IMPLEMENTATION OF KIKEN YOCHI INTERVENTION APPROACH TO REDUCE MUSCULOSKELETAL SYMPTOMS AMONG MALE WORKERS OF PINEAPPLE FARM PLANTATIONS IN JOHOR, MALAYSIA

NOOR AFIFAH BINTI YA’ACOB

FPSK(M) 2017 53
IMPLEMENTATION OF KIKEN YOCHI INTERVENTION APPROACH TO REDUCE MUSCULOSKELETAL SYMPTOMS AMONG MALE WORKERS OF PINEAPPLE FARM PLANTATIONS IN JOHOR, MALAYSIA

By

NOOR AFIFAH BINTI YA’ACOB

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Master of Science

June 2017
COPYRIGHT

All material contained within the thesis, including without limitation text, logos, icons, photographs and all other artwork, is copyright material of Universiti Putra Malaysia unless otherwise stated. Use may be made of any material contained within the thesis for non-commercial purposes from the copyright holder. Commercial use of material may only be made with the express, prior, written permission of Universiti Putra Malaysia.

Copyright © Universiti Putra Malaysia
IMPLEMENTATION OF KIKEN YOCHI INTERVENTION APPROACH TO REDUCE MUSCULOSKELETAL SYMPTOMS AMONG MALE WORKERS OF PINEAPPLE FARM PLANTATIONS IN JOHOR, MALAYSIA

By

NOOR AFIFAH BINTI YA’ACOB

June 2017

Chairman : Emilia Zainal Abibdin, PhD
Faculty : Medicine and Health Science

Background: Work tasks in pineapple plantations in Malaysia are characterized by non-ergonomic work posture, awkward movement and repetitive tasks that put a lot of strain on the body, heavy weight lifting and manual handling of work tools. Heavy work tasks contributes to the reporting of musculoskeletal symptoms (MSS) of workers. Thus, Kiken Yochi training was selected as training programmes in reducing MSS. Kiken (hazard) Yochi (prediction) training is a Japanese activity used to motivate members to recognize and predict hazards that develops sensitivity to unsafe conditions or hazardous situations. Objective: The aim of this study was to assess effects of work improvement module using a Kiken Yochi participatory approach in reducing MSS among male migrant pineapple farm plantation workers in Pontian, Johor. Methodology: A total of 45 male migrant workers that consisted of 27 workers for the intervention group and 18 workers for the control group from two pineapple plantations in Pontian, Johor were recruited by simple random sampling method in this experimental type study. This study consisted of three phases. Before the first phase of this study started, hazard identification, risk assessment and risk control (HIRARC) was conducted using a video recording which were based on the methods established by the Department of Occupational Safety and Health (DOSH) (Malaysia). In the first phase of the study, workers completed a self-administered questionnaire in Bahasa Malaysia which asks items on MSS. MSS were assessed using a questionnaire adapted from the standardized Nordic questionnaire (SNQ). Then ergonomic risks were assessed using rapid upper limb assessment (RULA) and lastly MSS education training were implemented to both groups of workers. The MSS education training provided information on proper lifting techniques and education on body mechanics and ergonomics to reduce MSS among workers. Kiken Yochi Training was given to the intervention group only. In the second phase of the study, post- intervention questionnaire was distributed among all workers 2 months after the first phase of the study was conducted. Results: The highest distribution of MSS for the past 12 months
during pre-intervention phase among intervention group are knee (59%, n=16), lower back (59%, n=16) and shoulder (56%, n=15) while among control group are lower back (67%, n=12), shoulder (50%, n=9) and knee (44%, n=8). Based on the HIRARC outcome, there are three work tasks categorized as high risk, namely cultivation, manual weeding and harvesting. While for ergonomic risk assessment, the highest risk were cultivation and harvesting where 22 of workers were categorized as having very high risk of MSS level (grand score of more than 7+). Approximately 8 of workers had very high risk for MSS while performing manual weeding. Post-intervention, statistical analysis using non-parametric McNemar test found significant decrease of prevalence of ankle/feet disorders but the prevalence of lower back symptoms showed an increase within the intervention group. Conclusion: Implementation of the Kiken-Yochi participatory approach training among male migrant pineapple workers at Pontian, Johor was not linked with the general reduction of MSS except for the selected regions of the body. It is suggested that work methods incorporating modifications on the existing manual tools are needed before a successful ergonomic training can be effectively implemented. Proactive measures and actions needs to be taken by the authority in improving the safety and health of workers in the pineapple plantation sector.

Keywords: Rapid Upper Limb Assessment, Farmers, Agriculture, Ergonomics, HIRARC
Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Sarjana Sains

PELAKSANAAN PENDEKATAN CAMPUR TANGAN KIKEN YOCHI BAGI MENGURANGKAN GEJALA PENYAKIT OTOT DALAM KALANGAN PEKERJA ASING LELAKI LADANG NANAS DI PONTIAN, JOHOR.

Oleh

NOOR AFIFAH BINTI YA’ACOB

Jun 2017

Pengerusi : Emilia Zainal Abibdin, PhD
Fakulti : Perubatan dan Sains Kesihatan

selidik telah diedarkan di kalangan semua pekerja 2 bulan selepas fasa pertama kajian ini dijalankan. **Hasil Kajian:** Taburan tertinggi MSS bagi tempoh 12 bulan lalu semasa fasa intervensi antara kumpulan intervensi ialah lutut (59%, n = 16), belakang (59%, n = 16) dan bahu (56%, n = 15) manakala taburan MSS antara kumpulan kawalan adalah belakang rendah (67%, n = 12), bahu (50%, n = 9) dan lutut (44%, n = 8). Berdasarkan keputusan HIRARC, terdapat tiga tugas kerja yang dikategorikan sebagai berisiko tinggi, iaitu penanaman, merumpum dan menuai. Manakala bagi penilaian risiko ergonomik, risiko paling tinggi adalah penanaman dan penuai di mana 22 pekerja telah dikategorikan sebagai mempunyai risiko tahap gejala ototkeletal yang sangat tinggi (jumlah skor lebih daripada 7+). Kira-kira 8 pekerja mempunyai risiko yang sangat tinggi untuk gejala ototkeletal semasa melakukan merumpum secara manual. Post-intervensi, analisis statistik menggunakan ujian McNemar bukan parametrik mendapat penurunan ketara untuk gangguan buku lali / kaki tetapi prevalens gejala belakang rendah menunjukkan peningkatan dalam kumpulan intervensi. **Kesimpulan:** Pelaksanaan pendekatan penyertaan Kiken-Yochi dalam kalangan pekerja asing lelaki di ladang nanas Pontian, Johor tiada kaitan dengan pengurangan gejala otot skeletal kecuali bagi anggota badan yang terpilih. Adalah dicadangkan bahawa kaedah kerja menggabungkan pengubahsuaian kepada alat manual yang sedia ada yang diperlukan sebelum latihan ergonomik yang berjaya dapat dilaksanakan dengan berkesan. Langkah-langkah proaktif dan tindakan perlu diambil oleh pihak berkuasa dalam meningkatkan keselamatan dan kesehatan pekerja dalam sektor perladangan nanas.

**Kata kunci:** Rapid Upper Limb Assessment, Peladang, Pertanian, Ergonomik, HIRARC
ACKNOWLEDGEMENTS

In the name of Allah, the Most Gracious and the Most Merciful

Alhamdulillah, all praises to Allah for the strengths and His blessing in completing this thesis. Special appreciation goes to my dedicated supervisor, Dr Emilia Zainal Abidin, for her supervision and never ending support. Her meaningful words and invaluable help of constructive comments and suggestions throughout the research and thesis works have contributed a lot to the success of this research. Not forgotten, my appreciation to my co-supervisors Dr Irniza Rasdi, Associate Professor Dr Anita Abd Rahman, Dr Suriani Ismail for their support and knowledge pertaining to this research.

I would like to express my deepest gratitude to my beloved and supportive family for their endless prayers and encouragement. My acknowledgement also goes to all office staffs of Department of Occupational and Environmental Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia for their co-operations.

My sincere thanks to all managers and workers of pineapple farm plantations who involved in this study for their involvement, co-operation and toleration through data collection phase. Last but not least, sincere thanks to all my lovely friends for their moral support during my study.

Thank you.
I certify that a Thesis Examination Committee has met on 9 June 2017 to conduct the final examination of Noor Afifah binti Ya'acob on her thesis entitled "Implementation of Kiken Yochi Intervention Approach to Reduce Musculoskeletal Symptoms among Male Workers of Pineapple Farm Plantations in Johor, Malaysia" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

Members of the Thesis Examination Committee were as follows:

**Haliza binti Abdul Rahman, PhD**
Associate Professor
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Chairman)

**Karmegam a/l Karuppiah, PhD**
Senior Lecturer
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Internal Examiner)

**Noor Hassim Ismail, PhD**
Professor
Universiti Kebangsaan Malaysia
Malaysia
(External Examiner)

---

**NOR AINI AB. SHUKOR, PhD**
Professor and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 28 September 2017
This thesis was submitted to the Senate of the Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science. The member of the Supervisory Committee were as follows:

**Emilia Zainal Abibdin, PhD**  
Senior Lecturer  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Chairman)

**Irniza Rasdi, PhD**  
Senior Lecturer  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Member)

**Anita Abd Rahman, M. CommH (OH)**  
Associate Professor  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Member)

**Suriani Ismail, M. CommH (OH)**  
Medical Lecturer  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Member)

---

**ROBIAH BINTI YUNUS, PhD**  
Professor and Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date:
Declaration by graduate student

I hereby confirm that:

- this thesis is my original work;
- quotations, illustrations and citations have been duly referenced;
- this thesis has not been submitted previously or concurrently for any other degree at any institutions;
- intellectual property from the thesis and copyright of thesis are fully-owned by Universiti Putra Malaysia, as according to the Universiti Putra Malaysia (Research) Rules 2012;
- written permission must be obtained from supervisor and the office of Deputy Vice-Chancellor (Research and innovation) before thesis is published (in the form of written, printed or in electronic form) including books, journals, modules, proceedings, popular writings, seminar papers, manuscripts, posters, reports, lecture notes, learning modules or any other materials as stated in the Universiti Putra Malaysia (Research) Rules 2012;
- there is no plagiarism or data falsification/fabrication in the thesis, and scholarly integrity is upheld as according to the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) and the Universiti Putra Malaysia (Research) Rules 2012. The thesis has undergone plagiarism detection software.

Signature: ________________________________      Date: ____________________

Name and Matric No.: Noor Afifah Binti Ya’acob, GS41038
Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) were adhered to.

Signature: ____________________________
Name of Chairman of Supervisory Committee: Dr. Emilia Zainal Abibdin

Signature: ____________________________
Name of Member of Supervisory Committee: Dr. Irniza Rasdi

Signature: ____________________________
Name of Member of Supervisory Committee: Associate Professor Dr. Anita Abd Rahman

Signature: ____________________________
Name of Member of Supervisory Committee: Dr. Suriani Ismail
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>i</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td>iii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>v</td>
</tr>
<tr>
<td>APPROVAL</td>
<td>vi</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>viii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xiii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xiv</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS</td>
<td>xv</td>
</tr>
</tbody>
</table>

## CHAPTER

### 1 INTRODUCTION

1.1 Background                     | 1
1.2 Problem Statements            | 4
1.3 Research Justification        | 6
1.4 Research Question             | 7
1.5 Research Objectives
   1.5.1 General objective         | 7
   1.5.2 Specific objectives       | 8
1.6 Research Hypothesis           | 8
1.7 Conceptual Framework          | 8

### 2 LITERATURE REVIEW

2.1 MSD among Agricultural Workers | 10
2.2 Risk Factors of MSS
   2.2.1 Occupational Factors      | 11
   2.2.1.1 Awkward working posture | 11
   2.2.1.2 Working tenure          | 12
   2.2.1.3 Repetitive movement     | 13
   2.2.1.4 Heavy weight lifting    | 13
   2.2.2 Non-occupational factors  | 14
   2.2.2.1 Age                     | 14
   2.2.2.2 Body mass index (BMI)   | 15
   2.2.2.3 Educational level       | 16
   2.2.2.4 Smoking                 | 17
   2.2.2.5 Physical activity      | 17
2.3 Participatory Approach for Work Improvement | 17
   2.3.1 Kiken Yochi Training     | 19
   2.3.2 Reducing MSS by participatory approach and education training | 22
2.4 Pineapple Farming in Malaysia | 23
   2.4.1 Pineapple Fruit Production Process | 24
2.5 Law and Regulations          | 29
2.6 Hazard Identification, Risk Assessment and Risk Control (HIRARC) | 29
3 METHODOLOGY

3.1 Study Location

3.2 Selection of states

3.2.1 Selection of zones

3.3 Study Design

3.4 Sample size

3.4.1 Sample Size of Participants

3.5 Study Population

3.6 Sampling Methods

3.6.1 Selection of farm plantations

3.6.2 Selection of study participants

3.7 Inclusion Criteria

3.8 Exclusion Criteria

3.9 Research tools

3.9.1 Video Recording

3.9.2 Hazard identification risk assessment and risk control (HIRARC)

3.9.3 Rapid Upper Limb Analysis (RULA)

3.9.4 Questionnaire

3.9.4.1 Section A (Socio-demographic characteristic)

3.9.4.2 Section B (Tobacco consumption history)

3.9.4.3 Section C (Medical information)

3.9.4.4 Section D (Employment data)

3.9.4.5 Section E (Standardized Nordic Questionnaires)

3.10 Intervention Module

3.10.1 MSS education

3.10.2 Kiken Yochi Training

3.11 Quality Control

3.11.1 Questionnaire

3.12 Statistical Analysis

3.12.1 Bivariate analysis

3.13 Permission to Conduct the Study

4 RESULTS

4.1 Response rate

4.2 Socio-demographic characteristics

4.3 Hazard Identification, Risk assessment and Risk Control (HIRARC) on ergonomic risk in pineapple plantation work task

4.4 Rapid Upper Limb Assessment (RULA) Score of Participants
5 DISCUSSION

5.1 Socio-demographic characteristics of pineapple workers in the intervention and control groups

5.2 Hazard identification, risk assessment and risk control (HIRARC)

5.3 Evaluation of body postural risk in pineapple plantation using RULA

5.4 Implementation of Intervention Program (MSS education and Kiken Yochi Training) and MSS

6 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

6.2 Limitations of the study

6.3 Recommendation for Future Study

REFERENCES

APPENDICES

BIODATA OF STUDENT

LIST OF PUBLICATIONS
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>The rapid upper limb assessment (RULA) level</td>
</tr>
<tr>
<td>2.2</td>
<td>Summary for Literature Review</td>
</tr>
<tr>
<td>3.1</td>
<td>Summary of sampling methods in selecting the state, zone, plantations and workers</td>
</tr>
<tr>
<td>3.2</td>
<td>Likelihood</td>
</tr>
<tr>
<td>3.3</td>
<td>Severity of hazards</td>
</tr>
<tr>
<td>3.4</td>
<td>Risk assessment</td>
</tr>
<tr>
<td>4.1</td>
<td>Socio-demographic non-occupational characteristics of control and intervention groups among pineapple plantation workers</td>
</tr>
<tr>
<td>4.2</td>
<td>Socio-demographic occupational characteristics of control and intervention groups among pineapple plantation workers</td>
</tr>
<tr>
<td>4.3</td>
<td>HIRARC in pineapple plantation</td>
</tr>
<tr>
<td>4.4</td>
<td>Rapid Upper Limb Assessment (RULA)</td>
</tr>
<tr>
<td>4.5</td>
<td>Comparison of 2 months of reported MSS within intervention and control groups in all nine body parts</td>
</tr>
<tr>
<td>4.6</td>
<td>Comparison of 7 days reported MSS within intervention and control groups in all nine body parts</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Work Process linked with Musculoskeletal Problems at Lower Back Area</td>
<td>5</td>
</tr>
<tr>
<td>1.2</td>
<td>Conceptual framework of the study</td>
<td>9</td>
</tr>
<tr>
<td>2.1</td>
<td><em>Kiken Yochi</em> procedure</td>
<td>21</td>
</tr>
<tr>
<td>2.2</td>
<td>Land Preparation</td>
<td>25</td>
</tr>
<tr>
<td>2.3</td>
<td>Double row planting</td>
<td>25</td>
</tr>
<tr>
<td>2.4</td>
<td>Fertilizer application</td>
<td>26</td>
</tr>
<tr>
<td>2.5</td>
<td>Flower induction and fruit growth (Hormoning)</td>
<td>27</td>
</tr>
<tr>
<td>2.6</td>
<td>Fruit Harvesting</td>
<td>27</td>
</tr>
<tr>
<td>2.7</td>
<td>Steps of Pineapple Working Processes</td>
<td>28</td>
</tr>
<tr>
<td>2.8</td>
<td>Flowchart of HIRARC process</td>
<td>30</td>
</tr>
<tr>
<td>2.9</td>
<td>RULA Assessment Worksheet</td>
<td>32</td>
</tr>
<tr>
<td>2.10</td>
<td>Standardized Nordic Questionnaire</td>
<td>34</td>
</tr>
<tr>
<td>3.1</td>
<td>Map of Pontian, Johor, Malaysia</td>
<td>36</td>
</tr>
<tr>
<td>3.2</td>
<td>Flow chart of data collection procedure</td>
<td>41</td>
</tr>
<tr>
<td>3.3</td>
<td>Brief concept of RULA Score</td>
<td>45</td>
</tr>
<tr>
<td>3.4</td>
<td>Standardized Nordic Questionnaires (SNQ)</td>
<td>47</td>
</tr>
<tr>
<td>4.1</td>
<td>Flow process of the intervention and control administration.</td>
<td>51</td>
</tr>
<tr>
<td>5.1</td>
<td>Cultivating Process</td>
<td>68</td>
</tr>
<tr>
<td>5.2</td>
<td>Weeding manually</td>
<td>68</td>
</tr>
<tr>
<td>5.3</td>
<td>Harvesting Process</td>
<td>69</td>
</tr>
<tr>
<td>5.4</td>
<td>Pesticide spraying</td>
<td>70</td>
</tr>
</tbody>
</table>
# LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>Body Mass Index</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>DOSH</td>
<td>Department of Occupational Safety and Health</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>HIRARC</td>
<td>Hazard Identification, Risk Assessment and Risk Control</td>
</tr>
<tr>
<td>ILO</td>
<td>International Labor Organization</td>
</tr>
<tr>
<td>KYT</td>
<td>Kiken Yochi Training</td>
</tr>
<tr>
<td>MAPIB</td>
<td>Malaysia Pineapple Industry Board</td>
</tr>
<tr>
<td>MSD</td>
<td>Musculoskeletal Disease</td>
</tr>
<tr>
<td>MSS</td>
<td>Musculoskeletal Symptoms</td>
</tr>
<tr>
<td>NADPOD</td>
<td>Notification of Accident, Dangerous Occurrence, Occupational Poisoning and Occupational Disease</td>
</tr>
<tr>
<td>NIOSH</td>
<td>National Institute Occupational Safety and Health</td>
</tr>
<tr>
<td>NKEA</td>
<td>National Key Economic Area</td>
</tr>
<tr>
<td>OR</td>
<td>Odd Ratio</td>
</tr>
<tr>
<td>PE</td>
<td>Participatory Ergonomic</td>
</tr>
<tr>
<td>RULA</td>
<td>Rapid Upper Limb Assessment</td>
</tr>
<tr>
<td>SD</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>SNQ</td>
<td>Standardized Nordic Questionnaire</td>
</tr>
<tr>
<td>SOCSO</td>
<td>Social Security Organization</td>
</tr>
<tr>
<td>WRMSD</td>
<td>Work Related Musculoskeletal Disorder</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION

1.1 Background

The economic activity in the agricultural sector propels the significant number of employments to fulfill the demands of the workforce worldwide. In 2014, it is estimated that the percent of employment in agriculture range between 30 to 49% in Asian countries such as Thailand, Vietnam, Indonesia, Philippines and Sri Lanka (World Bank, 2016). In Malaysia, the agricultural sector remains as an important sector for economy after services and manufacturing sectors employing an estimated 12.2% of employment in year 2014 (UNdata, 2016). Recent estimates showed that agricultural sector has contributed a gross domestic product (GDP) of 8.43% that is equal to RM 22.6 million (Department of Statistic Malaysia, 2015) to Malaysia. As reported by Department of Agriculture in 2008, the number of labor force in the agricultural industries has increased from 1.2 million to approximately 1.4 million workers (Tamrin & Aumran, 2014).

Nevertheless, agriculture is well known as one of the most hazardous occupational sectors worldwide (Fathallah, 2010). This is due to labor intensive practices such as manual handling of heavy materials and loads (Walker-Bone and Palmer, 2002; Gupta & Tarique, 2013), awkward and difficult work postures (Da Costa and Vieira, 2010; Gupta & Tarique, 2013), long and irregular working hours (Ranaas and Anderson, 2008; Earle-Richardson et al., 2010), exposure to extreme weather conditions (Earle-Richardson et al., 2010) and whole body vibration (Davis & Kotowski 2007; Walker-Bone and Palmer, 2002; Gupta & Tarique, 2013) apart from animal and insect bites (Rocha et al., 2014). These occupational hazards in the agricultural sector has been linked with musculoskeletal diseases (MSDs), physical stress (Essen & Curdy, 1998), respiratory disease, noise induced hearing loss, pesticide-related illnesses, and increased reporting of cancer cases (Arcury and Quandt, 2003; Arcury et al., 2002; Earle-Richardson et al., 2003; Kirkhorn and Schenker, 2002; McCurdy et al., 2003; Rautiainen and Reynolds, 2002).

In Malaysia, the main commodity for agricultural sector is the palm oil industry. Besides the palm oil sector, cocoa, rubber and paddy plantations are also important in Malaysia. Other than these plantations, Malaysia are involved in tropical fruits plantations which contributes significantly to the Gross Domestic Product (GDP) of the nation. Pineapple is one of the selected tropical fruits which has been promoted by the Malaysian government and has been included as one of the five fruits stated in the National Key Economic Area (NKEA) (Department of Agriculture (DOA), 2012). In 2015, canned pineapple from Malaysia has been exported to Japan, Pakistan and the United States of America (USA) while for fresh pineapples, Malaysia has exported large quantities of the product to Singapore, Iran and Egypt (Malaysian Pineapple Industry Board (MPIB), 2016). In 2015, Malaysia had 14,700 hectares of pineapple
plantation area producing approximately 427,680 metric ton of pineapple per year which valued at RM577.4 million (MPIB, 2016).

The pineapple industry in Malaysia is the oldest agro-based export-oriented industry which was introduced by the Portuguese in the sixteenth century (MPIB, 2012). The pineapple industry plays an important role in the socio-economic activity of the rural population in this country although it is relatively smaller compared to palm oil and rubber industries. This industry provided jobs to almost 5,200 smallholding farmers in Malaysia in 1994 (MPIB, 2001). In 2009, the Malaysia pineapple industry currently employs an estimated number of 8,000 workers (MPIB, 2010).

The Malaysian pineapple farming is unique because nearly 90% of the crop is planted on peat soil. Peat soil is characterized by its soft and unstable base of land (Rani et al., 2016). The primary area for pineapple production in Malaysia is Johor, a state in the southern peninsular of Malaysia. Three main districts in Johor that have planted pineapples are Pontian with 3,686 hectares, Kluang with 2,950 hectares and Muar with 1,286 hectares respectively (DOA, 2009). In addition, pineapple plantations has now advanced to Selangor, Pahang and Perak and also to Sabah and Sarawak.

In terms of occupational health effects from labor intensive practices, musculoskeletal disorder (MSD) is a common disease among those working in the agriculture sector (Holmberg et al., 2003). In general, MSD can affect the neck, back, shoulders, elbows, forearms, wrists and hands (Abas et al., 2008). Musculoskeletal symptoms (MSS) consists of signs such as pain, swelling in the joints, stiffness, numbness, tingling, clumsiness, loss of coordination, loss of strength, skin discoloration and difficulty moving in activities either at work or during leisure time (Pheasant et al., 2006). MSD is a chronic cumulative disorder, due to ergonomic reasons related to repeated exposure to heavy loads, repetitive movements, and awkward body postures over a period of time, forceful exertion, static muscular work, mechanical pressure and other relevant factors. These factors are also called work-related musculoskeletal disorders (WMSDs) (Aptel et al., 2002).

Complaints regarding WMSDs among agriculture workers are highest compared to other sectors of occupation. Agriculture is ranked as top three most hazardous sectors in world for both in developing and developed countries (DeRoo & Rautiainen, 2000). This is due to the fact that work in agricultural sector is strenuous and has been linked with high physical strain associated with farming tasks (Xiang et al., 1999). The tasks that agricultural workers have faced in their daily routine consist of among others lifting and carrying heavy loads over 23 kg, constant and repeated full body bending and twisting and performing highly repetitive hands work (Meyers et al., 2002).

The extent of the MSD problem among those working in agricultural sector is large. A survey was conducted among farmers at the Southeast of Kansas, USA in 2005 (Rosecrance et al., 2006) revealed nearly 60% of the workers experienced MSS.
According to Meyers et al. (2002), the rate of lost-time injuries occurred among field crop farmers are 5.8 injuries per 200,000 hours. Due to the fact that MSS can result in lifelong pain and permanent disability when not addressed (Singh & Arora, 2010), the impact of MSS problems is far-reaching and is above the scope of the individual. As a result, it is not only affects the psychosocial status of individuals but impacts on their families and those under their care (Woolf & Pfleger, 2003). Workers who are involved in labor intensive practices such as manual loading and those who work for a long period of time are at greater risk for MSS.

Consequently, MSD cause a huge burden to the industrial sector in terms of economic aspects. MSD can cost the farming industry lost productivity and human costs to the farmers (Chapman & Meyers, 2001). According to the Washington State Department of Labor and Industries, USA the direct cost for MSDs especially in the neck, back and upper extremity among workers who worked in the agriculture, forestry, fishing, and hunting industries is estimated to be more than United States Dollar (USD) 136 million between 1995 and 2007. While Demers and Rosenstock (1991) stated that insurance claims for agricultural workers were 50% higher compared to non-agricultural workers in Washington, USA. In 2011, the Bureau of Labor Statistics reported more than 1,500 farm workers experienced lost work time for a median of seven days due to MSDs (Lee et al., 2014). A 23% to 34% of farmers or farm residents were reported to undergo medical visits due to back pain in the USA (Rosecrance et al., 2006, Greenlee et al., 2005).

Since MSD can cause a huge burden in all aspects, it has been often been suggested that MSD can be reduced by employing an intervention approach in the work training. There have been many reports of intervention involving participatory approaches in reducing MSD and participatory ergonomic approaches interventions are one of the known avenues (Denis et al., 2007). Ergonomic improvement in the workplace condition play an important role in occupational health practices (Kogi, 2010) since it can generally improve both productivity at work and workers' quality of life (ILO, 2012; Niu & Kogi, 2012). These improvements have direct effects on manager and employee relationship, mutual support among co-workers, and workplace culture for better quality of work life. The participatory intervention has been successfully used in several studies to reduce physical work demands and to prevent MSDs (Vink et al., 2006). Participatory approaches have been frequently reported to be more effective than common training, or didactic training (Yu, Yu & Li, 2011).

Participatory approaches such as Kiken Yochi Training and Kiken Yochi Katsudou are methods which have originated from Japan (Ito et al., 2014) since year 1974 (Na & Yi, 2011). Kiken in Japanese means hazard while yochi means prediction. The purpose of Kiken Yochi Training is to enhance first-line employees’ ability to anticipate potential hazards in their workplace, discover hazards which they could cause themselves and work accordance with safety operating procedures. There are four-round steps in Kiken Yochi Training which consist of discussion, evaluation, planning, and implementation. This approach use an illustrations to represent abnormal or unplanned state of a
workplace. Through the discussion about how to improve abnormal or unplanned, workers learn to anticipate potential hazard in the work procedure and workplace.

*Kiken Yochi* has been frequently used in the manufacturing industries. With recent time, this method has evolved to include the calling out and verbal affirmation of the description of the hazard by practicing pointing activities in all of the important hazards in the workplace. This method is hugely popular in Japan, being implemented in Tokuyama Corporation (chemical product), zeon corporation (world leading products), NGK Spark Plug Co. Ltd. (provides information on job opportunities) and Hitachi Chemical co. Ltd. (chemical manufacturer).

### 1.2 Problem Statements

Activities performed in pineapple plantations entails tasks that are strenuous relative to other types of work in the agricultural sector as almost all of the activities are performed manually (Rani *et al.*, 2016). Pineapples are a short crop-rotation crop in which the life cycle for pineapple from planting to maturity is 14 to 16 months depending on the variety and the physical environment. Pineapple growing involves five main steps that start from land preparation, cultivating, weeding control, flowering induction (hormone growth) and ends with harvesting (Rani *et al.*, 2016). Work in pineapple plantation involve heavy weight lifting and repetitive and monotonous tasks that put a lot of strain on the body such as constant bending (Tamrin & Aumran, 2014). To make matters worse, since pineapples grow low from the ground averaging to a height of one meter tall and 0.5 meter width, the workers need to work in an awkward posture such as stooping and constant bending while tasks are performed due to manual work for 6 to 8 hours per day (Rani *et al.*, 2016). In addition, due to the soft peat soil, work tasks that require maneuvering manual loads becomes difficult (Tamrin & Aumran, 2014). From a previous study, it was found that MSS is common among pineapple workers who worked manually that many perceived them as no more than normal and inevitable consequences of plantation labour (Rani *et al.* 2016).

Recent data have found that pineapple workers complaints lower backache while bending for a prolonged time to perform the tasks (Tamrin & Aumran, 2014). Another local study found that MSS reported at the lower back area were linked with heavy lifting of pineapple fruits on the back which occurs during harvesting process and also excessive bending during the cultivation of shoots and manual weeding process (Rani *et al.*, 2016). When MSD data from the Social Security Organization (SOCSO) (2014) was observed, it was found that increasing trend of reported cases in Malaysia is evident, from 517 cases in 2013 to 675 cases in 2014.
Reiterating an earlier point, MSD causes a huge burden to the manual working sector in terms of economic aspects. On a local scale, Malaysia has reported the increasing trend of workers’ compensation for permanent and temporary benefits from 310 million in 2008 to 500 million in 2012 (SOCSO, 2012) for all the sectors.

All these evidences of MSS cases have shown the need for participatory approach such as in order to reduce MSS to be conducted. There are a lot of successful participatory approach programs based on simple and low-cost practical solution concept in disseminating ergonomically sound workplace improvement applicable and adaptable for different local situation and work environment (Niu, 2010). The programs such as Work Improvements in Small Enterprises (WISE), Work Improvement in Neighbourhood Development (WIND) and Ergonomics Checkpoints in Agriculture has been created specifically for the rural and agricultural setting. In Malaysia, a study done by Ng et al. (2014) described the implementation of Participatory-Action Oriented Training (PAOT) among harvesters at oil palm plantation (OPP) to the south of Peninsular Malaysia. The result revealed that the PAOT approach were ineffective in preventing MSD among harvesters in intervention group. The difference between PAOT and finger-point-and-call is finger-point-and-call is for ensuring safety and avoiding mistakes when working (Katsuya, 2009) while PAOT is and practical low-cost improvement measures that support self-help improvement actions (Kogi et al., 1989).

There are a lot of articles regarding studies which has been carried out on intervention approach in preventing MSS among agricultural workers (Jafry and O’Neill, 2000; Holmes et al., 2008; Singh and Arora, 2010). However, Kiken Yochi intervention approach never been applied and practiced by agricultural workers in the world including Malaysia. Japan and Thailand has done this intervention approach among their industrial workers but not for their agricultural workers. Poosanthanasarn et al. (2005a) had implemented Kiken Yochi Training among the auto-part factory workers. Kiken Yochi Training was used together with ergonomic intervention program (EIP) in reducing muscular discomfort. Muscular discomfort was measured by electromyography (EMG). The means for low back muscular activity of an applied ergonomics intervention program (AEIP) group had significantly reduced low back muscular discomfort compared from those of the non-AEIP group.
Most of the trainings on safe work practices among agricultural workers in Malaysia has been done at OPP and there is so far no training which has been done at pineapple plantation. The issue of safety and health of workers in the pineapple plantation are being less highlighted compared to other plantations and industries. To conduct effective training incorporating participatory approaches, there is the need for work tasks to have a thorough hazard identification, risk assessment and risk control (HIRARC) program. With the identification of significant risks, focus on the important aspect of training in participatory approaches can be identified. Data on HIRARC findings on pineapple plantations is limited.

Furthermore, in Malaysia, about 26% of foreign workers are employed in the agricultural sector (Central Bank, 2013). The training of foreign workers needs to be tailored to their language of understanding. It is the duty of all employer under the section 15 of the Occupational Safety and Health Act 1994 to ensure the safety, health and welfare of all employees. As such, there is a need for trainings to be delivered in the form which facilitates the understandings of the workers. The current statistics showed that there is a lack of awareness on safety and health among workers in the agricultural sectors as well as their top managements (Tamrin & Aumran, 2014).

All these evidences have shown the need for a study focusing on the impact of participatory approach such as Kiken Yochi Training among pineapple farm plantations workers in order to reduce MSS to be conducted.

1.3 Research Justification

MSS are major concern for farmers and health care professionals due to the negative impact on the health and productivity of workers. These impacts are measurable in terms of health and safety costs, injury and illness rate, lost work time, treatment duration, and workers’ compensation costs. It is expected that by reducing the incidence of MSS, a reduction in total costs, an increasing in productivity, and improvement in employees’ quality of life will be achieved.

The outcomes of this study will deliver broad understanding of the ergonomic hazards of the workers engaged in pineapple plantations. This research is expected to provide guidance in identifying steps that could be taken to improve the working methods of workers in their routine daily work. Besides, this study would benefit not only the pineapple plantation workers but other stakeholders, including DOSH, MPIB, and the DOA in improving the safety and health of workers.

In addition, this study functions as a source of a baseline data, as well as a measurement towards identifying the direction of plantation owners in Malaysia in addressing occupational health and safety problems. As a result, injuries due to ergonomic hazard can be reduced if the hazards can be identified earlier and appropriate and effective intervention methods are implemented.
Beside, this study will be able to identify, assess and determine risks related to ergonomic hazards at the selected pineapple plantations. By understanding the existence of risk and hazards that may harm workers, proper control measures can be taken before the predicted mishap happens. Thus, the application of HIRARC in this study aimed at improving the work environment in the pineapple plantation. Plus, it will enable employers to plan, introduce and monitor preventive measures to ensure that the risks are adequately controlled at all time.

This will be the first study in Malaysia conducted using Kiken Yochi intervention method in reducing MSS among pineapple workers. Finger-pointing method as practice testing in Kiken Yochi make it different from other participatory approaches that has been practiced before. Study done by Carpenter in (2009) proved that direct effects of practice testing is can enhance retention by triggering elaborative retrieval processes compared to restudy or rereading among students. It is because the practice test increase the likelihood that the related information was activated and encoded along with the target during learning. Hunt (2006), also suggests that practice testing may enhance how well students mentally organize information and how well they process idiosyncratic aspects of individual items, which together can support better retention. This method also can be applied among workers at pineapple farm where when they applied Kiken Yochi in their daily work, it can prevent and decrease the MSS by remembering the right body postures during working.

1.4 Research Questions

1. What are the hazards and its subsequent risks associated with work activities among pineapple workers at pineapple farm plantations?
2. What are the ergonomic risk factors associated with body postures of pineapple workers while performing work tasks at pineapple farm plantations?
3. What are the ergonomic work postures which needs to be improved to reduce MSS among pineapple farm plantation workers?
4. What are the effects of MSS among pineapple farm plantation workers after KYT is given?

1.5 Research Objectives

1.5.1 General objective

To assess the effects of work improvement module using a participatory approach of Kiken Yochi in reducing MSS among male migrant pineapple farm plantation workers in Pontian, Johor.
1.5.2 Specific objectives

1) To determine hazards and assess the risks within work activities among pineapple farm plantation workers.
2) To analyse body postures of pineapple workers during work at pineapple farm plantations
3) To construct and implement work improvement module to intervention (Kiken Yochi Training) and control groups (MSS educational training) of pineapple farm plantation workers.
4) To measure pre and post-intervention MSS among intervention and control groups of pineapple farm plantation workers.

1.6 Research Hypothesis

1) There will be a significant difference between MSS among control and intervention groups of pineapple farm plantation workers before and after the intervention.

1.7 Conceptual Framework

Among other agricultural workers, pineapple farm plantation workers are the target group of this study. The work tasks involved in pineapple plantations are land preparation, cultivating, weeding control, hormoning (flowering) and harvesting.

From the review of the literature, one of the ergonomic hazards in pineapple plantation are working in awkward posture for long period of time. Working in awkward posture may contribute to the development of MSDs. The risk factors for developing of MSDs can be divided into two categories which are occupational and non-occupational factors. Occupational factors consist of working tenure, specific work task done by workers. While for the non-occupational factors involve of age, body mass index (BMI) and smoking status.

The musculoskeletal symptoms (MSS) in the nine different body parts is divided into neck, shoulder, upper back, elbow, low back, wrist/hand, hip/thigh, knee and feet/ankle. MSS can be measured by the standardized Nordic questionnaire (SNQ). SNQ asked about muscle ache, discomfort and pain of the workers for past 12 months and 7 days.

In order to reduce MSS, an intervention approach utilizing participatory approach will need to be given to the workers. When workers who are given ergonomic participatory approach intervention are compared to workers who are given training using conventional methods, it is suggested that the former group will experience less MSS upon its practice compared to the latter when assessed within a suitable frame of time. Figure 1.1 shows the conceptual framework of the study.
Work Tasks Performed by Pineapple Plantation Workers

- Land preparation
- Cultivation
- Weeding control
- Hormoning
- Harvesting

Ergonomic hazards

- Awkward body postures

Occupational factors
- Years in jobs
- Heavy loading

Musculoskeletal Disorders (MSDs)
- Musculoskeletal symptoms (MSS)
  - Muscle ache
  - Muscle discomfort
  - Muscle pain (Kuorinka et al., 1987)

Non-occupational factors
- Age
- Body Mass Index (BMI)
- Smoking

Control Group

Intervention Group

1) Work Intervention Module
2) Kiken Yochi Training

Decreased of MSS

Figure 1.2: Conceptual framework of the study
REFERENCES


Luangwilai T., Norkaew S., Siriwong W. (2014) Factors associated with musculoskeletal disorders among rice farmers: cross sectional study in
Tarnlalord sub-district, Phimai district, Nakhonratchasima province, Thailand. *J Health Res. 28*(Suppl.): S85-91.


