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Noise exposure and risk of hypertension: a cross-sectional study

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Abstract

Background: Previous studies have indicated an unspecific correlation between noise exposure and blood pressure disturbances. Blood pressure disturbances could be caused by the environmental hazards such as noise exposure. The aim of this study is to analyze whether there is a relationship between noise exposure and hypertension.

Methods: A total sample of 218 workers working in a small workshop aged between 27 and 49 yrs answered the questionnaire in this survey. Blood pressure was measured in the sitting position after 5 minutes rest. Level of sound intensity in the workplace was measured by sound level meter (SKC Model CEL-480-440) and human noise exposure level was measured by audiometric device (MEVOX). The correlation between industrial noise and blood pressure was extracted. The t-test and Fisher's exact test was used to compare the qualitative variables and quantitative variables with normal distribution as being applied in parametric tests. Odds ratio (OR) with 95% confidence interval (95% CI) was used to compare the magnitude of risk variables.

Results: Sub-populations in this study consisted of 109 workers with noise exposure more than 85 dB (Case group) and the rest (i.e. 109 workers) with noise exposure less than 85 dB (Control group). High level systolic and diastolic blood pressure was more prevalent in the case group. Total hearing loss more than 25dB was significantly more prevalent in the case group (45% of case group have hearing loss). Adjusted Odds Ratio (OR) for the effect of age, food type and BMI on blood pressure was 3.56 (95% CI: 6.6 – 1.9).

Conclusion: This study showed that high blood pressure (≥140/90 mmHg) was more prevalent in the case group. This finding persisted after adjustment was made for age, food type, and BMI. (Odds Ratio 3.56 (95% CI: 6.6 – 1.9)).

Keywords: noise, hypertension, hearing loss.

Introduction

Noise is a persistent environmental problem or hazard. In Europe, a population of 450 million are exposed to equivalent noise levels of at least 55 dB(A) daily; a population of 113 million are exposed to equivalent noise levels of at least 65 dB (A) and a population of 9.7 million are exposed to equivalent noise levels of 75 dB(A) or more [1].

Noise exposure is associated or linked with a number of health hazards. We can identify & differentiate amongst psychosocial responses (such as annoyance, sleep disturbance, disturbance of daily activities and performance) and physical responses, such as hearing loss, hypertension and ischemic heart disease [2]. Current-

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ly, number of discussions have been held on how noise influences or transforms human health and tranquility. Stress is supposed to play an important role and can be seen & identified as an effect of the appraisal of noise or as a coping reaction of the body (fight-flight)-the so-called physiologic reflexes [2].

There have been numerous studies that have investigated the possible effect of either work or environmental noise exposure on blood pressure. Ninety percent of hypertension is defined as "essential" (cause unknown) and investigation of the cause of hypertension remains an active area of research. A review paper published in 2002 of 43 published articles concluded that for each five decibel increase in occupational noise exposure there is an increase of .51mm Hg (95% CI .012-1.00) in systolic blood pressure and a 14% increase (relative risk of 1.14 (95% CI 1.01-1.29) in the occurrence of hypertension [3].

Additional studies have also proved the correlation between work-related noise and blood pressure [4-12]. Although one of the studies has suggested the effect is only transient in people under the age of fifty. Potential accompanying biological mechanisms for noise and high blood pressure are: 1) release of stress hormones such as steroids; and 2) activation of the sympathetic nervous system with release of epinephrine.

It has also been suggested that noise exposure is interrelated with blood pressure changes and ischemic heart disease risk, but epidemiologic evidence is still limited. Furthermore, most reviews investigating these relations were not carried out in a systematic way, which makes them more prone to biased prejudgments.

To gain more insight into the relation between noise exposure and its potential health impact, we performed a cross-sectional survey to investigate the relation between noise and blood pressure.

Methods

Among a cross-sectional study, a total of 216 male small workshop workers filled out a questionnaire with questions about working condition, smoking habits, diet, level of physical activity, and family history of hypertension, diabetes, hyperlipidemia, and hypothyroidism. Blood pressure was measured in the sitting position after 5 minutes rest. Hypertension was defined as having a systolic blood pressure of 140 mmHg or more, or a diastolic blood pressure of 90 mmHg or more and answering yes about being on antihypertensive medication. Level of sound intensity in the workplace was measured by sound level meter (SKC Model CEL-480-440) and human noise exposure level was measured by an audiometric device (MEVOX). Association between industrial noise exposure and blood pressure were measured. Body weight was measured in light indoor clothing and recorded to the nearest kg. Height was measured to the nearest centimeter without shoes. Body mass index (BMI) was calculated as weight (Kg) divided by height squared (m^2). Those with a BMI of 30 or more were classified as obese.

The SPSS software version 11.5 was used. For statistical analysis the χ^2 test and fisher's exact test were used for comparing the qualitative variables and for quantitative variables with normal distribution we used the parametric tests. Odds ratio (OR) with the 95% confidence interval (95% CI) was used for comparing the proportion of risk variables. Logistic regression modeling was used for multivariable analysis and adjusting the effect of different variables (e.g. age, BMI, eating habits, etc).

Results

The mean age of the case group workers was 38.7 ± 10.4 years old and control group workers was 38.3 ± 10 years old.

The mean duration of job experience of the case group workers was 15.5 ± 9.6 years and the

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Variables	*Case* *No. (Percent)*	*Control* *No. (Percent)*
Sex (Male)	81 (74%)	89 (81.7%)
Smoker	47 (43%)	48 (44%)
BMI ≥ 25		
Systolic pressure ≥ 140	16 (15%)	0 (0%)
Diastolic pressure ≥ 90	18 (16.5%)	6 (5.5%)
Hearing loss > 25db	49 (45%)	0 (0%)

Table 1. Prevalence of variables.

control group workers was 12 ± 7.8 years.

Table 1 shows the result of mean of variables in the present study.

Systolic pressure ≥ 140 mmHg and diastolic pressure ≥ 90mmHg and total hearing loss ≥ 25db in case group workers were 15%, 16.5%, 45%, and in control group workers were 0%, 5.5%, 0%, respectively.

Table 2 shows the results of prevalence of variables in work groups (case and group workers).

Adjusted Odd's ratio for the effect of age, food type and BMI on blood pressure was 3.56 (95% CI: 6.6-1.9).

Conclusion

This study showed that high level systolic and diastolic blood pressure were more common in case group workers than in control group workers. This finding persisted after adjustment was made for age and food type and BMI. Our results are in agreement with the results in previous studies [1,2,9,14]. But other studies have been shown that there was no difference in hypertension levels between case group and control group workers [14].

We found no significant differences in the prevalence of diastolic hypertension when comparing case group workers and control group workers. Our results are in agreement with the results in previous studies [5-8,10,11].

We found significant differences in systolic hypertension when comparing the two groups. This result is in agreement with the results in previous studies[4-12].

On the basis of our survey, it is recommended that in every work place where noise exposure is mandatory, a chronoclinic should be established. Trained health care personnel of the chronoclinic should monitor intermittently (preferably every other 3 months) the state of each worker with high level noise exposure. Upon discovering hypertension, his/her transfer to a place with noise level less than 85db should take place. This would perhaps rule out the possibilities of ill-effects of noise exposure that are expected to be impinged upon the workers.

It has been proposed while examining the noise level exposed to workers, the level of

Variables	*Case* *Mean ± SD*	*Control* *Mean±SD*	*P-value*
Age (year)	38.7 ± 10	37.3± 10	0.320
Job experiences	15.5 ± 9.6	12±7.8	0.005
Sound level exposure Scale A (TLV)	94 ± 4	81 ± 2	<0.0001
Hearing loss (right ear)	26.5 ± 6	12 ±4	<0.0001
Hearing loss (left ear)	26.5 ± 6	12 ±4	<0.0001
Systolic pressure	129.4 ± 13	118.7 ±8	<0.0001
Diastolic pressure	81 ± 1	79 ± 8	0.187
BMI	24.2 ± 2.9	23.9 ± 2.8	0.397

P value <0.005

Table 2. Mean of variables.

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lipid profile, anxiety & mental health status of every individual worker shall be investigated.

In addition, appropriate chronotherapy should also be administered to hypertensive workers while they are being transferred from a place with high level noise exposure (more than 85 db) to a low level noise exposure area (less than 85 db).

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