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Effects of Occupational Noise on Blood Pressure

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Abstract

Background: Noise has been found to have non auditory effects. One of the possible non auditory effects of noise is its effect on blood pressure. Available data on the effect of noise on blood pressure has been found to vary. Hence, the aim of this study was to find if there is a predictive effect of noise on blood pressure.

Method: Study was done among sawmill workers in Ile-Ife. The noise in each sawmill was measured with a sound meter and blood pressure of each participants were recorded. A regression analysis was done using systolic and diastolic blood pressures as dependent variables and noise as the predictor.

Results: A total of 420 sawmill workers were recruited into the study with an average age of 33.53±8.59 years. The average noise level in the sawmill was 88±1.87 dB and the average systolic and diastolic blood pressures were 132 ± 21 mmHg and 85 ± 13 mmHg respectively. There was no significant effect of noise on systolic blood pressure {F (1, 419) = 0.958, P>0.05} but there was a significant effect of noise on diastolic pressure {F (1, 419) = 7.543, P<0.05}.

Conclusion: This study found that exposure to noise is a predisposing factor to increase in blood pressure.

Keywords: occupational noise, blood pressure, sawmill workers

1. Introduction

Noise is an aperiodic complex sound (Dhingra, 2010). Exposure to loud sounds for a prolong period of time has been shown to have deleterious effects on the sensory organ of hearing within the inner ear (Otoghile et al., 2018). According to the World Health Organization, noise in the big cities is the third most hazardous type of pollution after air and water pollution (WHO, 2005). As industrialization is on the increase in the many cities, the dangers of noise have become a major public health concern. Prolong exposure to loud noise is potentially associated with negative health consequences. The effects of noise on health could be classified as either direct or indirect (Babisch, 2005).The direct effects of noise include; hearing loss, tinnitus and cardiovascular effects, while the indirect effects include moderating or mediating factors such as annoyance and sleep disturbance (Basner et al., 2014). Several studies have confirmed the effects of noise on hearing, sleep and annoyance. However, the available data from studies on the effects of noise on blood pressure is rather sparse and shows some variability. Hypertension is a disease with multiple possible causes. The causes could be external and internal factors (kalantary et al., 2015). Noise has been identified as a possible external factor that can affect heart rate and blood pressure (Yousefi Rizi & Dehghan, 2012). While some studies have shown that noise has no effect on blood pressure, others have shown that noise can affect both systolic and diastolic blood pressures (Ayden &Kaltenbach, 2007; Singhal et al., 2009; Sorensen et al., 2011; Foraster et al., 2014). It is very essential to know and confirm the actual effects of noise on blood pressure as there are variable findings from the literature and hypertension is a known cause of potential morbidity and mortality if not detected and managed early. Also, there is paucity of data on the effects of noise on

blood pressure in Nigeria, particularly in Ile-Ife where there are many sawmills. Hence, the aim of this study was to determine the predictive effect of noise on blood pressure among sawmill workers.

2. Methods

2.1 Study Design

This was a prospective cross sectional community based study among sawmill workers.

2.2 Study Setting

Study was conducted in Ile-Ife in southwestern Nigeria. There are over 500 sawmills in Ife-East where the study was conducted.

2.3 Study Protocol

A total of 420 subjects who are sawmill workers were recruited for the study. A designed noise exposure evaluation questionnaire was used to retrieve data from the participants and the ambient noise level for each sawmill was measured with a sound meter (Pulsar model 14 class 2, meets the requirements of IEC 61672) when the machines were in operation. The blood pressure of all participants was measured twice while at work. It was measured using their left arm in a sitting position using a digital Sphygmomanometer (OMRON) and was repeated after 30 minutes interval and the average was noted. A systolic blood pressure of <120 mmHg and diastolic blood pressure of <80 mmHg was classified as normal, systolic pressure of 120–139 mmHg and diastolic pressure of 80–89 mmHg was classified as pre hypertension, systolic blood pressure of 140–159 mmHg and diastolic pressure of 90–99 mmHg was classified as stage 1 hypertension and stage 2 hypertension was classified as systolic blood pressure ≥160 mmHg or diastolic blood pressure ≥ 100 mmHg (American College of Cardiology, 2018).

Inclusion criteria included adult sawmill workers from the age of 18 years and above who gave consent for the study, while those workers with a history of hypertension or on anti- hypertensive medications were excluded from the study.

This study was done in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

2.4 Data Management

The data obtained was analyzed using the Statistical Package for Social Sciences (SPSS) version 20 software and results were presented in a descriptive format using tables. A simple linear regression was done using values of systolic and diastolic blood pressures as dependent variables and noise level as predictor. A ′p′ value < 0.05 was considered as statistically significant.

3. Results

The study consisted of 410 male and 10 female sawmill workers with a mean age of 33.53±8.59 years. The average noise level in the saw mill was 88±1.87 dB. The mean systolic blood pressure was 132 ± 21 mmHg while the mean diastolic blood pressure was 85 ± 13 mmHg. The sawmill workers were found to work an average of 8 hours daily and 6 days in a week. Table 1 below shows the age and blood pressure distribution of the participants. Table 2 and Table 3 show the effect of noise on systolic and diastolic blood pressure respectively. None of the participants used any noise protective device.

Table 1. Age distribution and blood pressure of subjects

Age Distribution of subjects	
Age(Years)	**Frequency (%)**
≤ 20	9(2.1)
21-30	158(37.6)
31-40	175(41.7)
41-50	74(17.6)
51-60	4(1.0)

Blood Pressure of subjects				
Classification of Blood Pressure	**Systolic Pressure**		**Diastolic Pressure**	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Normal	115	27.4	143	34.0
Pre hypertension	185	44.0	166	39.5
Stage 1	90	21.4	73	17.4
Stage 2	30	7.1	38	9.0
Total	420	100.0	420	100.0

Table 2. Effects of noise on systolic blood pressure

Variable	B	Std error	Beta	t	p
(Constant)	101.375	31.632		3.205	.001
Noise	.353	.360	.048	.979	.328

F (1, 419) = 0.958.

Table 3. Effects of noise on diastolic blood pressure

Variable	B	Std error	Beta	t	p
(Constant)	32.489	19.017		1.708	.088
Noise	.595	.217	.133	2.746	.006

F (1, 419) = 7.543.

4. Discussion

Loud noise is a neglected form of pollution in many countries. Unfortunately, this has a significant effect on the society, affecting the population. Most developing countries often lack both effective legislation against noise and programs to prevent its harmful effects on health. One of the potential effects of noise on health has been shown to be on the blood pressure (Yousefi Rizi & Dehghan, 2012). Majority of the sawmill workers recruited into this study were males. This is probably due to the tedious nature of the job as it involves lots of physical strength, lifting logs of wood and aligning the pieces together. Table 1 shows that the sawmill workers in this study were predominantly from the age of 31–40 years. This was followed by those within the ages of 21–30 years. Although the pre employment blood pressure of the subjects was unknown, it may be presumed that many of them had normal values since majority of them fell within the younger age group. Hypertension has been to be commoner in the older age group in the general population (Ajayi et al., 2016). Some of the factors that have been identified that are risk factors for hypertension include family history of hypertension, increasing age, sedentary lifestyle and diet. This study, however focused on the effects of prolonged noise exposure on blood pressure among sawmill workers. These sawmill workers were exposed to a noise level of an average of 88 dB for about 8 hours daily, and for 6 days/ week. This noise level is quite higher than the recommended permissible level of 55 dB for environmental noise (WHO, 1999). In this study, the mean systolic blood pressure was 132mmHg while the mean diastolic pressure was 85mmHg and this falls within the range of pre hypertension. This is rather alarming and calls for concern considering the fact that most of these workers are still young and in their prime age. Also, 21.4% and 17.4% of them had stage 1 hypertension, considering their systolic and diastolic blood pressure respectively and this reveals that a significant proportion of these workers had hypertension. This study also showed that 7.1% and 9.0% of the participants had elevated systolic and diastolic blood pressure respectively within the range considered as stage 2 hypertension. This result shows that hypertension is prevalent among this group of workers. In the location where this study was done, these group of people constitute a very significant proportion of the population as there are many sawmills in this location. The results of regression analysis showed that there was no significant effect of noise on systolic blood pressure. It however also found that there was a significant effect of noise on diastolic blood pressure. These are as shown in Table 2 and Table 3 respectively. These findings from this study corroborate the results from other studies (Aydin & Kaltenbach, 2007; Sorensen et al., 2011; Foraster et al., 2014). Noise has

been linked to some physiological responses that could explain the non auditory effect of noise. Noise is known to cause stress response with subsequent increased secretion of catecholamines and cortisol (Moghadam & Khanjani, 2013). Noise has also been implicated in causing increase in blood lipids and also noise-induced vascular damage (Lunberg, 1999; Schmidt et al., 2013). These lead to an increase in heart rate and blood pressure. The systolic hypertension is said to be due to a reduction in the compliance or stiffening of the aorta which usually occurs with increasing age. Elevated diastolic pressure on the other hand has been linked to exercise, diet and lifestyle (Smulyan & Safar, 2000; Franklin et al., 2009; Wang et al., 2015). These factors coupled with the stress response associated with prolonged noise exposure could probably explain the findings from this study. However, other confounding factors such as genetics, daily intake, working type that could also increase blood pressure were not considered and controlled for in this study.

5. Conclusion

Prolonged exposure to loud noise could predispose to increase in blood pressure. We recommend that workers who are exposed to occupational noise should as a matter of necessity have a regular check and monitoring of their blood pressure. Above all, the use of hearing protection devices such as ear muffs and plugs could go a long way in preventing the harmful effects of loud noise.

Competing Interests Statement

All authors declare that there are no conflicts of interest.

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