DEVELOPING A FRAMEWORK OF NON-FATAL OCCUPATIONAL INJURY SURVEILLANCE FOR RISK CONTROL IN PALM OIL MILLS

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I hereby declare that the work in this thesis is my own work except for the quotations and summaries which have been duly acknowledged.

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Date: 27/5/2018

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DEVELOPING A FRAMEWORK OF NON-FATAL OCCUPATIONAL INJURY SURVEILLANCE FOR RISK CONTROL IN PALM OIL MILLS

RUMAIZAH BINTI RUSLAN

A thesis submitted in fulfilment of the requirement for the award of the Doctor of Philosophy in Engineering Technology

Faculty of Engineering Technology
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MAY 2018
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ASSOC. PROF. DR. ISHAK BIN BABA
For my late father, who will always be my foremost inspiration.
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ABSTRACT

Non-fatal occupational injury (NFOI) and its risk factors have become a current global concern. The need of research towards the relationship between occupational injury and its risk factor is essential, to fulfil the purpose and setting the priority of implementing safety preventive approaches at workplace. This research intended to develop a framework of NFOI surveillance by using epidemiological data, noise exposure data and NFOI data among palm oil mills’ workers. A total of 420 respondents who assigned in operation and processing areas (OP) (n=333) and general or office workers (n=87) had voluntary participated in this research. A questionnaire session with respondents was held to obtain epidemiological data and NFOI information via validated questionnaire. Noise hazard monitoring was executed by using Sound Level Meter (SLM) for environmental noise monitoring and Personal Sound Dosimeter for personal noise monitoring. Gathered data were analysed in quantitative method by using statistical software IBM SPSS Statistic version 21 and a risk matrix table for injury risk rating evaluation. It was discovered that high noise exposure level (≥ 85 dB[A]) was significantly associated with non-fatal occupational injury among OP workers (φ=0.123, p<0.05) with OR=1.87 (95% CI, 1.080-3.235, p<0.05). Risk rating for reported NFOI was at moderate level, with minor cuts and scratches were the dominant type of injury (42.6%). Analysis of logistic regression indicated that working in shift, not wearing protective gloves, health problems such as shortness of breath and ringing in ears, and excessive noise level (≥ 85 dB[A]) were the risk factors of NFOI in palm oil mills among OP workers. A framework of non-fatal injury surveillance in palm oil mills was developed based on the findings with integration of risk management process and injury prevention principles. This framework is anticipated to help the management in decision making for preventive actions and early detection of occupational health effects among workers.
ABSTRAK

Kecederaan pekerjaan yang tidak membawa maut dan faktor risikonya menjadi kebimbangan serantau masakini. Keperluan untuk mengkaji perhubungan di antara kecederaan pekerjaan dan faktor risikonya adalah penting, dalam memenuhi tujuan dan memberi keutamaan dalam pelaksanaan keselamatan dan langkah pencegahan di tempat kerja. Kajian ini bertujuan untuk membina rangkakerja pengawasan kecederaan pekerjaan yang tidak membawa maut dengan menggunakan data epidemiologi, data pendedahan bunyi hingar dan data kecederaan pekerjaan yang tidak membawa maut di kalangan pekerja kilang sawit. Seramai 420 responden, iaitu pekerja yang ditugaskan di kawasan operasi dan pemprosesan (OP) (n=333) dan pekerja biasa atau pejabat (n=87) telah terlibat secara sukarela dalam kajian ini. Sesi soal-selidik bersama responden telah dijalankan untuk mendapatkan data epidemiologi dan maklumat kecederaan pekerjaan yang tidak membawa maut melalui borang soal-selidik yang telah disahkan. Pengukuran hazard bunyi hingar telah dilaksanakan dengan menggunakan Sound Level Meter (SLM) bagi pemantauan bunyi hingar persekitaran dan Personal Sound Dosimeter bagi pemantauan bunyi hingar perseorangan. Data yang diperolehi telah dianalisis melalui kaedah kuantitatif dengan menggunakan perisian statistik IBM SPSS Statistic versi 21 dan jadual risiko matrik bagi penilaian kadar risiko kecederaan. Pendedahan yang tinggi terhadap bunyi hingar (≥ 85 dB[A]) didapati mempunyai hubungan yang signifikan dengan kecederaan pekerjaan yang tidak membawa maut di kalangan pekerja OP (φ=0.123, p<0.05) dengan OR=1.87 (95% CI, 1.080-3.235, p<0.05). Kadar risiko kecederaan di tempat kerja telah direkodkan pada tahap sederhana, dengan kecederaan ringan dan calar adalah jenis kecederaan yang paling dominan (42.6%). Analisis regresi logistik menyatakan bahawa bekerja syif, tidak memakai sarung tangan keselamatan, masalah kesihatan seperti sesak nafas dan telinga berdengung, dan tahap bunyi hingar yang berlebihan (≥ 85 dB[A]) adalah faktor risiko kepada kecederaan pekerjaan yang tidak membawa maut di kalangan pekerja OP kilang sawit. Rangkakerja pengawasan kecederaan
pekerjaan yang tidak membawa maut di kilang sawit telah dibangunkan berpandukan hasil dapatan dengan menggabungkan proses pengurusan risiko dan prinsip-prinsip pencegahan kecederaan. Rangkakerja ini mampu membantu pihak pengurusan dalam membuat keputusan bagi tindakan pencegahan dan pengesanan awal kesan kesihatan pekerjaan di kalangan pekerja.
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LIST OF SYMBOLS AND ABBREVIATIONS

ILO - International Labour Organization
US - United States
BLS - Bureau of Labor Statistic
SOSCO - Social Security Organization
DOSH - Department of Safety and Health
GDP - Gross Domestic Product
EPU - Economic Planning Unit
MPOC - Malaysia Palm Oil Council
MPOB - Malaysia Palm Oil Board
FFB - Fresh Fruit Bunches
CPO - Crude Palm Oil
CPKO - Crude Palm Kernel Oil
RSPO - Roundtable for Sustainable Palm Oil
DOSM - Department of Statistic Malaysia
OSHMS - Occupational Safety & Health Management System
ILO-OSH - International Labour Organization-Occupational Safety & Health
BS: OHSAS - British Standard: Occupational Health & Safety Assessment Series
NKEA - National Key Economics Areas
ETP - Economic Transformation Programme
H_a - Alternative Hypothesis
MPOA - Malaysian Palm Oil Association
PKO - Palm kernel oil
R&D - Research & Development
FFA - Free Fatty Acids
EFB - Empty fruit bunches
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<th>Full Form</th>
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<td>POME</td>
<td>Palm Oil Mill Effluent</td>
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<td>SOP</td>
<td>Standard Operation Procedure</td>
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<td>HIRARC</td>
<td>Hazard Identification, Risk Assessment &amp; Risk Control</td>
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<td>WoS</td>
<td>Web of Science</td>
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<tr>
<td>sAA</td>
<td>salivary Alpha Amylase</td>
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<td>WBGT</td>
<td>Wet Bulb Globe Thermometer</td>
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<tr>
<td>ACGIH</td>
<td>American Conference of Governmental Industrial Hygienists</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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<tr>
<td>DALY</td>
<td>Disability Adjusted Life Year</td>
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<td>NFOI</td>
<td>Non-Fatal Occupational Injury</td>
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<td>FMA</td>
<td>Factories and Machinery Act</td>
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<td>MPOA</td>
<td>Malaysia Palm Oil Association</td>
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<tr>
<td>RBD</td>
<td>Refined, Bleached and Deodorised</td>
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<td>PKE</td>
<td>Palm Kernel Expeller</td>
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<td>EFB</td>
<td>Empty Fruit Bunch</td>
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<td>OER</td>
<td>Oil Extraction Rate</td>
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<td>dB</td>
<td>decibel</td>
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<tr>
<td>dB[A]</td>
<td>A-weighted decibel</td>
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<td>EASHW</td>
<td>European Agency for Safety and Health at Work</td>
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<td>OSHA</td>
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<td>US OSHA</td>
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<td>CMID</td>
<td>Core Minimal Injury Dataset</td>
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<td>$L_i$</td>
<td>Likelihood</td>
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<td>$O_i$</td>
<td>Outcome</td>
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<td>HAZOP</td>
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<td>FMEA</td>
<td>Failure Modes Effects Analysis</td>
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<tr>
<td>SWOT</td>
<td>Strengths, Weaknesses, Opportunities and Threats</td>
</tr>
<tr>
<td>PESTLE</td>
<td>Political, Economic, Social, Technological, Legal and Environmental</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organisation of Standardization</td>
</tr>
<tr>
<td>OP</td>
<td>Operational &amp; Processing worker</td>
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<td>General or Office worker</td>
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