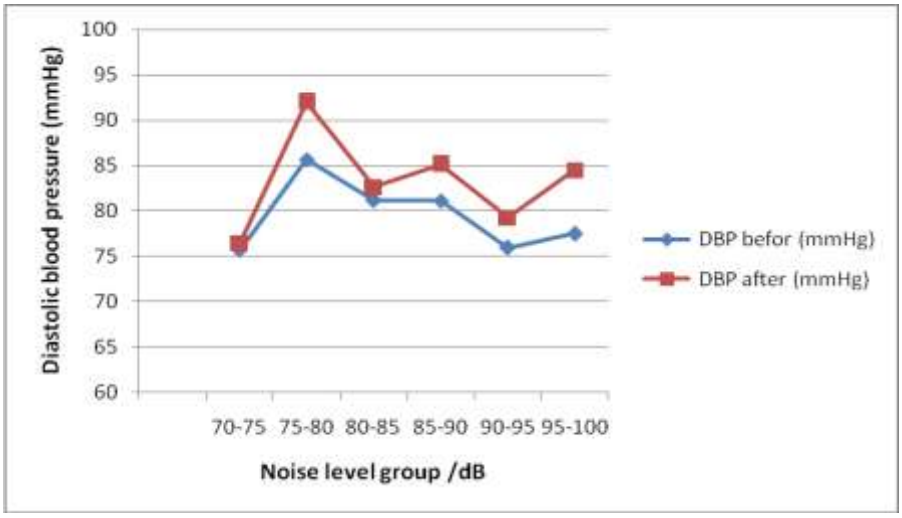

Figure 3 Values of average of diastolic blood pressure according to noise pollution level (before & after) exposure.

The results of this study are in a good agreement with other studies (such as Alsheikh Ibrahim, 2012, Hanini, 2002) which support that exposure to noise leads to increase of diastolic blood pressure of workers in wood factories after exposure to noise.
Values of average mean pulse rate (beats/min.) relative to different values of sound pressure levels dB, (before & after) exposure is shown in a histogram graph (Figure-4).

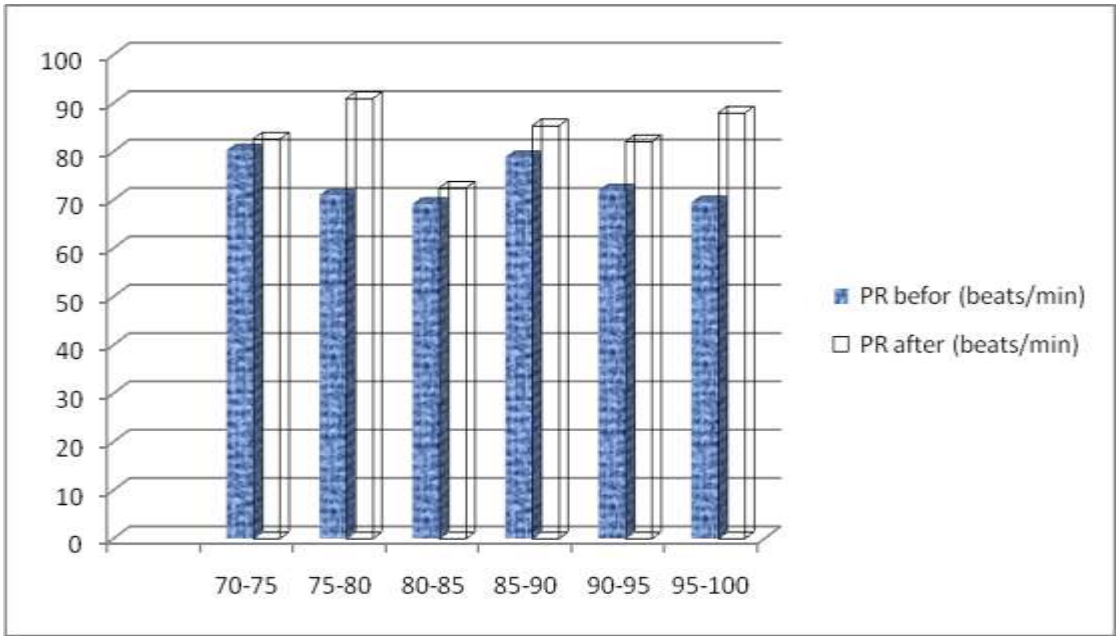

Figure 4. Values of average mean pulse rate (beats/min.) relative to different values of sound pressure levels (dB), (before & after) exposure.

Fig 4 shows that there is a significant shift in values of the pulse rate (beats/min) (of workers in wood factories) after exposure to noise. There is an increase in 26 subjects concerning the Pulse rate (see Table-3). It can be observed also, that there is small change of the pulse rate with different range of occupational noise.

The results of this study are rather similar to other studies and are comparable with many others in other countries, which give it a high credibility. Other studies found rather similar results; Talbott, et al, (1999), showed that for noise difference of 83 dB(A) to 89 dB(A), there is a mean increase of 2.5 mmHg for systolic blood pressure, and a 2.5 mm Hg mean increase of diastolic blood pressure. However, some researcher observed a rise only in systolic BP. (Germano, et al, 1991; Evans, et al, 2001). While many others found a significant increase in both systolic and diastolic B.P. in response to noise.

Correlation Coefficient and the T-test were calculated or performed to explore the differences for the measured quantities before and after the exposure was done. Correlation Coefficient, T-test, and other statistics analyzing were performed and used to identify the associations between the measured sound levels in dB and pulse rate, and arterial blood pressure.

The actual mechanism responsible for the increasing in blood pressure and pulse rate (Heart rate) is not yet completely understood so far, but a few facts are known to explain this increase. Harris, (1979) said that noise will cause a further increase in the stress reaction which will elevates blood pressure this will increase cardiac oxygen demand which will in turn increase in the pulse rate.

The peripheral vascular resistance increases and ban reflex sensitivity is not suppressed during intermittent noise exposure (Sawada, 1993). It was proved that rise in blood pressure due to noise exposure was sympathetically mediated in animals (Fisher and Tucker, 1991). Another possible biological mechanism for the relationship between noise and high blood pressure is activation of the sympathetic nervous system with release of epinephrine (Lenzi, et al, 2003). Also, The increased noise level alters the hormonal system especially the adrenal system resulted in increased urinary excretion of epinephrine, nor-epinephrine, dopamine and cardisol in subjects exposed to high noise level. (Bergomi, et al.,1991).

Based on all these preliminary studies, it may be suggested that noise may be related to a marked activation of the neuroendocrine system, resulting in increase in blood pressure and pulse rate.

4- CONCLUSIONS AND RECOMMENDATIONS

The following are some conclusions from this study:

1- High levels of occupational noise can affect adversely the blood pressure (systolic and

diastolic) and pulse rate of workers in wood factories (Carpentry) in Duhok City.

2- The noise pollution in industrial factories in Duhok City is very extensive, e.g. factories have noise pollution above 85 dB.

3- The results show that the measured values (SBP, DBP, and PR) are increased after exposure to noise. The average systolic and diastolic blood pressure was increased by about 3.5 mmHg, while the pulse rate is increased by about 8.5 beats/minute. Generally, the change of the values is depending on the noise levels. The correlation coefficients for the dependent variables are strong.

4- Most of the workers, managers, and factories owners have an apparent unawareness of noise problem.

5-There are no safety procedures or shields or any procedures to protect from the danger noisy machines and devices.

6- Although the Regulations are present in Iraq (The Environmental Law). But the activation for the legislations is absent or neglected or simply unknown. Therefore, media should play a special role concern with this issue.

There are many recommendations and actions (mainly from OSHA, WHO, and Engineering books and standards), which can be carried on to reduce or prevent the occupational noise problem in order to conserve workers health, they include:

1- Provide workers with noise protective equipment like ear protection.

2- To control and prevent the noise, factory's designer has to come up with designs that increase the factory's area, and allowing enough spaces between machines.

3- Shielding the emitting noise by acoustic barrier to help in absorbing or deflecting noise.

4- It is recommended that maximum allowable duration of exposure to noise should be reviewed and strictly followed.

5- There must be a supervision from ministry of Labor in order to put laws concern with noise health effects and work safety.

6- There should be permanent arrangements for regular measurements of noise levels at different locations in factories.

7- Regular maintenance for noisy machines or buying less noisy equipments.

8- Periodic tests for the workers in order to determine the health effects of noise early.

9- Health education regarding noise control should be given due importance.

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عبدالوهاب عبدالله قاســـم التورنجي التكاليف المالية للتلوث الضوضائي واث ارها الاجتماعية على الوحدات الاقتصادية (معمل أسمنت سرجنار- العراق نموذجا) رسالة ماجستير في ادارة البيئة مقدمة الى: مجلس كلية الادارة والاقتصاد الاكاديمية العربية المفتوحة في الدنمارك.2008.

تأثير الضوضاء على ضغط دم العمال في بعض المواقع الصناعية في مدينة دهوك

الخلاصة

ان الضوضاء او الضجيج هو من السمات البارزة في هذا العصر و تعتبر مشكلة بيئية تؤثر على صحة الانسان وراحته.
ان الغرض من الدراسة الحالية هو لتقدير و تخمين تأثير الضوضاء الصناعي (المهني) على بعض النواحى المتعلقة بالدورة الدموية او النظام القلبي (cardiovascular system) للعاملين المعرضين الى الضوضاء الصناعي في قطاع النجارة في مدينة دهوك/ عراق حيث ان مستوى الصوت للمناشير الكهربائية قد يصل الى حوالى 100ديسبل.
لقد تضمنت الدراسة(29)عامل في النجارة ويتعرضون الى ضوضاء خلال عملهم حيث تزيد على (95) ديسبل .كما تضمنت هذه الدراسة اعداد استمارة استبيان للعينة المدروسة.
ولقد اظهرت نتائج البحث حصول تغييرات مناسبة ومحسوسة في ضغط الدم الانبساطي والانقباضي . وكذلك في معدل الضغط الشرياني والضغط النبضي وعلى انتظام ضربات القلب للعاملين في معامل النجارة .

.....

كارتێكرنا پرەدەنگی یا دناف کاری دا ل سەر فشارا خوینا دەمارا ل دەڤ کارگەهێن پیشەسازی ل پارێزگەها دهوکێ

پوختە :

پیس بوونا پرەدەنگی (ژاوە ژاو) بشیوەیەکی مەزن دهێتە بەرچاڤکرن وەکو فاکتەرەکی فیزیکی دژینگەهی دا و ئەوێ دبیتە ئەگەرێ چەندین ئاریشین ساخلەمی .

مەرەم ژئەڤی ڤەکولینی ئەوە ژبو تاقیکرنا کارتیکرنا پرەدەنگی یا پیشەسازی ل سەر سیستەمی (cardiovascular) ل دەف کارکەرێن توشی پرەدەنگی یا پیشەسازی بوین ل کارگەهێن دارتاشی ل باژیری دهوکێ - عیراق چونکە ریژەیا دەنگی یا منشارین ئەلکتریکی دگەهیتە (100dB) .

گروپی ڤەکولینی پیکهاتی بو ژ 29کارکەرا ل کارگەهین دارتاشی و توشی ریژەیا دەنگی 90dB بوینە ژبو تاقیکرنا کارتیکرنا نەرینی یا پرەدەنگی ئەوا هاتیە ئەنجامدان ژ مەشینین دارتاشی و راپرسینەك هاتە ئەنجامدان بو هەر کارکەرەکی.

ئەنجامان دیار کر کو جیوازین بەرچاڤ هەبون دفشارا خوینی دا یا (سیستولیك) و فشارا خوینی یا (دایا سیستولیك) و تیکرایی فشارا دەمارا و فشارا لیدانا دلی ل دەف کارکەرین ل کارگەها دارتاشی . ب ڤێ چەندێ بومە دیار دبیت کو پرەدەنگی دبیتە فاکتەرەك دپەرەسەندنا فشارا خوینێ یا بلند