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The Prevalence of Occupational Stress as a Non-Auditory Effect of Noise among Palm Oil Mill Workers in 7 Sections of Two Selected Mills

Roya Latifi Naeini and Shamsul Bahri Hj Mohd Tamrin*

Occupational Safety and Health Department, University Putra Malaysia, Serdang 43400, Malaysia

* Corresponding author's Email: uvea_2000@yahoo.com

ABSTRACT: Palm Oil Mills are among the nosiest industrial workplaces, whereby excessive noise poses a threat to the health of organization and cause serious consequences. Excessive noise exposure gradually affects auditory and non-auditory aspects of health. The set symptoms are referred to as occupational stress, having a direct impact on concentration, thereby reducing the efficiency and productivity levels of organization. Therefore the objective of this study was to determine and the prevalence of occupational stress among Oil Palm Mill Workers in seven sections of two selected mills The study's scope was on the non-auditory effects of excessive noise while . The participants were 62 workers of two selected Palm Oil mills. They were chosen through proportional stratified sampling. Based on the objective of this study the environmental sound levels were measured in seven different section while on the other hand O'Donnell inventory was utilized as a tool to determine the stress level. Evidence shows that Physiological and performance effects are the two most important body reflexes affected by high exposure risky noise levels. Noise as an occupational factor contributes to high occupational stress levels.

Keywords: Environmental Sound Level, Non-Auditory Effects, Occupational Stress, Palm Oil Mill

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INTRODUCTION

The excessive noise, resulting from the operating machinery is a common problem that cannot be overlooked in industrial workplaces. According to the Malaysian's Factory and Machinery Act, Noise Exposure Regulation 1989 any sound level above 90 dB (A) is s considered as exceeding the Standard permitted by law. Continuously working at exposure to high levels of noise, after a period of time will cause variety of adverse effects to health namely auditory (hearing impairment) and non-auditory (entire organism, central and autonomic nervous system) effects (Juraj, 2012).

A significantly number of researches had investigated on the potential of noise-induced hearing loss in terms of auditory effects (Tung, 2013; Russo, 2013; Cruickshanks, 2010; Majumder, 2009). The relationship between hearing impairment and excessive noise exposure has been well established (Noweir, 2013; Hanidza, 2013; Yankaskas, 2013).The researchers proved that hearing problems appear in the form of temporary or permanently conductive sensory-neural hearing loss, noise-induced hearing loss (NIHL) or tinnitus (Zytoon, 2012). In addition, there are few literatures attempt to find the relationship between intense noise exposure level and non-auditory effects (Mathias Basner, 2013; Michael, 2012; Liu, 2013; Paunovic, 2011; Chang, 2009; Belojevic, 2008). The implication of the plethora epidemiological studies conducted over the years shows that noise impacts a wide range of health parameters. Whereby various negative non-auditory effects are often related to occupational noise exposure (Leather, 2003; Brink, 2011). Observational and experimental studies have shown that environmental noise exposure leaded to annoyance, closely interrelated stress (Stokholm, 2014; Wagner, 2010; Black, 2007), sleep disturbances and causes Fatigue during the day (Muzet, 2007; Tiesler, 2013;Frei, 2013), affects patient outcomes in hospital (Basner, 2013) and staff performance in different workplaces, increases the occurrence of hypertension and cardiovascular disease, and impairs cognitive performance in schoolchildren (Ljungberg, 2007).

The package of adverse effects of long-term occupational noise exposure causes occupational stress (Stokholm, 2014;Wagner, 2010; Black, 2007)that usually affects individuals' performance and Physical and mental health and has a negative impact upon job satisfaction (Nemecek, 1973; Aghdasi, 2011). The relations between noise from aircraft or road traffic near airports and the risk of hypertension as an important risk factor for cardiovascular disease has been surveyed by Jarup in 2008 among residential neighbourhoods near Sydney Airport . He explored a significant association between a range of indicators of physical health and including cardiovascular problems (Black, 2013) Evidence shows that the risk of ischemic heart disease increased among people living in noise exposure levels exceeding more than 65–70 dBA (Babisch, 2000). On the other hand the direct effects of long term exposure to occupational noise on textile industry workers' lung functions were probed by António Paes and his co-workers. Insomnia is one of the chronic adverse effects due to long term noise exposure that has strong relationship with the other non-auditory effects (M. Basner, 2010) (E.M. Elmenhorst, 2012) such as learning

outcomes and cognitive performance (G. Evans, 2007).Exposure to occupational noise has also been linked with some other adverse effects such as self-reported fatigue (Carlestam, 1973), sickness-related absenteeism (Cohen, 1973) and symptoms of psychological distress (McDonald, 1989).

Palm oil industry in Malaysia: The world's second-largest oil palm plantation company, Felda Global Ventures Holdings (FELDA), is based in Malaysia. In 2012, the Malaysian palm oil industry produced18.79 million tons of crude palm oil and nominated Malaysia as one of the world's largest palm oil exporter. This industry employed an estimated 491,000 workers and created variety of job opportunities for local and foreign people. statistically all the evidences lead Malaysian government to feel more responsibility toward advance the production, procurement and use of sustainable oil palm products through the development, implementation and verification of credible global standards. Palm oil mills are one of the plethora of industries where in several sections such as the engine room, boiler room, nut plant, sterilizing and press the sound level is above 85dB, and excessive noise is always considered as a key factor in creation of a series of Complaints. In fact one of the most important environmental stressors in palm oil mills is occupational noise that can develop job stress as a chronic disorder among palm oil mill workers. Nowadays occupational stress is the major occupational problem in palm oil industry. Stress as a physical, chemical or psychological hazard threaten the health of the workers and health of the organization subsequently. In fact Occupational stress is a psychosocial hazard that poses a threat to the health of organizations. Unfortunately there are a few studies that relate noise exposure levels and non-auditory effects especially stress levels in palm oil mill workers specifically. This study was undertaken to determine the correlation between stress level and the excessive occupational noise exposure level among palm oil mill workers.

MATERIAL AND METHODS

This cross sectional study took place in 7 different sections including Loading Ramp, , Sterilizing, Pressing, Nut Plant, Clarification, Boiler Room, Workshop of two palm oil mills located in Kilang sawit trolak and Kilang sawit serting hilir in Malaysia. The sample size of this study was calculated using the formula 1 by Lwanga and Lemeshow (1991). A total of 32 workers from Mill A and 30 workers from Mill B with similar socio-Demographic background were chosen based on their respective section, their task and inclusive (Malaysian and non-Malaysian, currently working in selected section, Male) and exclusive (Diagnosed with Cushing disease, Diagnosed with cardio vascular disease, Diagnosed with Psychiatric disorder, Changing in sleeping pattern, below 18 and above 65 years old, Working less than a year, Addicted) criteria.

Formula 1: $n = (Z/d)^2 (P) (1-P)$

n = Sample size

Z = Standard score for significant Level

P =estimation incident for population

Subjects, questionnaire and O'Donnell inventory: All respondents were required to answer two sets of validated Malay version of questionnaire; the first set of questionnaire includes socio-demographic background and health status. The second set of questionnaire, O'Donnell Personal Stress Inventory (PSI) used in order to determine stress level(s) approximately based on physiological and psychological symptoms of stress. PSI consist 11 psychological and physiological subscales adding up to 53 items. There were four musculoskeletal, six gastrointestinal, six physical system, six depression, eleven anxiety, three energy level, five diet, three activity, three relationship and three sleep categorised questions. The measurement of symptoms was based on using four point Likert scales and subsequently the items scores were summed up and dichotomized to stress (score of > 36) and No stress (score of <36) groups.

Environment Sound Level Monitoring and Recording: In each section of the palm oil mill, the environment sound level was identified individually using SoloSLM Digital Sound Level Meter (Figure 1). Prior to environmental sound measurement. the SLM was calibrated using a sound-level calibrator (TES-1356, TES Electronic Corp., Taipei, Taiwan) based on SOP of the equipment. The results were used to classify the exposed and non-exposed sections. The work areas involved this measurement are Loading Ramp, Sterilizing, Pressing, Nut Plant, Clarification, Boiler Room, Engine Room, Workshop. Figure 2 shows the location of each measurement.

Fig1. *SoloSLM Digital Sound Level Meter*

Statistical Analysis: To analyses the obtained data from the data collection sessions, SPSS version 20 software was utilized. All of the independent variables including age, marital status, salary, BMI , employment duration, , environmental sound level as well as the dependent variable which is the Stress level inventory results were keyed into the SPSS version 20 software. The prevalence of stress level were calculated and analyses at both of the mills.

RESULTS

The demographic characteristics and socioeconomic status of the workers in both Palm oil mills were tabulated in Table 1. In the total sample, the range of age was from 21 to 54 years old with the mean age of 38.5 years old. In statistically comparison the workers' age in both of mills, using a *t*-test, results show that there is not a significant difference of mean distance between Mill A and Mill B. (*P* value>0.05, t value=0.238, df=31).

In terms of educational status, the range of subjects' education level in the Mills A and B was from 3% non-registered to 45% high level of education such as diploma and degree while 80.6% of workers only had stopped their education in high school and 11.9% of them have stopped their education in primary school. In terms of socioeconomic status the minimum salary in both of the mills is RM900 and the maximum salary is RM 2580 in statistically comparison the salary between two mills, using a *t*-test, results show that there is not a significant difference of mean distance of salary between Mill A and Mill B.(*P* value>0.05, t value=0/60, df=31). Analyzing the marital status data shows that the number of married workers (50) is approximately three times more than the number of single workers (17). Overlay 25% of the workers are single while 75% of them are married and nobody is divorced.

The results of environmental noise measurement have been shown in table 2 and the status of both mills was compared simultaneously. As shown in Figure 2 in both of the two mills nut plant, clarification, engine-room and boiler houses sections are considered as the noisy environment due to excessive noise more than 90dB. (Factory and Machinery Act, Regulation 1989) while in workshop, general store and loading ramp, the environmental sound level is not exceeded more than 90 dB which is the cutoff point (90 dB)The average of noise level in each factory are shown in Table 2.

The Table 3 shows the results among 67 workers participated in this research. O'Donnell inventory results show that only 9 workers out of 67 workers experienced occupational stress in both of the mills with the scores above 36 (cut off line for stress detection). 6 workers in Mill An out of 32 workers, experienced stress as one of them was working in sterilizer section, (93.2 dB), four of them were working in nut plant section (97 dB) and one of them is working in workshop (73.5 dB). In Mill B, 3 out of 34 workers experienced occupational stress while they were working in workshop (63.5 dB), press section (92.9 dB) and one of them was working in loading ramp (80 dB).The prevalence of stress status in both of the mills have been shown in table 3. Figure 3 shows the prevalence of occupational stress in each section individually.

Table 1. Socio-demographic Information among 67 respondents

Parameters		F	P	M (sd)	df	P
Age	20-29 30-39 40-49 50-59	24 8 21 14	35.8 11.9 31.3 20.9	Mill A 37.62±11.79 Mill B 39.41±10.95	0.258(31)	0.798
Salary	<1000 ≥1000	28 38	31.5 42.7	Mill A 1223±253 Mill B 1285±511	-.600(31)	0.55
Education	Nonregistered Primary school Secondary Diploma/bachelor	2 8 54 3	3.0 11.9 80.6 4.5			
Marital status	Single Married Divorced Total	17 50 0 67	25.4 74.6 0 100.0			

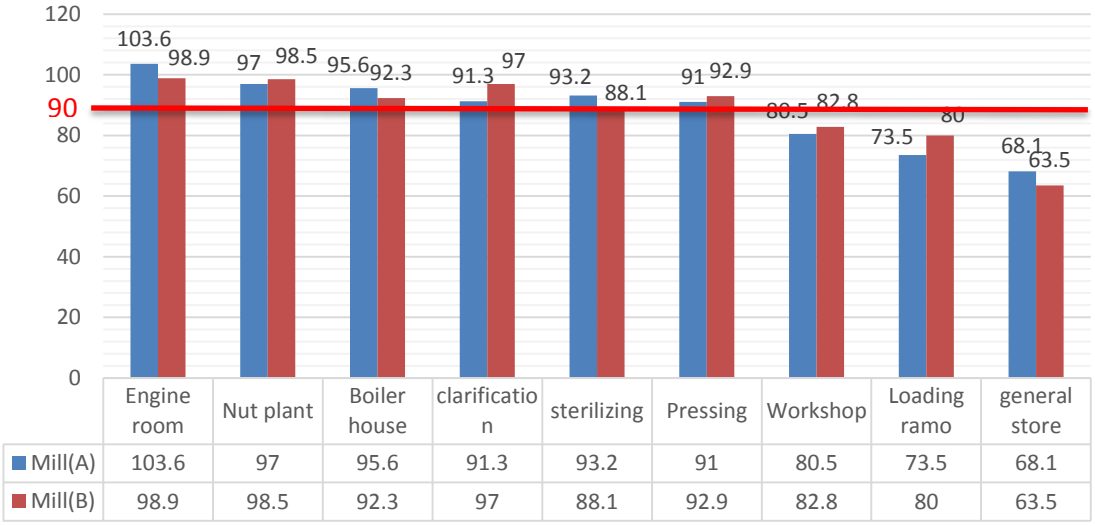

Fig2. *Environmental sound level status between the two mills*

Table 2. Environmental sound level measurement results

Sound Level	M (sd)	Min (section)	Max (section)	df	P
Mill A	88.2±11.67	68.1 (store)	103.6 (engine room)	*0.015(8)*	*0.514*
Mill B	88.22±11.42	63.5 (store)	98.9 (engine room)		

Table 3. Prevalence of stress

location	Stress status	No	%
Mill A	≥36 <36	8 24	25 75
Mill B	≥36 <36	6 29	17 83
Mills A and B	≥36 <36	14 53	21 79

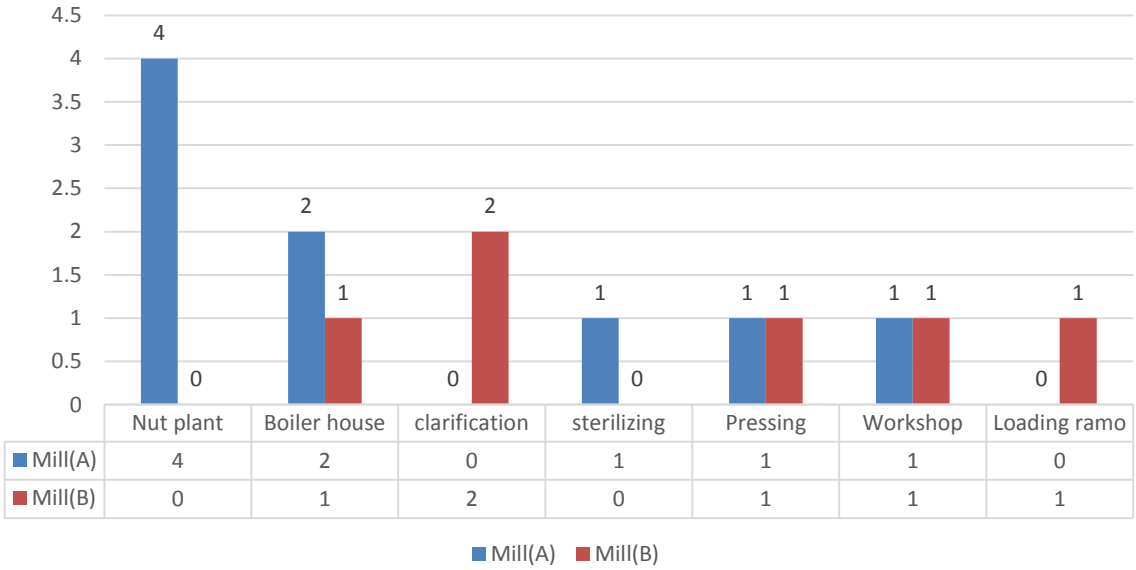

Fig3. prevalence of occupational stress

DISCUSSION

To assess the effects of exceeding noise exposure to stress level it was essential to conduct an adequately reliable investigation. To minimize the uncertainty of measurement, this study suggests the use of sound level meters, as well as regular correct selection of the measurement of variables and workers' observation during the test conduction. But some of the limitations were uncontrollable and not only could affect the results but on the other hand also prevents taking an accurate final conclusion in this regard. These limitations are due to several factors such as the temporal and spatial variability of noise levels, the specific acoustic characteristics of the noise sources. Some of the limitations are related to workers consistency of their position in working area and the variability of exposure times, and the limited duration of noise measurements. Noise level is not the only source of annoyance but type of noise, communication and activity interference, control of the noise source, time pressure, social atmosphere and the condition of the workers, are the other important factors to increase the stress level. In this research to determine the stress level and also to assign the casual pathway between environmental sound level and stress level, O'Donnell inventory was needed to conduct. Some of the basic influent factors have been controlled synchronously such as medicine usage, addiction or some of the disease such as Cushing syndrome.

The findings about stress level prevalence show that the parameter "noise level" is one of the significant influent factor to increase the stress level. Stress symptoms are more frequently reported in high noise levels than elsewhere. Thus probably these symptoms are dependent on the combination of noise with the other mentally stressful tasks or on the combination of noise with job-related communication. Usually stress symptoms develops over a long term period of time but in this study there was no accessible accurate information regarding workers' mentally and physically health condition before their recruitment to participate in this research. Thus, by assuming a healthy condition for workers during their recruitment and also a stable mental condition for participants, according to the data derived from the O'Donnell Inventory test, the calculated results demonstrate that the correlation between stress and noise intensity in the environment is regularly proportional.

The results in the table 3 illustrates that the number of workers whom the test was conducted on, are 67 people which as it is shown, 79 % of them were satisfied with current state of noise and no stress effective parameter were harming them as their thoughts would have said. The other portion of workers whom the test was conducted on, were suffering from the anxiety and stress. The further investigation shows that the remaining 21% are from which section of the mill and whether there are any harmful noises at the specific environment or not. In our study on Palm oil mill workers we found higher prevalence of occupational stress based on O'Donnell in workers exposed to noise at work, in comparison to workers working in quiet environment. O'Donnell inventory results were higher among workers exposed to noise at work, compared to workers from the two quiet environments. In addition the workers who are registered for workshop are exception where as they always stay very close to the devices and operating machineries for maintenance and repair them. During one working shift they should spend the majority of time inside the mill and in noisiest environments.

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