Asia Pacific Environmental and Occupational Health Journal (ISSN 2462-2214); Vol 2 (2): 43 -51, 2016

Occupational Noise Exposure and Its Association with Blood Pressure and Possible Health Effects among Workers Working at Port Industry, Penang.

Nadiah MN[1], Junaidah Z[1]

[1]Faculty of Engineering Technology,University Malaysia Pahang, Lebuhraya Tun Razak, 26300 Kuantan, Pahang, Malaysia

Abstract

Introduction: Nowadays, exposure to noise has become one of the major concerns in a workplace. A cross-sectional pilot study was conducted among port industry workers at Pulau Pinang, Malaysia.

Objective: The main objective of this study was to determine the association between noise exposures with blood pressure among exposed workers.

Methodology: An area noise monitoring was conducted at three different workstations namely Strategic Business Unit Marine (ferry basal) and Strategic Business Unit Container (rubber tyre gantry and prime mover). Eight hours personal noise exposure monitoring was conducted among respondents in those area. Blood pressure were taken before and after shift work for each respondent. A set of self-administered questionnaire was used to assess the social demographic information and their health complaints.

Result: A total number of 51 male workers involved as respondents in this study. The noise level at prime mover was between 74.5 dB to 88.9 dB which is above the action level of 85dB. The results also revealed that there was no significant difference in blood pressure reading before and after the work shift among workers. The majority of the workers (66.7%) was classified to having pre-hypertension. They was 15.7% of respondents classified as having stage 1 hypertension, 9.8% as having stage 2 hypertension and 7.8% was normal. There was no significant association between noise exposure and blood pressure. Results showed that stress was the commonest health affect claimed by the workers (76.47%) followed by communication disorder (68.63%), emotional disorder (64.71%) and exhaustion (62.75%).

Conclusion: In a conclusion, findings of this study showed that there was no association between noise exposure and blood pressure among the workers. There was only one area exceed the action noise level.

Key word: *noise, blood pressure, systolic and diastolic blood pressure and port industry.*

1.0 INTRODUCTION

Noise is all around us. Noise pollution is defined as a form of air pollution that is an unwanted audible sound that poses a threat to a person's health and well-being (Goines and Hagler, 2007). Port industry has become one of the workplace setting where noise is unavoidable. Studies conducted by the Baaj et al., (2001), Babisch (2008) and Niemann et al., (2008) revealed that short exposure to low level of noise emitted from the container terminal can cause minor irritant and exposure to a higher levels and for a long period of time can cause serious annoyance.

According to Stansfeld and Crombie (2011) and Kempen et al., (2006) there was an association between environmental noise exposure and hypertension and ischemic heart disease. Noise also affects the physiological functions in humans which can be temporal or permanent (Archer et al., 1993 and Babisch et al., 2005). This study was intended to investigate the association between noise exposure with blood pressure and also other possible health effect among workers at a port industry in Penang.

Noise or unwanted sound is one of the most pervasive occupational health problems. According to Celen and Arin, (2003), the undesirable irritating sound in daily life is called noise. Karrabiber (1991), Kumbar and Yalcin (2000) and Acar (2001) affirmed that noise is gradually affecting a larger group of people. Prashanth and Venugopalachar (2011) revealed that the common noise in the workplace includes noise made by traffic, landing and departing airplanes, construction machines, earth moving and building machinery, ventilation systems, sirens and such other sound that operated by employees or machines.

Abdul Raziq (2003) affirmed that blood pressure of industrial workers raised as a result of occupational noise exposure. Furthermore the other previous studies which was conducted by Carter et al., (2002) and Haralabidis et al., (2008) also reported that an acute noise exposure has been shown to induce physiological responses such as increased blood pressure and heart rate.

According to Berglund (1999), Heslop (2007) and Dinno et al., (2011), community noise is associated with the adverse health effects on the individuals. From the previous study that was conducted by I – Hung and Tang – Hung (2011) it was reported that a container sector has the highest level of noise which was generated by the ships, straddle carriers, cranes, forklifts, trucks and trains.

2.0 MATERIALS AND METHOD

Study design and study area: This was a cross sectional study conducted at Penang Port Sdn. Bhd, Georgetown, Penang at the Strategic Business Unit (SBU) Marine and the Strategic Business Unit (SBU) Container.

Study sample: A total of 51 workers were respondents in this study. All respondents were randomly selected from SBU Container and SBU Marine. Three ferries were operating during the working hour. About 11 workers were selected in this study. There were two areas for data collection at the SBU Container namely the Rubber Tire Gantry (RTG) and Prime Mover (PM). Twenty workers involved for sampling in each of these two areas.

Questionnaire: A set of questionnaire was used to obtain data on social demographic, history of disease and other possible health effects. Section A comprised of variables on demographic data which include age, gender, level of education, monthly income, working hour per day and rest hour. Section B comprised of general information about noise.

Noise area monitoring: Area noise monitoring was measured using the Larson Davis Spark sound level meter (706- ATEX). This measuring device was calibrated every time before use.

Dosimeter: Dosimeter was used to measure personal noise monitoring. Calibration was performed before and after each measurement. The dosimeter stores the noise level information and carries out an averaging process. It is useful in industry where noise usually varies in duration and intensity and where the person changes locations. Wearing dosimeters over a complete work shift gives the average noise exposure or noise dose for that person. This is usually expressed as a percentage of the maximum permitted exposure. If a person has received a noise dose of 100% over a work shift, this means that the average noise exposure is at the maximum permitted level.

Automatic electronic blood pressure measurement: The automatic electronic blood pressure was used to measure blood pressure. The cuff which was attached to the respondents' wrist or upper arm was connected to an electronic monitor. The blood pressure before and after work was measured for each worker.

Data analysis: All data collected was analyzed using the Statistical Package for Social Sciences (SPSS) version 15.0 software. Normality test was run. If the data was normally distributed, parametric tests were run. Non-parametric tests were run for data which was not normally distributed.

3.0 RESULTS

Table 1 shows the information on socio-demographic information of the respondents including age, level of education, job specification, monthly income, rest hour, job operation and health symptoms of high blood pressure. Information on the socio – demographic background was completed by the respondents working at the prime mover, ferry engine and rubber tire gantry. Result showed that majority of the respondents aged from 40 to 50 years old (49.0%). The highest level of education of the respondent was Malaysian for certificate education which is (58.8%). In Penang Port majority of the respondent work as an operator (92.16%) and the monthly income of the respondent were between the range from RM1000 to RM2500 (74.5%). Most of the respondents had rest once a day and did not report any medical history for high blood pressure.

Table 2 shows the noise level from area monitoring at two different workstations which were at the parking prime mover and at the rubber tire gantry (RTG) workshop. The 8-hour time-weighted average (TWA) level of noise for prime mover was higher than rubber tire gantry which was 76.96 dB.

Table 3 shows the level of noise for 8-hour TWA for job specifications between ferry engine, prime mover and rubber tire gantry. Table 4 shows the level of noise for 8-hour TWA for shift work between day and night. The level of noise during the night was significantly higher than day time. Table 5 shows the equivalent continues noise level (Leq) specific to job operations between ferry engine, prime mover and rubber tire gantry. The mean Leq during the night was higher than during the day. Table 6 shows Leq specific to the shift work between day and night. For the Leqspecific to the job operation, the result showed that the noise level at ferry engine was higher than prime mover and rubber tire gantry (97.09 dB (A)).

Table 7 shows the comparison of the blood pressure reading for blood pressure before and after shift work among the workers. The results showed that there was no significant differences in systolic blood pressure before and after work shift ($t = - 0.0415$ and $p = 0.680$). Similar results was found for diastolic blood pressure ($t = - 1.964$, $p = 0.055$). Figure 1 shows the percentage of blood pressure classification among workers. For the classification of blood pressure before and after work shift, majority of the blood pressure of the respondent was under pre-hypertension category (66.7%), followed by the stage one hypertension (15.7%) and stage two hypertension (9.8%). Approximately 8% of the respondents had normal blood pressure.

When association between noise exposure and blood pressure was performed, it was found that there were no correlation between the two variables. Table 8 shows the association between noise exposure and the systolic and diastolic blood pressure.

A few health effects were reported by the workers. The workers reported effects such as hearing impairment, sleep disturbance, exhaustion, stress, dizziness or feeling light headed, communication disorder, poor work performance, emotional disorder and feeling unhappy.. The results showed that, the highest possible health effect claimed by the respondents was stress which was 76.47% while about 11.76% claimed that they have no possible health effect. Figure 2 shows the health effects due to noise exposure as reported by the workers.

Table 1: Demographic information for the respondent.

Variable	Frequency	Percentage (%)
Age (years)		
20 to 30	12	23.5
30 to 40	14	27.5
40 to 50	25	49.0
Level of education		
Malay for Lower Certificate Education (MLCE)	13	25.5
Malaysian Certificate Education (MCE)	30	58.8
Certificate	5	9.8
Diploma degree	2	3.9
Bachelor degree	1	2
Job specification		
Operator	47	92.16
Engineer	4	7.84
Monthly income		
Less than RM1000	3	5.9
RM1000 to RM2500	38	74.5
RM2500 to RM3500	8	15.7
RM3500 and more	2	3.9
Rest hour		
Once a day	40	78.4
Twice a day	6	11.8
No rest time	5	9.8
Job operation		
Prime mover (PM)	20	39.2
Rubber tire gantry (RTG)	20	39.2
Ferry engine	11	21.6
Medical history of high blood pressure		
Yes	8	15.7
No	43	84.3

Table 2: The noise area monitoring at two different workstations.

Workstation	Working area	Number of exposed workers	Sources of noise	Type of noise	Noise level (dB)
1	Parking prime mover	20	Engine from the prime mover	Continues	74.5 – 88.9
2	At the rubber tire gantry (RTG) workshop	20	Engine from the rubber tire gantry	Continues	79.7 – 82.7

Table 3: Level of noise for 8-Hour Time Weighted Average for job specification.

Job operation	Mean dB (A) (SD)	N	Percent (%)	Max dB(A)	Min dB(A)
Ferry engine	69.35 (2.54)	11	22	72.8	64.7
Prime mover	76.96 (6.26)	20	39	90.8	65.3
Rubber tire gantry	71.86 (5.05)	20	39	80.3	62.7

N = 51
SD = standard deviation

Table 4: Level of Noise for 8-hour TWA for shift work.

Shift Work	Mean dB(A)	N	Max dB(A)	Min dB(A)	t	p value
Day	71.11	25	81.4	77.6	-2.762	**0.008
Night	75.44	26	90.8	75.7		

N = 51
Independent sample t-test
**Significant at $p < 0.05$

Table 5: Equivalent continuous noise level (Leq) specific to the job operation

Job operation	Mean dB(A) (SD)	N	Percent (%)	Max dB(A)	Min dB(A)
Ferry engine	97.09 (2.84)	11	22	104.5	93.2
Prime mover	84.38 (3.77)	20	39	91.5	78.2
Rubber tire gantry	82.65 (22.39)	20	39	180.7	81.1

Table 6: Equivalent continues noise level (Leq) specific to the shift work

Shift Work	Mean dB(A)	N	Max dB(A)	Min dB(A)	t	p value
Day	84.59	25	104.5	77.6	-1.564	0.124
Night	91.03	26	180.7	75.7		

N=51
Independent sample t-test
$p < 0.05$

Table 7: The comparison of the blood pressure reading for blood pressure before and after shift work.

Variable	Mean	Median	t	P value
Systolic blood pressure				
Before	134.65	132.00		
			-0.415	0.680
After	135.27	133.00		
Diastolic blood pressure				
Before	79.45	79.00		
			-1.964	0.055
After	81.67	82.00		

N = 51
Paired t-test
**Significant at p<0.05

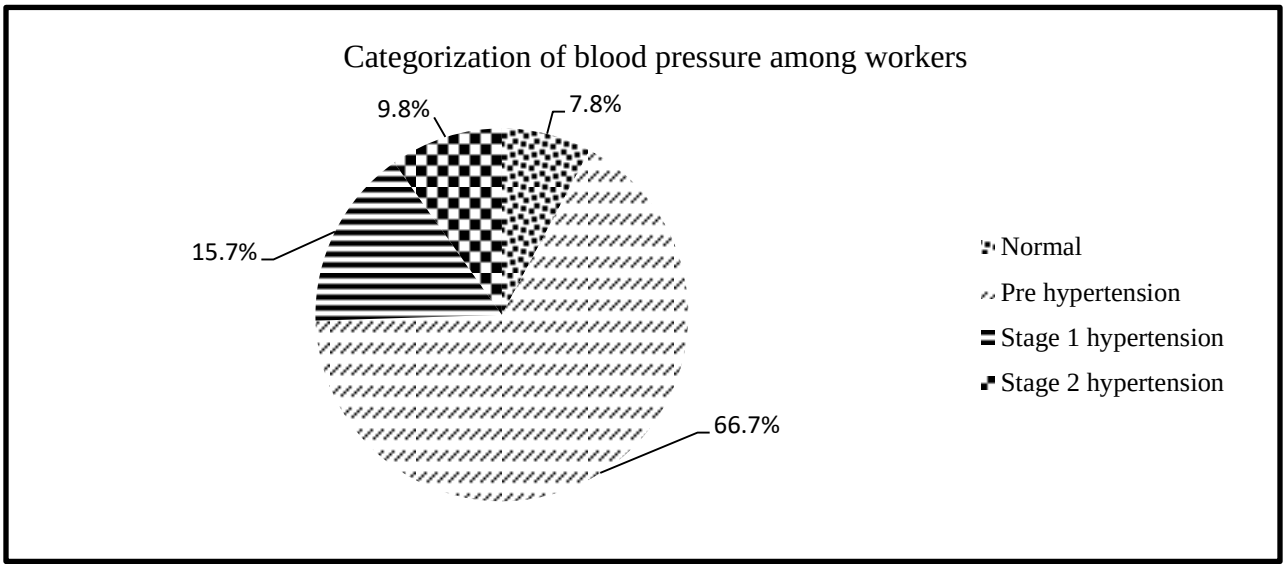

Figure 1: The percentage of blood pressure categorization among workers

Table 6: The association between noise exposure and the systolic and diastolic blood pressure (N=51)

Correlation	*r*	*p* – value
Time weighted average (TWA)	1	
Average systolic before and after work shift	0.219	0.123
Average diastolic before and after work shift	-0.046	0.715

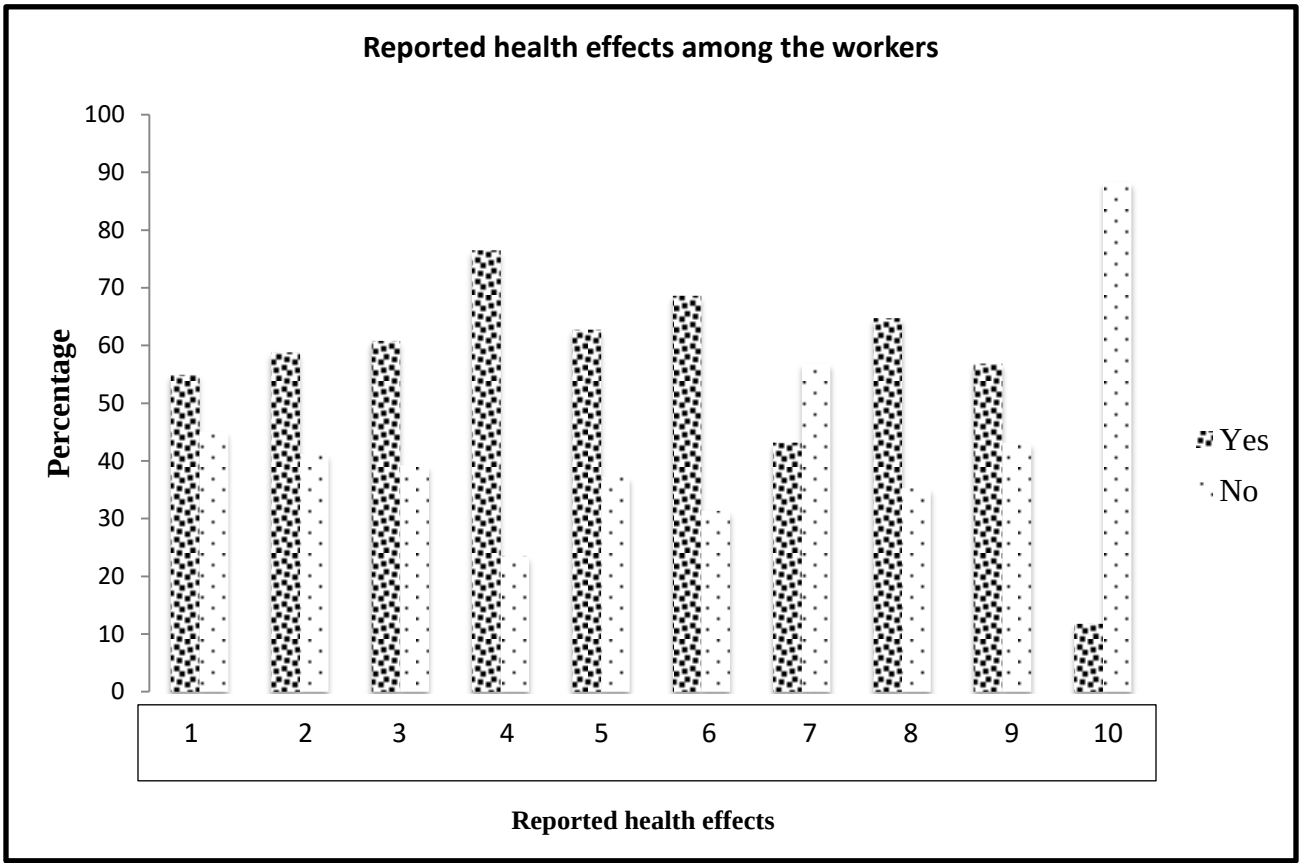

Figure 2: Reported health effects among the workers at Penang Port

Legend
1. Hearing impairment
2. Sleep disturbance
3. Feel exhausted
4. Stressed
5. Communication problem
6. Poor work performance
7. Emotional disorder
8. Unhappy
9. Not affected

4.0 DISCUSSION

The results for the noise area monitoring in two different workstations showed that only noise level at prime mover area exceeds the action level which was more than 85dB (A). The reading at this area ranged between 74.5 dB to 88.9 dB. The reading of noise area monitoring showed that the noise level at rubber tire gantry was lower than that at the prime mover because maintenance was done for rubber tire gantry at the workshop.

The mean equivalent continues noise level for ferry engine exceeds the permissible noise exposure limit and action level. The mean equivalent continues noise level (Leq) during night time was higher than during a day time but this difference was not significant.

The results showed that there was no significant differences in systolic blood pressure before and after work shift ($t = - 0.0415$ and $p = 0.680$). Similar results was found for diastolic blood pressure ($t = - 1.964$, $p = 0.055$). From the previous study, Babisch (2006) affirmed that there was no evidence that transport noise increased the systolic and diastolic blood pressure in the adult population. According to Attarchi et al., (2012) although diastolic blood pressure had increased along with the increase in noise exposure, the difference was not significant.

According to Van Kempen et al., (2002) noise may lead to stress. From the results of this study, it shows that about 58.82% said they have sleep disturbances. According to Muzet (2007), noise can cause disturbances in sleep and subsequent deleterious health effects and a perceived decrease in quality of life. For the communication disorder, findings of this study indicated that 68.63% of respondents claimed that they had possible health effect. Evans and Lepore (1993) affirms that noise pollution interferes with the ability to communicate in normal speech and may lead to a number of personal disabilities, handicaps, and behavioral changes. Some of these effects may lead to increased accidents, disruption of communication in the classroom, and impaired academic performance.

The present study had some limitations. The study was conducted using a cross sectional design which may restrict causal relationship, therefore it is recommended that a longitudinal studiy is conducted to evaluate this relationship in future studies.

5.0 CONCLUSION

In conclusion, this study found that there is no association between noise exposure and blood pressure among workers in Penang Port.

ACKNOWLEDGEMENT

We acknowledge all participants for their cooperation given during the course of this study.

REFFERENCES

Acar M. (2001). Ülkemizde gürültü mevzuatının uygulanması ve karşılaşılan sorunlar. Gürültü.

Attarchi M, Dehghan F, Safakhah F, Nojomi M. And Mohammadi S. (2012). Effect of exposure to occupational noise and shift working on blood pressure in rubber manufacturing company workers. *Industrial health*, *50*(3), 205-13.

Baaj M, El-Fadel M, Shazbak S, and Saliby E. (2001). "Modeling noise at elevated highway in urban areas: a practical application" Journal of Urban Planning and Development, pp169-180.

Babisch W, Beule B, Schust M, Kersten N and Ising H. (2005). Traffic noise and risk of myocardial infarction. Epidemiology,16:33–40.

Babisch W. (2006) Transportation noise and cardiovascular risk: updated review and synthesis of epidemiological studies indicate that the evidence has increased. Noise Health, 8:129.

Babisch W. (2008). "Road traffic noise and cardiovascular risk" *Noise and Health Journal,10*, pp 27-33.

Barregard L, Bonde E, Ohrstrom E (2009) Risk of hypertension from exposure to road traffic noise in a population-based sample. Occup Environ Med, 66:410- 415.

Berglund B, Lindvall T, Schwela D (1999). *Guidelines for Community Noise.* Geneva, World Health Organisation.

Bluhm GL, Berglind N, Nordling E and Rosenlund M. (2007). Road traffic noise and hypertension. Occup. Environ. Med.;64:122–6.

Bodin T, Albin M, Ardo J, Stroh E, Ostergren PO, Bjork J (2009). Road traffic noise and hypertension: results from a cross-sectional public health survey in southernSweden. Environ Health, 8:38.

Carter N, Henderson R, Lal S, Hart M, Booth S and Hunyor S. (2002). Cardiovascular and autonomic response to environmental noise during sleep in night shift workers. Sleep, 25:457–64.

Celen IH and Arın S, (2003) Noise levels of agricultural tractors. *Pakistan Journal of Biological.* Dinno A, Powell C, and King MM. (2011). A study of riders' noise exposure on a bay area rapid transit trains. *Journal of Urban Health,* 88: 1-13.employees. *Ergonomics SA,* 19: 14-23.

Evans G.W, and Lepore, S.J. (1993). "Non-Auditory Effects of Noise on Children: A Critical Review". *Children's Environment*. 10:42-72.

Floud S, Vigna-Taglianti F, Hansell A, Blangiardo M, Houthuijs D, Breugelmans O, Cadum E, Babisch

W, Selander J, Pershagen G, Antoniotti MC, Pisani S, Dimakopoulou K, Haralabidis AS, Velonakis V, Jarup L. (2011). Medication use in relation to noise from aircraft and road traffic in six European countries: results of the HYENA study. Occup Environ Med 2011, 68:518-524.

Goines L and Hagler L. (2007). Noise Pollution: A Modern Plague. Southern Medical Journal; 100(3):287-293.

Haralabidis AS, Dimakopoulou K, Vigna-Taglianti F, Giampaolo M, Borgini A and Dudley ML. (2008). Acute effects of night-time noise exposure on blood pressure in population populations living near airports. Eur. Heart J. 29:658–64.

Heslop K. (2007). Psychosocial factors associated with sick building syndrome among office

Jarup L, Babisch W, Houthuijs D, Pershagen G, Katsouyanni K, Cadum E, et al., (2008).Hypertension and exposure to noise near airports: the HYENA study.Environ.HealthPerspect.116:32 9–33.

Stansfeld S and Crombie R. (2011). Cardiovascular effects of environmental noise: research in United Kingdom.*Noise Health Journal*, 13(52), 229-33 from Van Kempen EE, Kruize H, Boshuizen HC, Ameling CB, Staatsen BA, and de

Hollander AE. (2002). The association between noise exposure and blood pressure and ischemic heart disease: a meta-analysis. Environ Health Perspect 110, 307–1