



UNIVERSITI PUTRA MALAYSIA

***ASSOCIATION BETWEEN RISK FACTORS, MUSCULOSKELETAL
DISORDERS (MSD) AND WORK PRODUCTIVITY AMONG OIL PALM
PLANTATION HARVESTERS IN JOHOR***

**BY
YIK WAI MUN**

**Ip
FPSK4 2012 53**

ACKNOWLEDGEMENT

All praise to the Lord that this project can be completed. Completion of this project needs the courage from oneself and help from the people around where the knowledge in this field can be acquired. Firstly, I would like to thank Associate Professor Dr. Shamsul Bahri Mohd Tamrin as the supervisor of this project for the guidance and teaching throughout this whole project and discussion of the data analyses and also write up of the thesis.

Nevertheless, my gratitude also goes to Mr. Ng Yee Guan and Mr. Irwan for the assistance and guidance throughout the preparation and the whole process of data collection. I also wish to extend my special thanks to all the members in the team for helping each other out during data collection not forgetting the oil palm plantation management and respondents in this study for cooperation.

This acknowledgement also directed to Prof. Dr. Zailina Hashim as the head of the Environmental and Occupational Health department and also Dr. Saliza Mohd Elias as the coordinator of the final year project for all the encouragement and advice given.

For many others whom I have failed to name, my gratitude is yours for all your help and contribution to this project.

ABSTRACT

**ASSOCIATION BETWEEN RISK FACTORS,
MUSCULOSKELETAL DISORDERS (MSD) AND WORK PRODUCTIVITY
AMONG OIL PALM PLANTATION HARVESTERS IN JOHOR****Yik, W.M, Shamsul B.M.T**

Department of Environmental and Occupational Health, Universiti Putra Malaysia

Introduction: A cross sectional study was done among 143 oil palm plantation harvesters with the objective of determining the prevalence of musculoskeletal disorders (MSD) and the association with risk factors and productivity. **Methodology:** Nordic questionnaire was used in determining musculoskeletal disorders (MSD) symptoms and Rapid Entire Body Assessment (REBA) was used to determine the posture performed by the harvesters. Productivity is defined by 5 indicators (presenteeism, absenteeism, efficiency, daily harvesting income and daily quantity) in this study. Secondary data was obtained for daily harvesting income and daily quantity; data for other indicators were obtained through questionnaire. Median or mean score on productivity indicators was used as the cut-off point to dichotomize workers into group with productivity loss and group without productivity loss. Harvesters that had absenteeism (past month) or presenteeism (past week) were categorized to the group with productivity loss. Mean of group with productivity loss and without was compared to determine the mean reduction of productivity. **Result:** There is a high prevalence of MSD (93%) among the oil palm plantation harvesters. The REBA scores is high for most of the harvesters whereby 62.4% of them are in the high risk category and another 43% is in the very high risk category. There is a significant difference for efficiency ($p=0.019$) and the days of presenteeism (sick at work), $p=0.00$ between harvesters with MSD and without MSD. No significant association was found between risk factors and MSD but significant association was found between daily quantity ($p=0.024$) and presenteeism ($p=0.006$). Logistic regression adjusted for BMI, age and smoking also showed that harvesters with MSD (past 7 days) is 2.87 times more likely to have presenteeism and 2.09 more likely to be not productive in daily quantity compared to harvesters without MSD (past 7 days). **Conclusion:** There is no association between risk factors and MSD although there is significant association between presenteeism and quantity (work productivity indicators) with MSD. MSD is the predictor for reduced productivity in this study.

Keywords: oil palm plantation, harvesters, musculoskeletal disorders, risk factors, productivity

ABSTRAK

PERKAITAN ANTARA FAKTOR RISIKO, GANGGUAN OTOT RANGKA DAN PRODUKTIVITI KERJA DI KALANGAN PENUAI KELAPA SAWIT DI JOHOR

Yik, W.M, Shamsul B.M.T

Jabatan Kesihatan Persekitaran dan Pekerjaan, Universiti Putra Malaysia

Pengenalan: Satu kajian keratan rentas telah dijalankan di kalangan 143 penuai kelapa sawit dengan objektif untuk menentukan kelaziman gangguan otot rangka dan perkaitannya dengan faktor risiko dan produktiviti kerja. **Metodologi:** Borang soal selidik *Nordic* telah digunakan untuk menentukan gejala gangguan otot rangka dan *Rapid Entire Body Assessment* (REBA) juga digunakan untuk menentukan postur penuai kelapa sawit. Produktiviti dalam kajian ini ditakrifkan oleh 5 indikator (*presenteeism*, ketidakhadiran, kecekapan, pendapatan menuai harian dan kuantiti harian). Data sekunder telah diperolehi untuk maklumat indikator produktiviti seperti pendapatan menuai harian dan kuantiti harian. Data untuk indikator lain diperolehi dari data borong soal selidik. Markah median atau min untuk indikator produktiviti telah digunakan sebagai pembahagi untuk mengklasifikasikan penuai kepada kumpulan yang kehilangan daya produktiviti dan kepada kumpulan yang tidak kehilangan daya produktiviti. Penuai yang ada ketidakhadiran (bulan yang lepas) atau *presenteeism* (minggu yang lepas) diklasifikasikan sebagai kumpulan yang kehilangan daya produktiviti. Min antara kumpulan yang kehilangan daya produktiviti dan kumpulan yang tidak kehilangan daya produktiviti telah dibandingkan untuk menentukan pengurangan min untuk daya produktiviti. **Hasil Kajian:** Terdapat kelaziman yang tinggi untuk gangguan otot rangka (93%) di kalangan penuai. Markah REBA untuk risiko ergonomik menunjukkan 62.4% daripada penuai adalah dalam kategori risiko tinggi dan 43% dalam kategori risiko sangat tinggi. Markah kecekapan ($p=0.019$) dan hari yang ada *presenteeism* ($p=0.00$) mempunyai perbezaan yang signifikan di antara kumpulan yang mengalami gangguan otot rangka dan kumpulan yang tidak. Tiada perkaitan yang signifikan antara gangguan otot rangka dengan faktor risiko tapi walau bagaimanapun terdapat perkaitan yang signifikan antara kuantiti harian ($p=0.024$) dan *presenteeism* ($p=0.006$) dengan gangguan otot rangka. Regresi logistik yang telah diselaraskan dengan BMI, umur dan merokok menunjukkan penuai yang mengalami gangguan otot rangka (7 hari yang lepas) adalah 2.87 kali lebih cenderung untuk mengalami *presenteeism* dan 2.09 kali lebih cenderung menjadi tidak produktif untuk kuantiti harian berbanding dengan penuai yang tidak mengalami gangguan otot rangka (7 hari yang lepas). **Rumusan:** Tiada perkaitan yang signifikan antara gangguan otot rangka dengan faktor risiko tapi walau bagaimanapun terdapat perkaitan yang signifikan antara kuantiti harian dan *presenteeism* dengan gejala gangguan otot rangka. Kajian ini menunjukkan gejala gangguan otot rangka merupakan prediktor kepada pengurangan daya produktiviti.

Kata Kunci: Ladang kelapa sawit, penuai, gangguan otot rangka, faktor risiko, produktiviti

TABLE OF CONTENT

	Page
ACKNOWLEDGEMENT	iv
ABSTRACT	v
ABSTRAK	vi
TABLE OF CONTENT	vii
LIST OF TABLES	xii
LIST OF FIGURE	xiii
LIST OF ABBREVIATION	xiv
LIST OF APPENDICES	xvi
CHAPTER 1: INTRODUCTION	1
1.1 Introduction	1
1.1.1 Research Background	2
1.2 Problem Statement	8
1.3 Study Justification	12
1.4 Objectives	14
1.4.1 General Objectives	14
1.4.2 Specific Objectives	14

1.5 Hypothesis	15
1.6 Variables	15
1.6.1 Independent Variables	15
1.6.2 Dependent Variables	15
1.7 Variables Definition	16
1.7.1 Risk Factors	16
1.7.2 Body Mass Index (BMI)	17
1.7.3 MSD Disorders	18
1.7.4 Work Productivity	19
1.8 Conceptual Framework	20
CHAPTER 2: LITERATURE REVIEW	24
2.1 The Musculoskeletal System	24
2.1.1 Anatomy of the Musculoskeletal System	25
2.2 MSD	27
2.2.1 MSD in Adult Population	27
2.2.2 MSD in agriculture and Oil Palm Plantation Industry	29
2.3 Risk Factors Contribute to MSD	31
2.3.1 MSD and age	32
2.3.2 MSD and BMI	33
2.3.3 MSD and Smoking	33
2.3.4 MSD and Education	34
2.3.5 MSD and Psychosocial Factors	35

2.3.6 MSD and Leisure Activities	36
2.3.7 MSD and Arthritis	36
2.3.8 MSD and Accident History	37
2.3.9 MSD and Work Durations	37
2.3.10 MSD and Overtime on Rest Day	38
2.3.11 MSD and Ergonomics Risk Factors	38
2.4 MSD and Work Productivity	40
2.4.1 Absenteeism as Indicator for Productivity	42
2.4.2 Presenteeism as Indicator for Productivity	42
2.4.3 Efficiency as Indicator for Productivity	43
2.4.4 Quantity as Indicator for Productivity	43
2.4.5 Wages as Indicator for Productivity	44
CHAPTER 3: METHODOLOGY	45
3.1 Study Design	45
3.2 Study Location	45
3.3 Sampling	46
3.3.1 Sampling Population	46
3.3.2 Study Sample	46
3.3.3 Sampling Frame	46
3.3.4 Sampling Unit	46
3.3.5 Sampling Size	47
3.3.6 Sampling Method	48

3.3.7 Study Methodology	49
3.3.7.1 Questionnaire	49
3.3.7.2 Rapid Entire Body Assessment	52
3.3.7.3 Secondary Data	55
3.3.7.3.1 Calculation	56
3.4 Quality Control	58
3.4.1 Pre test of Questionnaire	58
3.4.2 Validity of Questionnaire	59
3.5 Data Analysis	59
3.6 Study Ethics	59
3.7 Study Limitation	60
 CHAPTER 4: RESULT	 62
4.1 Demographic data	62
4.2 MSD	70
4.3 Work Productivity	72
4.4 Comparison of Work Productivity	74
4.5 Association of risk factors and MSD	76
4.5 Association of productivity and MSD of past 7 days	78
4.6 Logistic Regression model of MSD with productivity	79

CHAPTER 5: DISCUSSION, CONCLUSION AND RECOMMENDATION 80

5.1 Study Background	80
5.2 MSD	83
5.3 Work Productivity	85
5.4 Association between MSD and Risk Factors	87
5.5 Association between MSD and Productivity	89
5.6 Study Limitation	91
5.7 Conclusion	92
5.8 Recommendations	92
5.8.1 Recommendations for further study	92
5.8.2 Recommendations for the oil palm plantation management	93
REFERENCE	94
APPENDICES	107

LIST OF TABLES

	Page
Table 1.1 The International Classification of adult underweight, overweight and obesity according to BMI	4
Table 3.1 Degree of the risk is determined from the REBA decision scale	53
Table 3.2 Categorization of group with productivity loss and group without productivity loss	57
Table 3.3 Data Analysis using respective statistical tests	59
Table 4.1 Socio demography of the respondents	63
Table 4.2 Working Information	66
Table 4.3 Lifestyle Information	68
Table 4.4 Medical Information	69
Table 4.5 Musculoskeletal Disorders	71
Table 4.6 Work Productivity among harvesters	73
Table 4.7 Comparison of work productivity between harvesters that have MSD and harvesters that do not have MSD (past 7 days)	75
Table 4.8 Association of risk factors and MSD (in the past 12 months)	77
Table 4.9 Association between MSD in the past 7 days and productivity	78
Table 4.10 Logistic regression Model examining productivity indicators associated with productivity indicators	79

LIST OF FIGURES

	Page
Figure 1.1 The Flow Chart of Oil Palm Production	4
Figure 1.2 The chisel used to harvest the fresh fruit bunch	5
Figure 1.3 Ripe Fresh Fruit Bunch	6
Figure 1.4 A harvester cutting the fruit bunch from the palm oil tree	7
Figure 1.5 Harvester collect the FFB with loading spike to the wheelbarrow	10
Figure 1.6 Conceptual Framework	20
Figure 2.1 Human Musculoskeletal System (<i>Anterior</i>)	26
Figure 2.2 Human Musculoskeletal System (<i>Posterior</i>)	27
Figure 3.1 REBA Procedures	53

LIST OF ABBREVIATIONS

<	Less Than
>	More than
≥	Equal or more than
≤	Equal or less than
χ^2	Chi Square
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
FFB	Fresh Fruit Brunch
GHQ	General Health Questionnaire
GNI	Gross National Income
Kg	Kilogram (weight)
LBP	Low Back Pain
LF	Loose Fruit
m ²	Meter square
MSD	Musculoskeletal Disorders

MSI Musculoskeletal Injuries

REBA Rapid Entire Body Assessment

SNQ Standardized Nordic Questionnaire

VAS Visual Analogue Scale

WHO World Health Organization



LIST OF APPENDICES

	Page
Appendix 1 Ethics Approval Letter	108
Appendix 2 Respondents Consent Form	109
Appendix 3 Questionnaire	110
Appendix 4 REBA form	111



CHAPTER 1

INTRODUCTION

1.1 Introduction

1.1.1 Research Background

Palm oil was introduced to Malaysia at the start of the 20th century, identified as an economically important crop back in 1903 by the Department of Agriculture and commercially produced since 1917 (Mahmud, Md Deros & Abdul Wahab, 2009). The Malaysian palm oil industry is the fourth largest contributor to the Malaysian Gross National Income (GNI) and currently accounts for RM52.7 billion of the national GNI (Prime Minister Department of Malaysia, 2010). In Malaysia as of 2010, the area of oil palm plantation was 4.85 million ha covering 14% of the total land area in Malaysia (Chin, 2010). According to the Director of Malaysia Palm Oil

Board, Choo (2011) reported that the crude palm oil production was 16.99 million tonnes as of year 2010.

Basically, there are two major sections in the palm oil processing which are upstream and downstream. Upstream activities consist of production of fresh fruit bunches (FFB) in plantations, processing of FFBs in mills and palm kernel crushing and palm oil refining activities. Downstream activities focused on processed food, biodiesel, second generation biofuel, and oleochemicals. In Malaysia, the upstream activities still very dependent on the availability and productive of workers which are very manual labour intensive (Prime Minister Department of Malaysia, 2010).

There are four major activities involved in the Malaysia Oil palm plantation industry which belongs to the upstream activities, namely

1. Seed Nursery
2. Planting
3. Harvesting
4. Collecting
5. Milling

(Mahmud et al.,2009).

Manual labor is widely used in oil palm plantation whereby there is an over reliance on manual labor for all key activities such as land preparation, nurseries, planting, fertilizing, field upkeep and maintenance, harvesting, collection and transportation. As a result, Malaysian oil palm plantations are heavily dependent on foreign workers (currently estimated at 80 percent of total industry workforce), (Prime Minister Department of Malaysia, 2010). Manual labour is still widely use because the cost benefit of using chisel and sickle is still better than the mechanization that uses machine to harvest fruit (Jelani, 1998). Other than that, mechanized infield fruit transport may result in soil compaction, unless low ground-pressure tyres are fitted to properly designed vehicles.

The job scope of a harvester is to cut the fruit brunch with a chisel or sickle. At present, harvesting of short palm tree is normally done by using a chisel fixed to a short steel pole. For tall palm tree, harvesting is done using a sickle attached to a long steel pole. However, with the tools, which can be as heavy as 6.5 to 8.5 kg, harvesters are forced to use a lot of energy in the harvesting operation. This is because the harvesters need to move around fast in the plantation carrying the chisel and forceful exertion was observed when harvesters need to cut the FFB (fresh fruit bunch) at high speed to create enough momentum. In this study, the palm trees in all the plantations were still short palm tree. Harvesting the FFB from shorter palm tree may be easier than taller palm tree. Angle of cutting, skill and experience of harvesters play an important role in the success of cutting the FFB (Jelani, 1998).

Tall palm requires greater energy to harvest. A sickle attached to a long pole is used and cutting is done by slicing through pulling the sickle downwards. Harvester need to lift the pole before he can pull the sickle to cut, thus it is more energy consuming. Generally the harvesters for the tall palm would not be able to maintain their endurance for the whole day and they normally stop in the afternoon (Jelani, 1998). However, only chisel was used in this study as all the palm trees are shorter palm trees.

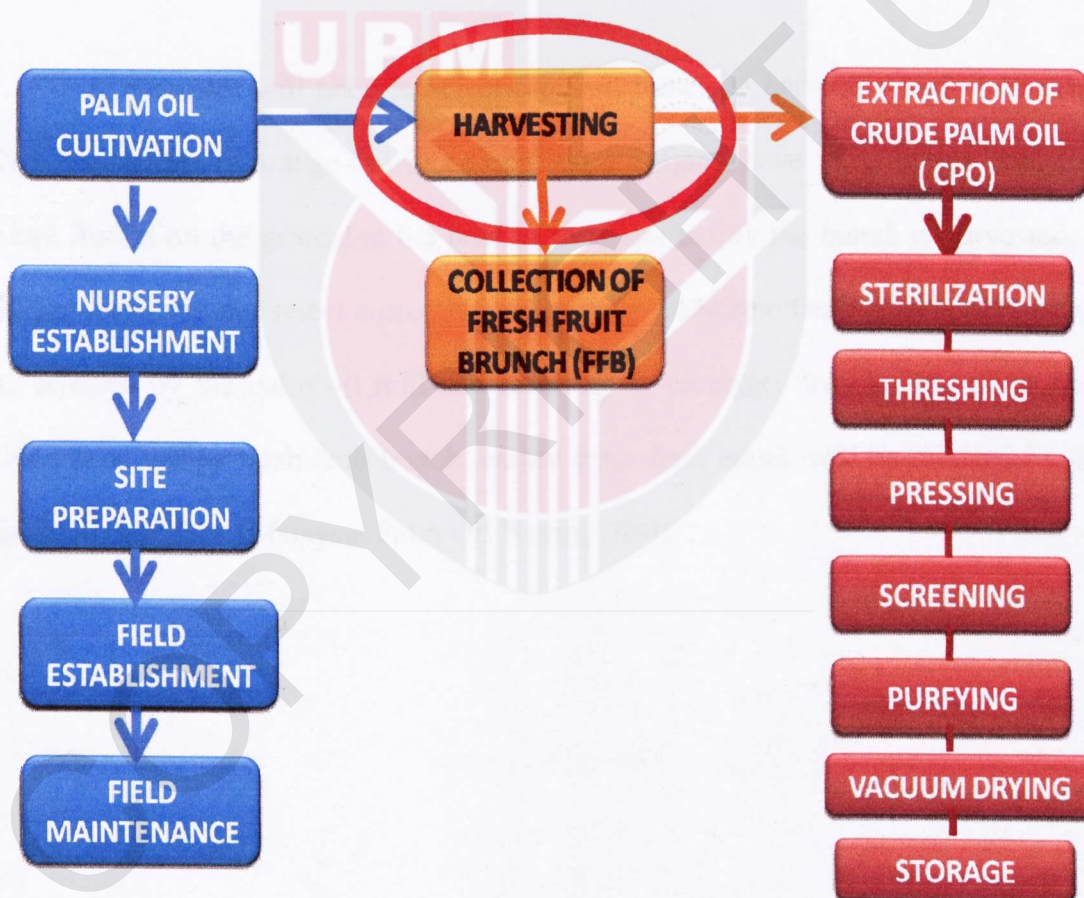


Figure 1.1: The Flow Chart of Oil Palm Production

Source: Hai, 2002

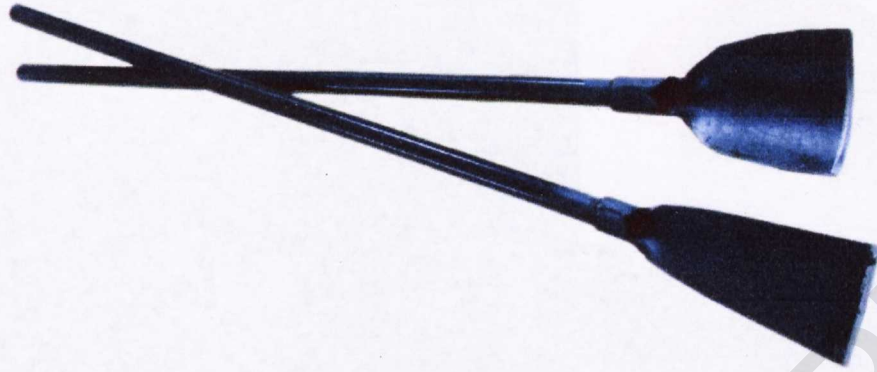


Figure 1.2: The chisel used to harvest the fresh fruit bunch.

A harvester will need to select the fruit bunch to harvest, which is the ripe fruit bunch that is orange-red in color (figure 1.3) and have at least one detached loose fruitlet on the ground at the base of the palm before the bunch is harvested. If the harvester did not select correctly, and harvest the unripe fresh fruit bunch, it will be rejected by the palm oil mill and resulting in monetary loss for the plantation. Other than unripe fresh fruit bunch, empty fresh fruit bunch will be rejected by the palm oil mill also. (Malaysia Palm Oil Board, 2003)

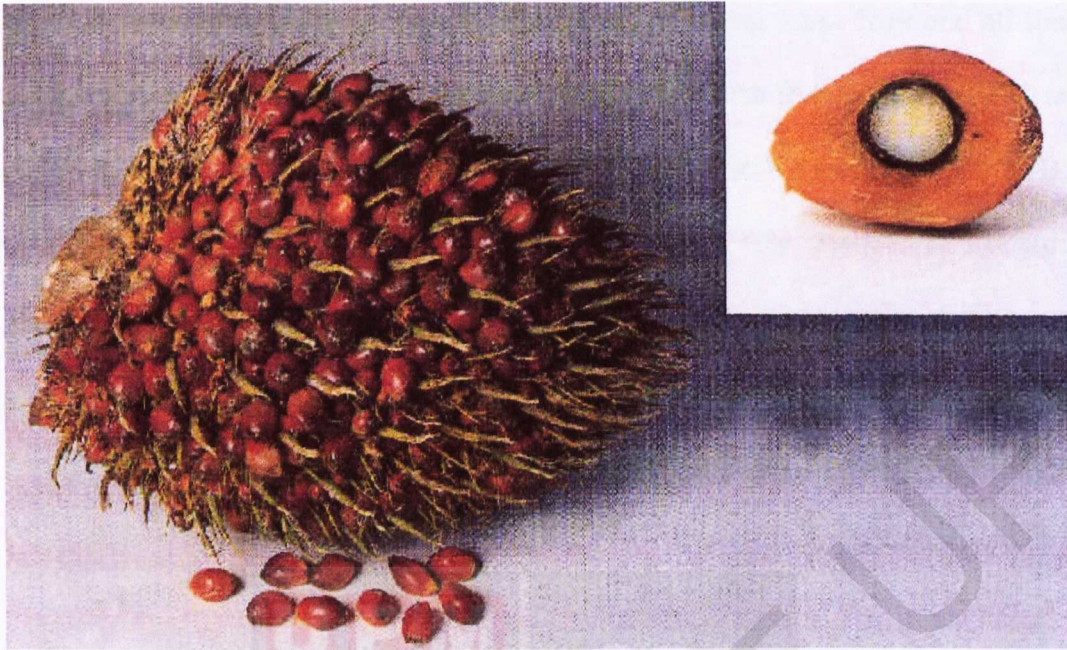


Figure 1.3 : Ripe Fresh Fruit Bunch

Harvesting rounds are usually maintained at 7-10 days intervals and done according to row of the palm tree. Each harvester is issued with a complete set of harvesting tools and it is carried around through the whole harvesting process. When a ripe bunch is located, the harvester cuts the frond subtending the bunch. After that the exposed bunch stalk is cut and the ripe bunch falls to the ground.

In the oil palm plantation, harvesters usually work in pairs when they are in a gang of 6 to 8 persons. One will responsible of cutting the FFB and frond whereas another person will responsible to collect the FFB with loading spike and loose fruit in the wheelbarrow.

Wheelbarrows will be used to collect the FFB and loose fruit and all these will be put at the collection point by the roadside. Ripe fresh fruit bunches (FFB) and loose fruit will be then delivered to the mill by lorry. Usually the weight of a FFB is around 15 to 50 kg, depending on the age of the palm tree (Hendra & Rahardjo, 2009).



Figure 1.4: A harvester cutting the fruit bunch from the palm oil tree.

Injuries and illnesses in agriculture that have been consistently identified through epidemiological and community-based studies. There is a need for controlling due to their high reporting rates among agricultural workers. These include musculoskeletal disorders, respiratory disease, noise induced hearing loss, pesticide-related illnesses (Earle-Richardson et al., 2003 ; McCurdy et al., 2003). However, it has been consistently shown that musculoskeletal disorders (MSD) are the most common of all occupational non-fatal injuries and illnesses for agriculture workers, especially those who are involved in labor-intensive practices (McCurdy et

al., 2003; Meyers et al., 1997). According to Bernard et al., 1997), MSD is the most prevalent and costly of all work-related injuries.

1.2 Problem Statement

MSD is a major problem in the work force, for the employee, they cause personal suffering and loss of income; for the employer, they reduce productivity of the workers; and for government, they increase social security costs (European Agency for Safety and Health at Work, 2012).

In Malaysia, there is a high prevalence of MSD among oil palm plantation workers as reported prevalence (67%) of low back pain reported by Mohd Nizam and Rampal (2005), it is not limited in Malaysia, in other country, such as Indonesia, Hendra and Rahardjo (2009) reported 71.4% of MSD prevalence among harvesters. A current study done in similar workplace setting, which is in the rubber plantation also reported 85.7% of MSD among rubber workers (Chow, Adon, Abdul Rahman, Syed Hassan & Ismail, 2012)

The work activities of harvesters exposed them to a lot of ergonomics risk factors. Based on a study conducted by Hendra and Rahardjo (2009), 71.4 % of the harvester in the study reported that they experience pain on lower back and neck. Other than that, Hendra and Rahardjo (2009) also found out that the work task of the harvester is at the high risk level as the Rapid Entire Body Assessment (REBA) has high score of 9, indicating high ergonomic risk. Another study done by Meyers et al. (1997), stated that overexertions predominate as the major types of injury in agriculture, it was reported in a later study by Meyers et al. (1998) that overexertion is a cause of MSD injury and was cited for 25% of reported MSD injuries, both workplace settings of the study were in wine grape vineyard.

The action of cutting itself requires workers to lower down their body, where frequent bending is inevitable as the palm tree when this study was conducted were still short palm. According to one of the study in Malaysia, high frequency of bending forward is the predictor of back pain where it can increase the back pain risk by 5 times (Mohd. & Rampal , 2005). Frequent bending is often observed also for harvesters that need to collect FFB and LF to the wheelbarrow from the ground.

As harvesters need to handle heavy load in their daily work task, such as loading the FFB to the wheelbarrow with the loading spike, pushing the loaded wheelbarrow to the collection point and carrying the heavy chisel (6.5-8.5kg) while moving around in the plantation to look for ripe fruit for harvesting, they need to bear with the load of the FFB which is around 15 to 50 kg before they can put it into the wheelbarrow. The wheelbarrow itself is heavy, which is around 11kg. In a study done by Hoogendoorn et al. (1999), stated that a load that exceeds the failure tolerance of the tissue, applied once, can cause back pain. Physical load is assumed to have both an acute and a cumulative effect on the occurrence of back pain. An increased risk of a new episode of low back pain was found in those whose jobs involved lifting or pulling or pushing objects of at least 25 lbs, which is equivalent to 11.33 kg in a cohort study. (Macfarlane et al., 1999).



Figure 1.5 : Harvester collect the FFB with loading spike to the wheelbarrow.

Awkward posture of harvesters while working had been observed in study by Hendra and Rahardjo (2009), which are cutting the frond and FFB, collecting the FFB and LF and pushing the wheelbarrow to the collection site. All these awkward posture and movement can caused the biomechanical stress on the muscle, ligament and joint to develop musculoskeletal pain.

A study was done in Netherland to investigate the association between productivity loss and health, the findings revealed that moderate and severe functional limitations due to health problems and lack of control at work were associated with productivity loss at work. The most prevalent disease in the study population was musculoskeletal disease (45%). (Alavinia, Molenaar & Burdorf, 2009).

Pain from arthritis, back pain and other musculoskeletal problems had caused productivity loss among 13% of US workers (Stewart, Ricci, Chee, Morganstein & Lipton, 2003). In the United States and Sweden, musculoskeletal disorders cause more work absenteeism or disability than any other group of diseases (Feeney, North, Head, Canner & Marmot, 1998) and absenteeism can cause productivity loss. Brouwer et al., 1999 reported on an average day, over 7% of the respondents were working with health problems, indicating that productivity losses without absence is a common problem.

MSD can result in disability, lost work time, and increased production costs. MSD increase production costs as a result of worker absence, medical and insurance costs, decreased work capacity, and loss of employees to turnover and competition from other less physically demanding industries (Kirkhorn, Earle-Richardson & Banks 2010)

1.3 Study Justification

In developing countries like Malaysia, the problem of productivity associated with MSD and risk factors with productivity specifically in oil palm plantation is still ambiguous, this study will provide a reference to employers and industry that MSD among workers need to be emphasized in order to increase productivity and also avoid premature quit from workforce. Several studies have demonstrated that workers who develop musculoskeletal disorders in ergonomically stressful jobs are more likely to transfer to less exposed positions or to leave the workplace altogether (Ekberg & Wildhagen, 1996; Katz et al., 1997). In this study, productivity was defined comprehensively and specifically by 5 different indicators which are presenteeism, absenteeism, daily harvesting income, daily quantity and efficiency so that the problem can be tackled better if there is any intervention program in the future.

Workers have the rights to know what health effect they are facing, this study can let them know their health status whether they are at risk of musculoskeletal disorders or already develop the MSD. According to Cole and Hudak (1996), knowledge is sparse to the workers who continue in exposed jobs after onset of musculoskeletal disorders.

It may also create awareness among employers that MSD issue need to be addressed properly and prevent it before it happens. MSD are largely chronic, require long term treatment, it also can affect the sick leave pattern due to disability and care-seeking. Medical cost is an incremental cost following the inflation rate, thus, while addressing the problem of MSD, company can reduce on compensation and medical cost for the workers, eventually increase productivity and business profit.

This study can contribute to the pool of known risk factors that contribute to MSD; it will cover work-related and non-work related risk factors as well as psychosocial factor. Thus, the study will address the potential and known risk factors for MSD specifically in oil palm plantation. Oil palm industry then can take prevention steps reduce the MSD prevalence among harvesters. This study can help the management to identify the risk factors and assess the health status of the harvesters in order to design an appropriate intervention programme.

Most studies were about the association of risk factors with MSD and productivity among the white collar workers, such as Hagberg et al. (2002). Few studies had been done among blue collars such as the oil palm plantation workers, only Meerding et al., 2005 had studied the productivity loss due to musculoskeletal disorders among blue collar workers. There is also limited study about the effect of musculoskeletal disorder in productivity among blue collar workers so this study will help the industrial to weight the cost and benefit of preventing musculoskeletal disorder and the need to invest on the intervention measures.

1.4 Objectives

1.4.1 General Objectives

To determine the association between risk factors with MSD and association between MSD with work productivity among harvesters.

1.4.2 Specific Objectives

1. To determine the prevalence of MSD among harvesters.
2. To determine the work productivity among harvesters

3. To compare the productivity among harvesters with MSD and harvesters without MSD.
4. To determine the association of risk factors with MSD
5. To determine the association of MSD with work productivity.

1.5 Hypothesis

1. There is a significant difference of work productivity between harvesters that have MSD and harvesters that do not have.
2. There is a significant association between risk factors and MSD among harvesters
3. There is a significant association between MSD and work productivity

1.6 Variables

1.6.1 Independent Variable

Risk factors

1.6.2 Dependent Variable

Musculoskeletal Disorders (MSD)

Work productivity

1.7 Variables Definition

1.7.1 Risk factors

Conceptual definition

The factors that contribute to the development of Musculoskeletal Injuries (MSI) are called risk factors. A risk factor is something that may cause or contribute to an injury (Workers' Compensation Board of British Columbia, 2009).

Operational definition

Risk Factors are elements or components of a task that increase the probability of cause or contribution to musculoskeletal disorders. It might not necessary work-related but may come from leisure and daily activities. Example of occupational risk factors that cause or contribute to MSD are jobs requiring repetitive, forceful, or prolonged exertions of the hands; frequent or heavy lifting, pushing, pulling, or carrying of heavy objects; and prolonged awkward postures. Non-occupational activities such as racquet sports, gardening, carpentry, knitting, and playing musical instruments involve risk factors and have also been associated with the cause or contribution to MSD (Minnesota Department of Employee Relations Safety and Industrial Hygiene Unit, 2001).

1.7.2 Body Mass Index

Conceptual definition

BMI is an index that is calculated from a person's weight and height which provides reliable indicator for body fatness (CDC, 2011).

Operational definition

Body Mass Index (BMI) is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in metres (kg/m^2).

Table 1.1 : The International Classification of adult underweight, overweight and obesity according to BMI (WHO, 2000).

BMI (kg/m^2)	Classification
< 18.5	Underweight
18.5 – 24.99	Normal weight
≥ 25	Overweight
25.0 – 29.99	Pre- obese
≥ 30	Obese

1.7.3 MSD Disorders

Conceptual definition

Musculoskeletal disorders (MSD) are disorders of the muscles, nerves, tendons, ligaments, joints, cartilage and spinal discs. MSD do not include disorders caused by slips, trips, falls, motor vehicle accidents, or other similar accidents. (OSHA, 2004)

The musculoskeletal system comprises of bones and joints with their adjacent structures, as well as muscles, tendons and ligaments. “Disorder” refers to any complaint, symptom or disease of the musculoskeletal system. Complaint is an explicit health problem experienced by an individual. (Martimo, 2010)

Operational definition

MSD is identified using the Standardized Nordic Questionnaire (SNQ) by Kuorinka et al. (1987). MSD in this study are defined as reported pain at any of the nine different body parts, consisting neck, shoulder, upper back, elbow, lower back, wrists or hands, hip or thigh, knee and ankles or feet.

1.7.4 Work Productivity

Conceptual Definition

According to neoclassical economic theory, the concept of productivity is based on the production function, where output is a function of capital input, labour input and technology allowing for substitution between different types of inputs. Productivity is a measure of output per unit of input (Organisation for Economic Co-operation and Development, 2001).

Operation Definition

It is defined by five indicators which are the daily harvesting income (Hægeland and Klette, 1999), daily quantity (Shikdar & Das, 2003), efficiency score, presenteeism (Brouwer, Koopmanschap & Rutten, 1999) and absenteeism (Escorpizo et al., 2007)

1.8 Conceptual Framework

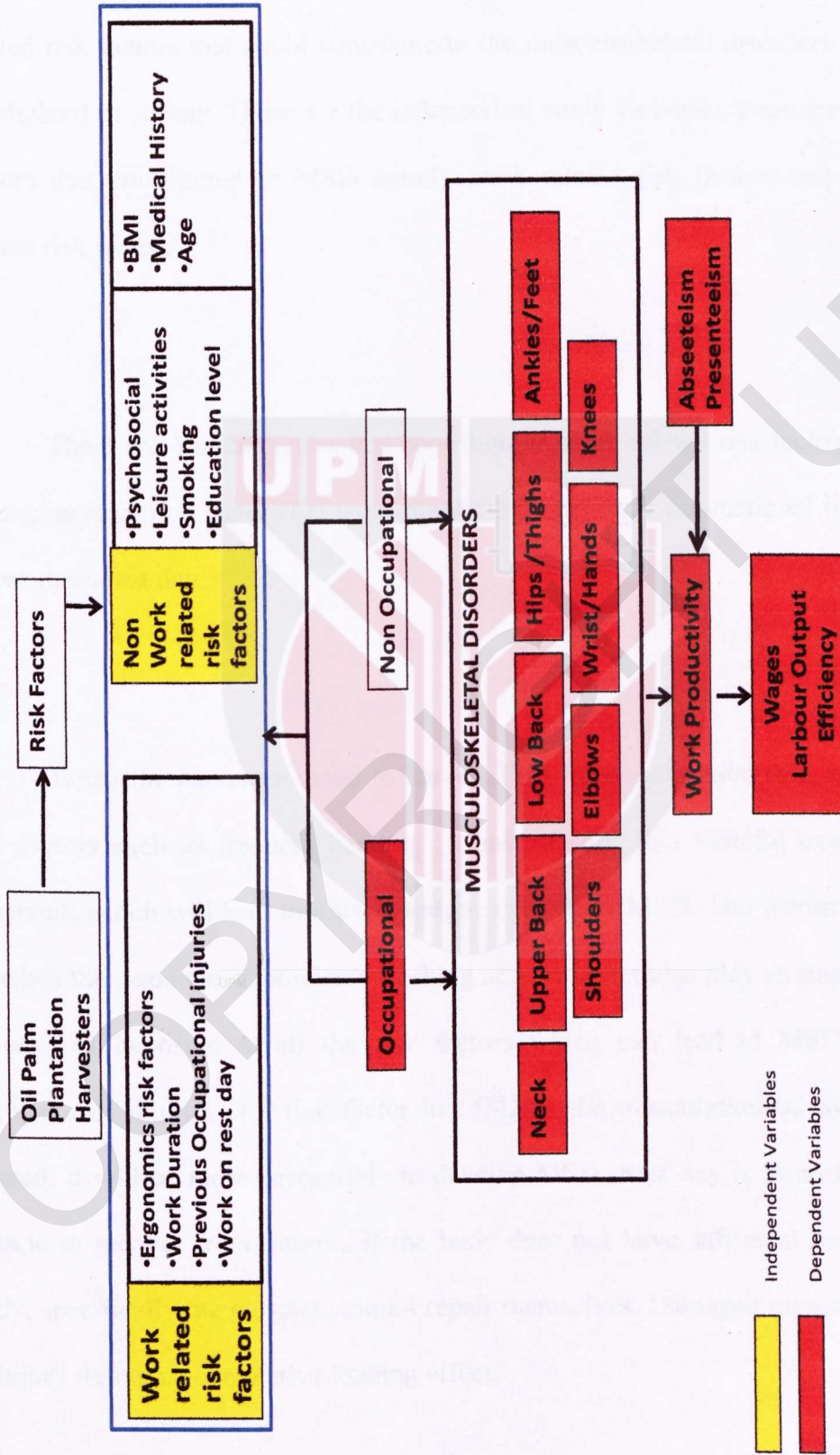


Figure 1.6: Conceptual frameworks of risk factors contributing to MSD and Productivity Variables that is affected by MSD.

This study is focusing on the harvesters that are working in the oil palm plantation. Their job scope exposed them to various ergonomics risk factors and related risk factors that could contribute to the musculoskeletal disorders which are highlighted in yellow. These are the independent study variables, there are two main factors that contributed to MSD mainly work related risk factors and non-work related risk factors.

There are 4 main factors that contribute to work related risk factors. They are (1) ergonomics risk factors (2) work duration (3) previous occupational injuries and (4) work on rest day.

When the harvesters need to harvest FFB from short palm tree, ergonomics risk factors such as frequent bending, trunk twisting and forceful exertion were observed, which will lead to muscle fatigue eventually MSD. The working duration which is the years the respondents working as a harvester also play an important role in term of exposure to all the risk factors which can lead to MSD. Previous occupational injuries is a risk factor to MSD as the musculoskeletal system once injured, it will be more susceptible to develop MSD. Rest day is important for the muscle to recover from fatigue, if the body does not have sufficient rest, then the body, specifically the muscles, cannot repair themselves. Damaged muscles can lead to injury through a cumulative loading effect.

For non-work related risk factors, it includes (1) psychosocial factors, (2) leisure activities, (3) smoking , (4) education level, (5) BMI, (6) medical history and (7) age.

Stressful psychosocial factors can significantly increase the risk for MSD, especially the salary of harvester is based on performance. Strenuous leisure activities such as gardening that might require stooping and bending might increase the risk for MSD. Smoking is a risk factor to MSD too as a lot of studies shows that smoking had significant association with MSD. In general, workers with lower education levels are more likely to be blue collar workers and thus more likely to develop MSD. In addition, workers with higher education might have gained awareness about MSD. For BMI, increase level of obesity can contribute the risk of having MSD. Medical history such as rheumatoid arthritis (inflammation of joint) can mask the condition of musculoskeletal pain that is caused by the work nature of harvesters which is very physically demand. Aging contribute to the MSD as they are likely to become more prevalent as the population ages throughout the world.

The dependent variable will be musculoskeletal disorders. It will be identified according to the various body parts as in the Nordic questionnaire such as neck, shoulder, elbow, wrists or hands, upper back, hips or thighs, ankles or feet, knees and lower back. The work productivity, which could be an outcome due to musculoskeletal disorders, is other dependent variables in this study.

Musculoskeletal disorders will in turn affect the work productivity which will reflect in the daily harvesting income, efficiency, daily quantity, absenteeism and presenteeism.

CHAPTER 2

LITERATURE REVIEW

2.1 The Musculoskeletal System

Human movement is brought by the musculoskeletal system under the control of the nervous system. The musculoskeletal system consists of the skeletal muscles, bones and joints (Figure 2.1). The bones of the skeleton are linked together at joints in a way that allows them to move relative to each other. The skeletal muscles pull on the bones to control the movements of the joint and control the body movement as a whole. Through coordinated activity of the various muscle groups, the forces generated by our muscles are transmitted by our bones and joints to enable us to maintain an upright or partially upright posture, move from one place to another and manipulate objects, often simultaneously. Other than lying down, most of the postures and movements, the muscles need to exert very large forces which in turn result in very large forces in joints.

In response to the forces, the musculoskeletal components experience strain. Under normal circumstances, the musculoskeletal components adapt their size, shape and structure, a process referred to as structural adaptation, to more readily withstand the time-averaged strain of everyday physical activity. However, injury occurred under excessive strain. Capacity for structural adaptation decreases markedly with increase in age after maturity as tissue degenerates and dysfunction in older age.

The skeletal system consists of the skeleton (the bones) and the structures forming the joints between the bones. The skeletal system gives the body its shape and provides a supporting framework for all the other systems. (Watkins, 2010)

2.1.1 Anatomy of the Musculoskeletal System

The musculoskeletal system comprises of skeleton and skeletal muscles account for half of the total body weight. The skeleton consists of 206 bones that are linked by more than 200 joints. There are approximately 640 skeletal muscles to control the movement of the joints and bones enabling the movement of the body. Each complete skeletal muscle consists of a large number of long muscle cells bound together by layers of connective tissue. There are two basic shapes which is the tendon (narrow band) and aponeurosis (broad band). Skeletal muscle contracts to create a pulling force and if necessary, change in length while maintaining the

pulling force. By coordinating activity between various muscle groups, forces generated by the muscles are transmitted by the bones and joints enable a person to maintain upright or partially upright posture and bring voluntary controlled movements. Bones are usually divided into two groups which are the axial and the appendicular skeleton. Adult axial skeleton consists of 80 bones comprising the skull, vertebral column (backbone) and ribs. The adult appendicular skeleton consists of 126 bones that make up the upper limbs (arms and hands) and the lower limbs (legs and feet). The knee joint is designed to rotate in one plane, movements of knee in this plane are referred to as knee flexion and knee extension. However, other joints such as hip and shoulder are designed to move in more than one plane (Watkins, 2010).

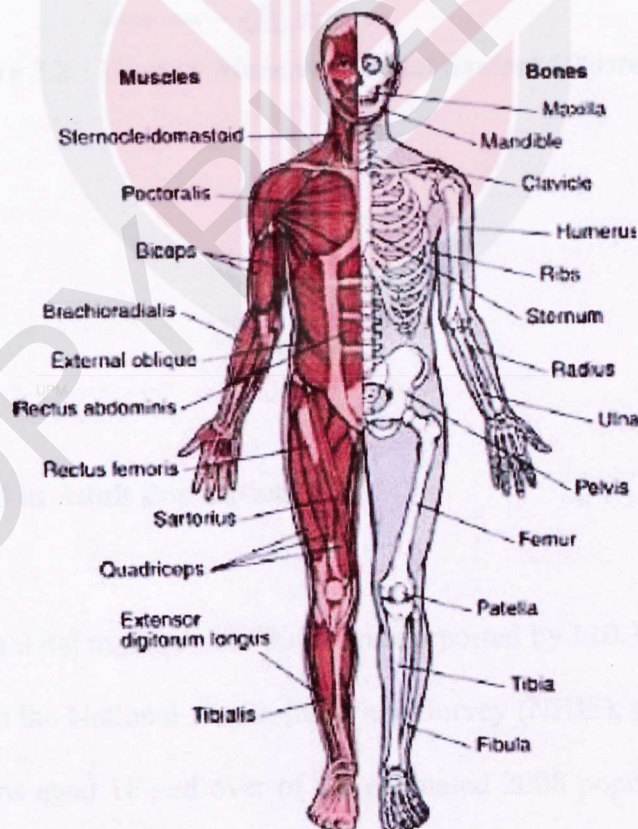


Figure 2.1 : Human Musculoskeletal System (Anterior)

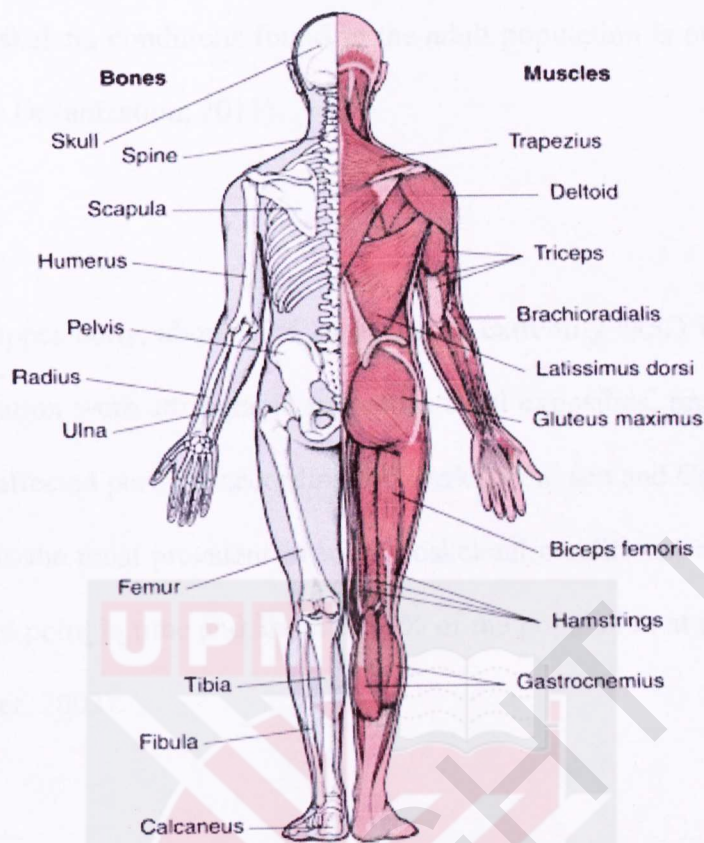


Figure 2.2 : Human Musculoskeletal System (*Posterior*)

2.2 MSD

2.2.1 MSD in Adult Population

Musculoskeletal medical conditions were reported by 110.34 million adults in the U.S. in 2008 in the National Health Interview Survey (NHIS), representing nearly one in two persons aged 18 and over of the estimated 2008 population. The rate of

chronic musculoskeletal conditions found in the adult population is 60% (The Bone and Joint Decade Organization, 2011).

For the upper body, about 40% of all upper extremity MSD in the total US employed population were attributable to occupational exposures, representing over 500,000 people affected per year according to Tanaka, Petersen and Cameron (2001). Low back pain is the most prevalent of musculoskeletal conditions; it affects nearly everyone at some point in time and about 4–33% of the population at any given point (Woolf & Pledger, 2003).

In specific industry setting, such as factory, it was reported by Choobineh et al. (2007) that the vast majority of the workers (73.6%) had suffered from some kind of musculoskeletal symptoms during the past 12 months. Low back pain (50.2%) was the highest prevalence compared other body region. Among nurses, it was reported that 78% of nurses have had MSD once or more in their occupational lives (Tinubu, Mbada, Oyeyemi & Fabunmi, 2010). Among intensive computer workers in a data processing environment, 86% of the workers had reported musculoskeletal pain/discomfort in the previous year (Woods, 2005). The annual prevalence of self-reported musculoskeletal symptoms attributed to work was 63% among office workers (Janwantanakul, Pensri, Jiamjarasrangsi & Sinsongsook, 2008)

2.2.2 MSD in Agriculture and Oil Palm Plantation Industry

According to Eurostat, the highest incidents rate of MSD were found among workers in agriculture, health and social work, transport, storage and communication, construction and agriculture (1.2 to 1.6 times higher than average) (Eurostat, 1999). In agricultural jobs with significant physical labor, MSD are typically the most frequently reported injury. (Kirkhorn, Earle-Richardson & Banks, 2010). In an earlier study, Kirkhorn et al (2006) reported that according to Agricultural Workers' Survey (NAWS) 1999 data, the percentage of musculoskeletal pain or discomfort increases from 11% during the first year of farm work to 19% by the 10th year and was highest in those working in the multiple crop categories. In the review of the ergonomics risk in production agriculture, Kirkhorn et al. (2006) also reported that the most commonly affected body parts are the neck and back, shoulders, wrists, hips, and knees.

According to Meyer et al. (1997), overexertions (or MSD) predominate as the major types of injury in agriculture, with more than 43% of all agricultural injuries falling in this category. The prevalence of low back pain (LBP) in farmers also had been reported to be around 50%, which is higher than other manual laborers (about 37%) (Walker-Bone & Palmer, 2002). Rosecrance et al. (2006) also reported LBP rates among Kansas farmers were 37% with 60% of these individuals seeking medical treatment.

Musculoskeletal injuries, which are cumulative in nature, cost the farming industry in excess of \$167 million, not including lost productivity and human costs to the farmers and farm workers (Chapman & Meyers, 2001). Demers and Rosenstock (1991) also reported that insurance claims in Washington State were 50% higher for agricultural workers than non-agricultural workers.

High prevalence of MSD among the oil palm plantation workers also shown by a study done among harvesters in Indonesia that reported the prevalence of MSD was 71.4% (Hendra & Rahardjo, 2009). Recent study done in Malaysia rubber plantation showed that overall prevalence of MSD was high (85.7%) among rubber workers (Chow et al., 2012). Another local study, focusing on low back pain showed that high prevalence of back pain (82.6%) among oil palm plantation harvesters. A study done in Thailand among rubber tappers showed that high prevalence (52.9%) of low back pain while the prevalence of other MSD among other regions was low (Meksawi et al., 2011).

2.3 Risk factors Contribute to MSD

According to Punnett and Wegman (2004), the risk factors for MSD, based on both experimental science and epidemiologic investigations, include rapid work pace and repetitive motion patterns; insufficient recovery time; heavy lifting and forceful manual exertions; non-neutral body postures (either dynamic or static); mechanical pressure concentrations; segmental or whole-body vibration; local or whole-body exposure to cold.

Non work-related risk factors include daily life, such as sports and housework, may present physical stresses to the musculoskeletal tissues. Risk varies by age, gender, socioeconomic status, and ethnicity. Other suspected risk factors include obesity, smoking, muscle strength and other aspects of work capacity. There are also numerous epidemiologic risk factors such as cigarette smoking, reproductive history, dietary intake and et cetera. (Punnett & Wegman, 2004).

2.3.1 MSD and Age

MSD increases markedly with age, in a nationwide study of Taiwan, age had a significant association with MSD ($p < 0.001$ for chi-square test in both genders), and workers between 45 and 64 year of age had the highest prevalence in both genders. In general, effects of age were similar for different body parts, and the prevalence tended to increase with age as age itself is an important etiology for MSD where it takes time to develop (Guo et al., 2004). Low back pain also becomes more severe around the age of 40, showing different development of nonspecific and radiating LBP. Another study showed that the incidence of major radiating LBP increases with age. (Shiri et al., 2010)

A study done in the oil palm plantation settings showed that workers with the age more than 35 years old or above have 2.56 times higher risk developing MSD compare to workers that are below 35 years old. In United States, there was an age-dependent effect among farm residents where the prevalence was less than 5% before age 30, but greater than 50% after age 65. (Davis & Kotowski, 2007)

2.3.2 MSD and BMI

Other than that, BMI contribute to MSD as there is higher chance of MSD if the person is overweight. Study done by Vieira, Kumar and Narayan (2006) showed that the lifetime rate of low back disorder was 66% (odds ratio of 1.38) for the overweight workers.

2.3.3 MSD and Smoking

A few studies had shown the association between smoking and MSD, in a study that was done among welders and nurses, the lifetime rate of low back disorder was 86% (odds ratio of 2) for the workers that smoked (Vieira et al., 2006). Another study among the occupational motorcyclists in Malaysia showed that smoking status is one of the major factors that significantly associated with higher LBP prevalence (Mohd Hafzi, Rohayu, Noor Faradila & Wong, 2011). In a British national survey, there is an association between smoking and report of regional pain, which is apparent even in ex-smokers, with the highest risk (prevalence ratio up to 1.6) for pain that prevented normal activities in current smokers. (Palmer, Syddall, Cooper & Coggon, 2003). Another national survey in Norway showed that the OR for musculoskeletal pain were 1.69 (95% CI 1.45,1.97) for current smokers, and 1.22 (95% CI 1.02,1.47) for former smokers (Brage & Bjerkedal, 1996). Those who continued to smoke through the follow up period of a prospective study among metal industry

workers had a higher increase in clinical findings 2.5 (1.1 to 5.9) than never smokers (Leino-Arjas, 1998)

2.3.4 MSD and Education

The level of education of an individual can affect one's approach to pain and treatment seeking behaviour. Sometime sufferers might not take the episodes of musculoskeletal pain serious because of ignorance of the possible consequences in form of reduced function and disability. A study done in Norway showed that people having secondary, occupational and elementary school education level are likely to have more widespread pain, 1.61, 1.71 and 1.91 times as compared to people with university level education (Lal, 2008). As reported by Guo et al. (2004), education had a significant association with MSD ($p < 0.001$ for chi square test in both genders). A study that is done among rubber tappers showed that there is a significant association of education with low back pain (Meksawi, 2011)

2.3.5 MSD and Psychosocial Factors

In a study done in Australia among veterinarians, MSD was statistically correlated with a range of psychosocial factors, including stress associated with career structure, time pressures, client's attitude, lack of recognition by the public, lack of recognition by colleagues, lack of understanding from family or partners and work stress because of insufficient holidays each year (Smith, Leggat & Speare, 2009). Job strain had the strongest association with neck pain (OR 3.46, 95% CI 1.30 to 9.21) and wrist/hand pain (Harcombe, McBride, Derrett & Gray, 2009). Another study done among sales people reported that high job demands were related to neck and shoulder symptoms (ORs 1.43-1.47 in the highest exposure groups compared with the lowest), and tendency to become overworked and lack of social support from colleagues were related to back pain (OR 1.81-2.04 in the highest exposure groups compared with the lowest) (Skov, Borg & Orhede, 1996). A cross-sectional studies reported that monotony, time pressure, and worry about mistakes was related to back symptoms established in a physical examination (odds ratio 2.0) (Heliovaara, Makela, Knekt, Impivaara & Aromaa, 1991)

2.3.6 MSD and Leisure Activities

A physically active lifestyle both at work and at leisure was associated with fewer musculoskeletal disorders among personnel in the Royal Norwegian (Navy Morken, Magerøy & Moen 2007). There is no association between participation in sports or other physical activities in leisure time and musculoskeletal symptoms, however, sedentary activity in leisure time was associated with higher prevalence rates of low back symptoms and sick leave due to low back symptoms (Hildebrandt, Bongers, Dul, van Dijk & Kemper, 2000). Vieira, Kumar and Narayan (2006) reported that the lifetime rate of low back disorder was 86% (odds ratio of 2) for the workers that did not exercise.

2.3.7 MSD and Arthritis

According to a study done by Roquelaure (2009), Upper limb inflammatory arthritis was significantly associated with Upper extremities MSD (OR=2.4, 95% CI=1.5 – 4.1, $p<0.001$).

2.3.8 MSD and Accident history

A local study done among local motorcyclist had reported that past accident was significantly associated (OR= 1.951, $p= 0.006$) with higher LBP prevalence in motorcyclists. Another study in a factory setting also showed that MSD risk increased with past injury history (OR: 3.04; 95% CI: 2.14–4.32) (Yu et al., 2012). Study in Korea reported the significant association between MSD and prior injury according to body region, whereby those who experienced prior acute injuries were more likely to have MSD in the same region as of the injury (for upper extremities, OR= 2.19, 95% CI =1.51-3.16; for the lower extremities, OR=4.2, 95% CI= 2.33-7.57; for the back, OR= 7.35, 95% CI= 4.01-13.48) (Choi, Kang, Kim & Han, 2009)

2.3.9 MSD and Work Duration

For work duration, workers that have been working more than 4 years have 2.755 higher risk compared to workers with the working duration of ≤ 4 years according to Hendra and Rahardjo (2009). Another study among nurses also showed that nurses with > 20 years of clinical experience are about 4 times more likely to develop MSD (OR=3.81; CI= 1.08-13.4) than those with 11-20 years experience (Tinubu et al., 2010)

2.3.10 MSD and Overtime on Rest Day

The MSD risk increased with those with over 55 hours work hours per week (OR=3.04, 95 CI: 1.28-1.90) , according to a recent study done by Yu et al. (2012). Working "long hours" (>12 hours/day, >40 hours/week) and "off hours" (weekends and "other than day shifts") were associated with a 50-170% increase in the age-adjusted odds ratio for musculoskeletal disorders in three body sites (Lipscomb, Trinkoff, Geiger-Brown & Brady, 2002).

2.3.11 MSD and Ergonomics Risk Factors

Some other studies that put more focus on low back pain had reported that activities characterized by an awkward posture, by the same posture for a long time, or by often bending and rotating the trunk increased the risk for low back pain (Picavet & Schouten, 2000). Some specific physical activities such as lifting , twisting , lifting while twisting, pulling, pushing, carrying and lowering, bending and bent or twisted posture are the well known risk indicator for LBP according to Liira, Dhannon, Chambers and Haines (1996). Other risk factors include repetitive upper extremity motion patterns; forceful exertions, whether manual only or whole-body (e.g. heavy lifting); non-neutral body postures; and vibration. The risk is especially pronounced when a job includes exposure to a combination of two or more of these risk factors. (National Research Council, 2001).

In other studies, Wolfe et al.(1996) and Guo (2002) had described the effects of trunk movement on the lower back. Repetitive trunk motion affected the pattern of trunk muscle coactivity that appeared to be the driving force behind diminished strength and functional capability as well as increased spine structural loading that included both compression and shear force. A study done in the rubber plantation setting reported that the high frequency of weight lifting (lifting any object more than 8 kg per time) was a co-factor affecting low back pain for rubber tappers (Meksawi et al., 2011).

There are three main ergonomics risk factors for MSD that are of utmost priority in agriculture These include: lifting and carrying heavy loads (over 50 lb); sustained or repeated full body bending (stoop); and very highly repetitive hand work (clipping, cutting) as reported by Fathallah (2010).

In a study conducted among rubber tappers in Thailand, Meksawi (2011) stated that MSD among rubber tappers may relate to possible ergonomic problems from working such as an awkward work posture and highly repetitive work. The work task often involves rubber tappers being in ergonomically awkward activities, such as the repetitive tapping movement which is often repeated hundreds of times per day in awkward postures of the upper limbs, neck, trunk, and legs. These ergonomic problems may be a cause of MSD in rubber tappers.

A major consideration in preventing MSD is adequate time for the affected body part to recover from physical forces and equipment that is not adequately designed to lessen the impact of force, awkward work postures, and pressure points. Body parts most commonly affected are the neck and back, shoulders, wrists, hips, and knees. (Fathallah, Miller & Miles, 2008)

2.4 MSD and Work Productivity

Chronic conditions such as depression/anxiety, obesity, arthritis, and back/neck pain are especially important causes of productivity loss as reported by Loeppke et al. (2009). Brouwer et al. (1999) reported that, on an average day, 7% of the workers in a trade company experienced health problems while being at work, with an estimated productivity loss of 13% per worker with health problems. Lerner's study found that there was a 4% to 5% decrease in work productivity for every 10% increase in limitations while at work. (Lerner et al., 2003)

Among computer users, 8% reported reduced productivity due to musculoskeletal symptoms; the mean productivity loss was 15% for women and 13% for men (Hagberg, Tornqvist & Toomingas, 2002).

Another study among construction and industrial workers by Meerding et al. (2005) showed that among workers with musculoskeletal problems, the average productivity loss amounted to 7% for industrial workers and 25% for construction workers.

The initial musculoskeletal disorder caused 75% of the productivity loss shortly after return to work and 60% at the follow-up. Worse physical health, more functional disability, and poorer relations with the supervisor were associated with productivity loss shortly after return to work. (Freek, Willem-Jan & Alex, 2005.)

In France, MSD have lead to seven million workdays lost, about 710 million EUR of enterprises contributions in 2006 (Schneider& Irastorza, 2010). In a study done using self-administered questionnaire, after sickness absence from musculoskeletal disorder, reduced productivity was prevalent for 60% of the workers after they returned to work, and for 40% still at the 12-month follow-up (Lötters, Meerding & Burdorf ,2005)

2.4.1 Absenteeism as Indicator for Productivity

Most productivity studies measure the amount of work loss incurred by employees in the form of absenteeism and presenteeism. Absenteeism usually can be determined by asking those in supervisory roles to report absent days or by asking employees to self-report days absent (Mattke, Balakrishnan, Bergamo & Newberry, 2007). Absenteeism was measured as a continuous variable in terms of total days lost (a sum of whole days and portion of days) in the past 30 days and as a binary variable describing whether a person has missed any work in the past 30 days (Huang, 2008).

2.4.2 Presenteeism as Indicator for Productivity

Health disorders do not cause merely absence from work, but also decreased on-the-job performance while at work, which is called “sickness presenteeism” (Martimo, 2010). Although workers are present at work, their productivity could be reduced due to functional limitations. It had been suggested that extent of productivity loss while present at work accounts for the majority of lost productivity costs associated with chronic pain (Stewart, Ricci, Chee, Morganstein & Lipton, 2003; Van Leeuwen, Blyth, March, Nicholas & Cousins, 2006). Another study done on presenteeism showed that 63–83 % of employees reported having worked despite illness on at least one occasion during the previous year (Bergström et al., 2009). In

addition, blue-collar workers were reported to have a higher presenteeism than white-collar workers. (Aronsson, Gustafsson & Dallner, 2000).

2.4.3 Efficiency as Indicator for Productivity

DeRango, Benjamin, Michelle, Ted and Moore (2003) reported that the efficiency of tax collections was identified as source for overall productivity gain. Efficiency score was one of indicator to measure productivity in the adapted Osterhaus method in the quantity and quality questionnaire (Brouwer et al., 1999).

2.4.4 Quantity as Indicator for Productivity

In a study done by Shikdar and Das (2003), productivity was defined as the quantity of amount of output which is the quantity of fish that is trimmed and sorted measured in kg. Productivity also measured with quantity which is defined as the size of street or floor surface made that day (square meters) among floor layers (Meerding et al., 2005).

2.4.5 Wages as Indicator for Productivity

Hægeland and Klette (1999) reported that higher wages generally reflect higher productivity. According to the study of variations in productivity over the life span, the findings suggest that the trend in wage growth is similar to the trend in productivity growth for young employees. (Skirbekk, 2002). In a study which is a review of the labor market of three countries, consist of India, Philippines and Pakistan, it was discussed that harvest piece-rate productivity is a good predictor of productivity. The finding of the study revealed that the worker from the group with the higher average productivity will have a higher wage. (Foster & Rosenzweig, 1993).

The relationship between wages and productivity is tested by Biesebroeck (2003) whereby equality between wages and productivity holds strongly for the study in Zimbabwe.

A study was done on wages, productivity and aging and it was found out that the hypothesis are equal to productivity could not be rejected whereby the wages do not deviate significantly from productivity estimates (Dostie, 2006). Reville et al. (2002) reported that workers with musculoskeletal injuries for the upper extremity had a sharp drop-off in wages of 10.6% loss relative to control workers.

CHAPTER 3

METHODOLOGY

3.1 Study Design

The cross sectional study was done with questionnaires, observation and video-based analysis of the working postures using the Rapid Entire Body Assessment (REBA) method and secondary data from the oil palm plantation management.

3.2 Study Location

The study was conducted at four oil palm plantations, which were situated at Kota Tinggi , Johor.

3.3 Sampling

3.3.1 Sampling Population

The sampling population is the workers in the 4 oil palm plantation located in Kota Tinggi, Johor.

3.3.2 Study Sample

The study sample is consisting of harvesters in the entire 4 oil palm plantations.

3.3.3 Sampling Frame

The study sample was based on the name list of harvesters working in the entire 4 oil palm plantations which were obtained from the management.

3.3.4 Sampling Unit

The sampling unit is the harvesters that was selected based on the inclusive criteria and exclusion criteria.

Inclusive criteria:

1. Permanent or contract staffs
2. Malaysia or Foreigners
3. Working experience of more than 1 month as harvester

Exclusive Criteria:

1. Above 60 years old

3.3.5 Sampling Size

The sample size was calculated using formula (Danial., 1999) which is :

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

Where; n = sample size

Z = statistic for a level of confidence

P = expected prevalence or propotion

d = precision (in proportion of one; d= 0.05)

For the level of confidence, it is set to 95 %, which is the 1.96 for the conventional Z value with 95 % confidence intervals (CI). P is the prevalence value and the sample size varies depending on the value of P. Based on Hendra and

Rahardjo (2009), the prevalence of MSD complaint among harvesters was 71.4%. Therefore, by computing the prevalence (0.714) , the sample size was calculated as below:

$$\begin{aligned}n &= (1.96)^2(0.714)(1-0.714) / (0.05)^2 \\&= 313.78 \\&\approx 314\end{aligned}$$

As minimum sample needed is 314, additional 10 % was added the minimum sample size to overcome the problem of low response rate. A total of 345 respondents is the minimum sample size requirement in this study.

3.3.6 Sampling Method

Purposive sampling was used to select respondents from the name list (provided by the management) that fulfill the inclusion and exclusion criteria.

3.3.7 Study Methodology

3.3.7.1 Questionnaire

Questionnaire was conducted by interview, before the interview starts, consent was obtained from the harvesters and signature was asked as the evidence of approval. The interview was held after work, this is to ensure that the interview do not disrupt their routine work activities. Respondents was briefed about the study, purpose of the study, type of assessment carried out and the confidentiality of the data.

Section A – Socio Demographic Questionnaire

Questionnaire section A asked for general information such as personal details and demography background, ethnicity, age and education level.

Section B - Working Information

Section B asked about working information such as the previous jobs, type of the job and the duration. It also asked about the body part that injured because of the previous job, whether receive treatment for the accidents and current job information.

Section C - Lifestyle Information

Information about lifestyle such as smoking and leisure activity was asked.

Section D - Medical Information

Information about diagnosed disease and prescribed medicine information is being asked. There is also questionnaire to ask about general health which is the general health questionnaire (GHQ).

The General Health Questionnaire (GHQ) is widely used internationally and locally to measure mental health status especially in detection of emotional disorders such as distress. GHQ has four versions based on the number of items; GHQ-60, GHQ-30, GHQ-28 and the shortest version GHQ-12. The enclosed questionnaire is the shortest version which is GHQ 12, the shortened version work was found to be as reliable as the long version in detecting distress (Goldberg et al., 1997).

GHQ is a score based questionnaire. The minimum GHQ-12 total score was 0 and the maximum GHQ-12 total score was 12. The questionnaire was translated to Malay language by Bahri Yusoff et al. (2009), whereby the items were subjected to jury technique in order to establish the content validity of the Malay version GHQ-12. The Malay version of the questionnaire was validated.

The items of the GHQ-12 were rated under 4 categories of responses; *tiada langsung* (not at all) , *tidak lebih dari biasa* (no more than usual), *lebih dari biasa* (more than usual), *sangat lebih dari biasa* (much more than usual) for statements: 1, 2, 7, 10, 11 and 12 as shown in Table 2, whereas, for the rest of the statements the responses were *lebih dari biasa* (more than usual), *tidak lebih dari biasa* (no more than usual), *kurang dari biasa* (less than usual) and *sangat kurang dari biasa* (much less than usual). The scoring method was a binary scoring method whereby the two least symptomatic answers score 0 and the two most symptomatic answers score 1 – i.e. 0-0-1-1. Caseness threshold had been defined to the score of 3.

Section E - Modified “Standardized Nordic Questionnaire”

The prevalence of musculoskeletal disorders was determined with the standard Nordic questionnaire, which had been proven to be a valid instrument to collect information on the nature, duration (days), and frequency (occurrences per month) of symptoms.

The Nordic questionnaire (Kuorinka et al., 1987), is used to detect the nine body parts of the workers that experience

1. Pain during the past 12 months
2. Pain during the past 7 days
3. Pain due to working factors
4. Pain had preventing from doing normal activities

This questionnaire was used record reported pain at any of the nine different body parts, consisting neck, shoulder, upper back, elbow, lower back, wrists or hands, hip or thigh, knee and ankles or feet.

3.3.7.2 Rapid Entire Body Assessment (REBA)

REBA is an observational postural analysis tool for whole body activities developed by Hignett and Mcatamney (2000) giving a musculoskeletal risk action level for whole body activities (static and dynamics). Ergonomics risk factor through posture analysis was identified with REBA. This method is based on the worker's body observation and scoring of body postures warranting quick assessment of the postures of the neck, trunk, legs and upper limbs along with muscle function and the external loads experienced by the body.

Analysis was based on a worst posture selected over a 20 minutes video of their working activities for every respondent. The result of the REBA is the REBA score and the ergonomics risk level classification was based on the score (table 3.1). REBA decision scale ranged from 0 to 5, higher REBA score indicate higher ergonomics risk. Intra-tester reliability was done with the cronbach alpha value of 0.836. Figure 3.1 shows the entire REBA scoring procedures.

Table 3.1: Degree of the risk is determined from the REBA Decision scale

Action Levels	Scoring	Risk Level	Action (Including Further Assessment)
0	REBAScore =1	Negligible	Not necessary
1	REBA Score = 2-3	Low	Change may be necessary
2	REBA Score = 4-7	Medium	Further investigation, change is necessary
3	REBA Score = 8-10	High	Investigate, necessary implement change soon
4	REBA Score = 11-15	Very High	Necessary implement change now

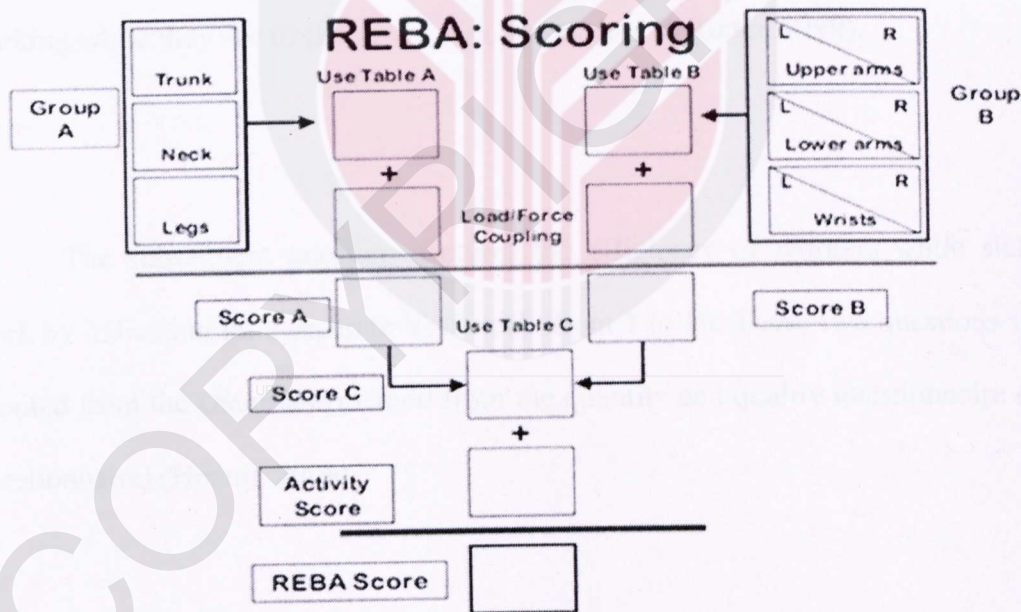


Figure 3.1: REBA procedures

Source: Hignett and Mcatamney, 2000

Productivity in this study is defined as absenteeism, presenteeism, daily harvesting income, efficiency score and daily quantity. Data of presenteeism (days of sick at work) of the past week, absenteeism of the past month and efficiency score were obtained with the questionnaire.

For absenteeism, respondents were asked for information such as their absenteeism during the past 30 days (Mattke et al., 2007). For presenteeism, the question asked whether in the past 7 day the harvesters were sick at work, meaning having MSD but yet go for work. Presenteeism is defined by the Osterhaus method in the quantity and quality questionnaire whereby it is use to detect the days workers working while they are ill (Brouwer, Koopmanschap & Rutten,1999).

The subsequent question captures the efficiency of workers while sick at work by indicating on a separate VAS scale from 1 to 10. These two questions were adopted from the Osterhaus method from the quantity and quality questionnaire (QQ questionnaire) (Huang, 2008).

3.3.7.3 Secondary Data

Secondary data is obtained for the daily quantity harvested and daily harvesting income. Several studies showed that wages (Haegelang & Klette, 1999 ; Skirbekk, 2002; Foster & Rosenzweig, 1993; Biesebroeck,2003; Dostie,2006; Reville at al.,2006) and daily quantity (Shikdar and Das (2003) are used as an indicator to reflect productivity

The data for quantity was obtained from the receipt issued by the oil palm plantation to the harvesters. The quantity for one month (based on the daily receipt) was summed up and averaged to daily quantity based on the days that the harvesters was working in that month.

Data for the income was obtained from the management whereby the information about the income gained per worker from cutting the fresh fruit bunch are stated in the pay sheet. The wages of harvesters are commission based, depending how much fruit they harvested. The data of income was averaged to daily income based on the day they worked

Due to the average weight of the fresh fruit bunch varies between plantations, the categorizing process of productivity for daily quantity was done manually according to the mean value of quantity for each plantation. The data was sorted according to plantation, the daily quantity of the harvester was compared against the mean value according to each plantation respectively and the respondents were grouped into 2 groups (table 3.1), one with productivity and another without productivity loss.

3.3.7.3.1 Calculation related to Productivity

Respondents was categorized into group with productivity loss and without based on the 5 productivity indicators (absenteeism, presenteeism, daily harvesting income, daily quantity and efficiency score), meaning the respondents were categorized for 5 times, according to each of the indicators.

In this study, the median or mean score of productivity indicators was used as cut-off point to dichotomize workers into group with productivity loss and group without productivity loss for the indicators of harvesting income, daily quantity and efficiency score. Based on Alavinia et al., 2008, the decision of categorizing the workers is expressed as:

Productivity loss = $x < \text{mean value}$

No productivity loss = $x \geq \text{mean value}$

Workers that had absenteeism and presenteeism were categorized as having productivity loss.

The categorization decision was summarized as :

Table 3.2: Categorization of Group with Productivity Loss and without Productivity Loss

Productivity Indicators	Group with Productivity Loss	Group without productivity loss
Absenteeism	Absent from work due to MSD during the past 30 days	Did not absent from work due to MSD during the past 30 days
Presenteeism	Sick at work (one day or more) during the past 7 days	Was not sick at work at all during the past 7 days
Daily Quantity	Daily quantity $< \text{mean value}$	Daily quantity $\geq \text{mean value}$
Daily Harvesting Income	Daily harvesting income $< \text{mean value}$	Daily harvesting income $\geq \text{mean value}$
Efficiency Score	Efficiency score $< \text{median value}$	Efficiency score $\geq \text{median value}$

Mean value of group with productivity loss was compared with the mean value of group without productivity loss to determine the mean reduction of productivity. Mean reduction percentage of productivity loss (Meerding et al., 2005) is expressed as:

Mean/median Reduction of Productivity loss

$$= \frac{y - x}{y} \times 100$$

y = Mean/median (Group without Productivity Loss)

x = Mean/median (Group with Productivity loss)

3.4 Quality Control

3.4.1 Pre Test of Questionnaire

Standardized Nordic Questionnaire that had been translated to Bahasa Indonesia was pre-tested on 10 % of the estimated sample size, which are 35 persons. A Cronbach's alpha value of 0.75 and above shows good reliability value. The questionnaire had been tested on the harvesters in Felda Sungai Tinggi , Kuala Kubu Baru. The pre-test respondents were asked for comments and feedback for the improvement of the questionnaire especially about the understanding of the questions that being asked. Pre-test was done on 35 workers with the cronbach value of 0.92.

3.4.2 Validity of questionnaire

The questionnaire was conducted by face to face interview. This is because a lot of the workers are foreigners and illiterate, so face to face interview is the best option as body language might be needed to ease explanation. The questionnaire was in Indonesian language. An Indonesian student had been engaged to translate the questionnaire and the questionnaire had got the cronbach alpha value of 0.92 for the reliability test. The intra-reliability test of the REBA was done with the cronbach alpha value of 0.836.

3.5 Data Analysis

The data collected was analysed with SPSS (Statistical Package for Social Sciences) version 15 with the P value determined at $p < 0.05$. The respected types of statistical test was based on the objectives of the study as tabulated as below.

Table 3.3: Data analysis using respective statistical tests

Objectives	Statistical Test
1. To determine the prevalence of MSD among harvesters	Exploratory
2. To determine the work productivity among harvesters	Exploratory
3. To compare the productivity among harvesters with MSD and harvesters without MSD	Mann-Whitney Test
4. To determine the association of risk factors with MSD	Chi-square Logistic regression
5. To determine the association of MSD with work productivity.	Chi-square Logistic regression

Logistic Regression was used to adjust for confounders which are BMI, age and smoking.

3.6 Study Ethics

The study was approved by the Ethics Committee of the Faculty of Medicine and Health Sciences, University Putra of Malaysia with the reference number of UPM/FPSK/PADS/T7-MJKEtikaPer/F01(JKK(U)_Dis(11)36). All the respondents was given briefing about the basic information of the research such as how the information was used. Before data collection start, a consent form must be signed by the respondent to prove that they are willing to participate in the study. All the information obtained from the study will remain confidential.

3.7 Study Limitation

This is only a cross sectional study design whereby it just gives a snapshot of the problems and situation. All the variables may changes as time passes. Respondents may have recall bias regarding the information such as history of accident. Furthermore, the ergonomics risk factor which is caused by the load of the fresh fruit bunch varies according to the age of the oil palm tree. This is because

younger oil palm tree produced fresh fruit bunches that are smaller in size. Older oil palm tree can produced heavier fruit bunch.

The study did not get all the respondents as the calculated sample size because respondents need to fulfill the inclusive and exclusive criteria to involve in this study. Another reason of not meeting the require sample size is because of the time limitation and budget constraint.



CHAPTER 4

RESULT

4.1 Demographic Data

In this study, there are 143 respondents, whereby all of them are harvesters in 4 oil palm plantations. Age distribution is showed in table 4.1. Age range was wide, from 18 to 55 years, with mean value of 28.30. Most of the respondents are in the age range of 19 to 29. Compared to 3.5% local respondents which are from Malaysia, 96.5 % of the respondents are from Indonesia. More than half of the respondents are married, which is 62.9%.

For the number of household members, most of them have 1 to 5 household members, which is 78.3%. Education level among respondents is generally low, mostly in lower secondary school, 49%.

The BMI range of the respondents were as follows: underweight (6.3%), normal weight (86%) and pre-obese (7.7%). For the harvesting income, most of the harvesters have low pay from cutting the fresh fruit bunch (FFB). Majority of them are paid below RM 700 per month for harvesting alone, exclusive of other incentive and allowance which may differs from company to company, depending on the management.

Table 4.1: Socio demography of the respondents

Variables	No.	%	Mean $\pm$ S.D	Median (IQR)	Range
Age (Years)			28.30 $\pm$ 7.24	26.00 (9)	19-55
19-29	92	64.3			
30-39	34	23.8			
40-49	15	10.5			
≥ 50	2	1.4			
Total	143	100.0			
Nationality					
Malaysian	5	3.5			
Others	138	96.5			
Total	143	100.0			
Ethnicity					
Malay	5	3.5			
Others	138	96.5			
Total	143	100.0			
Marital Status					
Single	53	37.1			
Married	90	62.9			
Total	143	100.0			

Table 4.1: Socio demography of the respondents (continue)

Variables	No.	%	Mean $\pm$ S.D	Median (IQR)	Range
No. of Household Members			3.80 $\pm$ 2.39	3(3)	0-17
0	7	4.9			
1-5	112	78.3			
6-10	21	14.7			
>10	3	2.1			
Total	143	100			
Education					
None	15	10.5			
Primary School	39	27.3			
Lower Secondary School	49	34.3			
Upper Secondary School	40	28.0			
Total	143	100.0			
BMI					
< 18.5 (underweight)	9	6.3			
18.5 – 24.9 (normal Range)	123	86.0			
25 – 29.9 (Pre-obese)	11	7.7			
$\geq$ 30 (obese)	0	0			
Total	143	100.0			
*Harvesting Income (RM)			525.47 $\pm$ 164.38		288.79 - 956.64
<RM 400.00	24	27.6			
RM400.00- RM700.00	49	56.3			
>RM700	14	16.1			
Total	87	100			

N =143

*Harvesting Income(RM), N =143, 56 respondents had missing data.

Based on table 4.2, 60.1% of the respondents have working experience, and among that, 70.5% work as harvester for the previous job also. Most of them work for one to three years for the previous job (54.5%) and have no history of accident or injuries (53.4%). For those who had history of injury, usually it is the feet injury (18.2%) caused by the thorn of the oil palm tree in their previous job as a harvester.

As for current working information, 65% of them already working as harvester for 1 to 5 years. 49% had not worked more than one year and only 0.7% worked more than 5 years. The harvesters usually will work on their rest day (93.7%), meaning working on Sunday.

Most of the respondents worked as long as 5 to 8 hours a day (93.7%) although the job itself is quite strenuous. 80.4% of the harvester took short break which are mostly half an hour to 1 hour. Mean value for working hour per day is 6.6 hours and for break time is 0.5 hour. 97.2% of the harvesters do not do part time.

Table 4.2 : Working Information

Working Experience	Frequency (N)	Percentage (%)	Mean ± S.D	Median (IQR)	Range
Have working experience	88	60.1			
No working experience	55	39.9			
Total	143	100.0			
Working History					
Construction Worker	4	4.5			
Cleaner	1	1.1			
Factory Worker	4	4.5			
Farmer	2	2.3			
Fisherman	1	1.1			
Harvester	62	70.5			
Labour	2	2.3			
Loaders	6	6.8			
Nursery Workers	1	1.1			
Pesticide Sprayers	5	5.7			
Total	88	100			
Duration of Previous Employment (Years)					
< 1	16	18.2	2.09 ± 0.67		
1-3	48	54.5			
>3	24	27.3			
Total	88	100.0			
History of Accident or Injuries					
No history of accident	47	53.4			
Have history of accident	41	46.6			
Total	88	100			
History of Accident according to Body Part					
Head Injury	8	9.1			
Neck Injury	2	2.3			
Shoulder Injury	1	1.1			
Hand Injury	15	17.0			
Finger Injury	13	14.8			

Table 4.2 : Working Information (continue)

History of Accident according to Body Part	Frequency (N)	Percentage (%)	Mean ± S.D	Median (IQR)	Range
Elbow Injury	2	2.3			
Upper back Injury	4	4.5			
Lower Back Injury	3	3.4			
Thigh Injury	4	4.5			
Knee Injury	6	6.8			
Feet Injury	16	18.2			
Duration of Current Work					
<1 year	49	34.3			
1-5 year	93	65			
>5 year	1	0.7			
Total	143	100			
Work on rest day					
Yes	134	93.7			
No	9	6.3			
Total	143	100			
Working duration					
<5 hours	9	6.3	6.6 ± 1.23		3-11
5hours -8hours	134	93.7			
Total	143	100			
Rest time					
			0.72± 0.43	0.5 (0.5)	0-2.5
< ½ hour	18	12.6			
½ hour -1hour	115	80.4			
>1 hour	10	7			
Total	143	100			
Part time					
Do part time	4	2.8			
Do not do part time	139	97.2			
Total	143	100			

N=143

Referring to table 4.3, which is about the lifestyle information of the respondents, 98.4 % are smokers at the current. During their leisure time, usually they will cook (92.3%), followed by doing household chore (82.5%) and sports (52.4%). Only a small number of them injured from doing the leisure activities (18.9%) but mostly did not injure (81.1%).

Table 4.3 : Lifestyle Information

Smoking	Frequency (N)	Percentage (%)
Smokers	125	87.4
Non smokers	18	12.6
Total	143	100
Still Smoking	123	98.4
Stop Smoking	2	1.6
Total	125	100
Leisure activities		
Hunting	1	0.7
Gardening	19	13.3
Cooking	132	92.3
House hold chore	118	82.5
Fishing	36	25.2
Karaoke	7	4.9
Sports	75	52.4
Injured from leisure activities		
Injury	27	18.9
No Injury	116	81.1
Total	143	100

N=153

Table 4.4 showed that the existing medical condition of the respondents mainly is asthma, which is 14% of the respondents. 89.5% of the respondents do not have psychosocial risk factors.

Table 4.4: Medical Information

Medical condition	Frequency (N)	Percentage (%)
Heart Disease	1	0.7
Hypertension	0	0
Diabetes	0	0
Asthma	20	14
Rheumatoid Arthritis	18	12.6
Psychosocial Risk Factor		
Have (GHQ score ≥ 3)	15	10.5
Do not have	128	89.5
Total	143	100

N=143

4.2 Musculoskeletal Disorders (MSD)

From table 4.5, there is a high number of respondents which is 93% that had MSD in the past 12 months and most of them experience the pain at their lower back (58.0%) , followed by knee (45.5%) , shoulder (32.9%), neck (32.2%), upper back (28.0%), arms or hands (26.6%), feet (25.2%), thigh (21.0%) and elbow (20.3%).

A total of 43.4 % of the respondents had MSD in the past 7 days, most of the respondents experienced the pain at their lower back (24.5 %), followed by knee (14.0 %), neck (11.2 %), shoulder (9.8 %), upper back (9.8 %), elbow (6.3 %), arms or hands (6.3 %), thigh (5.6 %) and feet (14.0 %).

As for the REBA (Rapid Entire Body Assessment) postural analysis, it is found out that most of the respondents were in the risky category, as 62.4% is in the high risk category.

Table 4.5: Prevalence of Musculoskeletal Disorders

Total MSD (Past 12 Months)	Frequency (N)	Percentage (%)
Have MSD	133	93.0
Do not have MSD	10	7.0
Total	143	100.0
Had trouble (ache,pain, discomfort) at any time during the last 12 months)		
Body parts	No.	%
Neck	46	32.2
Shoulder	47	32.9
Elbow	29	20.3
Arms / Hand	38	26.6
Upper back	40	28.0
Lower back	83	58.0
Thigh	30	21.0
Knee	65	45.5
Feet	36	25.2
Total MSD (Past 7 days)		
Have MSD	62	43.4
Do not have MSD	81	56.6
Total	143	100
Had trouble (ache,pain, discomfort) at any time during the last 7 days)		
Body parts		
Neck	16	11.2
Shoulder	14	9.8
Elbow	9	6.3
Arms / Hand	9	6.3
Upper back	14	9.8
Lower back	35	24.5
Thigh	8	5.6
Knee	19	14.0
Feet	6	4.9
*REBA Score		
Medium risk (4-7)	1	0.9
High Risk (8-10)	73	62.4
Very High Risk (11+)	43	36.8
Total	117	100.0

N=143

*REBA score, N =143, 26 respondents had missing data.

4.3 Work Productivity

Work productivity in this study is defined according to 5 indicators, which are daily harvesting income, daily quantity, efficiency score, absenteeism and presenteeism (Table 4.6). To interpret these indicators, a cut-off point which based on the mean or median value, depending on the data of the indicator, is used to dichotomize workers into having productivity loss and no productivity loss. Based on the daily harvesting income, the mean value is RM 18.09. Harvesting income that is lower than the mean value considered as not productive, the result showed that 47.1% is having productivity loss and 52.9% do not have productivity loss.

For the daily quantity of each respondents, it is dichotomized with the mean value of the respective plantation as different plantation have mean value. This is due to the fresh fruit bunch in different plantations have different weight depending on the age of the oil palm tree, the older the tree, the heavier the fruit is. Based on the data of the daily quantity (tonnes), most of the respondents are productive, which is 50.3%.

The rate of absenteeism is not high as there is only 16.8% of the respondents took sick leave from the past 30 days. However, in contrast, there is a high rate of presenteeism, whereby 61.5% admitted that they were sick at work due to MSD for

the past week. Respondents who had presenteeism mostly were still efficient although they are sick at work, which was 53.4%.

Table 4.6: Work productivity among harvesters

Variables	No.	%	Mean ± S.D	Median (IQR)	Range
Daily Harvesting Income			18.09 ± 5.89		9.63-35.43
Productive	46	47.1			
Not productive	41	52.9			
Total	87	100			
Daily Quantity			16.35 ± 12.54	8.43	2.79-42.70
Productive	59	41.3			
Not productive	84	58.7			
Total	143	100			
Absenteeism (past 30 days)					
Took sick leave	24	16.8			
Did not take sick leave	119	83.2			
Total	143	100			
Presenteeism (past week)					
Had presenteeism	88	61.5			
Did not have presenteeism	55	38.5			
Total	143	100			
Efficiency score			7.9 ± 2.092	8 (3)	1-10
Efficient	47	53.4			
Not efficient	41	46.6			
Total	88	100			

N=143

*Daily Harvesting Income, N =143, 56 respondents had missing data.

4.4 Compare the productivity among harvesters that had MSD and harvesters that do not have MSD.

Table 4.7 shows the 5 indicators of the productivity in this study which are harvesting income, efficiency while sick at work, daily quantity, presenteeism and absenteeism. The table showed harvesters with MSD have lower mean value, which is lower productivity for the category of daily quantity and efficiency. Group that have MSD produce an average of 14.91 tonnes daily compared to an average of 17.45 tonnes of harvesters without MSD. Group that have MSD have lower mean value for efficiency score which is 8.00 compared to 9.00 by harvesters that are without MSD.

Other categories such as presenteeism, have higher mean value, whereby harvesters with MSD generally have more days of sick at work, which is 2 days compared to one day for the harvesters that without MSD. there is no difference to the days of absent between the two groups.

Only the data for income shows different trend from other productivity indicators, whereby harvesters with MSD have an average mean value of higher income, RM 18.67, compared to harvesters without MSD, RM 17.7.

Table 4.7: Comparison of work productivity between harvesters that have MSD and harvesters that do not have MSD (past 7 days) (N =143)

Daily Harvesting Income	n	Mean	SD	Median	IQR	Z	p
With MSD	35	18.67	6.32	18.98	12.69	-0.602	0.547
Without MSD	52	17.70	5.60	18.05	7.75		
Total	87						
Efficiency							
With MSD	62	7.52	2.00	8.00	3	-2.344	0.019*
Without MSD	81	8.19	2.13	9.00	3		
Total	143						
Daily Quantity							
With MSD	62	14.91	13.06	6.83	22.88	-1.174	0.241
Without MSD	81	17.45	12.09	16.04	22.58		
Total	143						
Absenteeism							
With MSD	62	59.24	35.23	31.0	71	-0.505	0.613
Without MSD	81	54.44	33.50	31.0	69		
Total	143						
Presenteeism							
With MSD	62	2.32	2.23	2.00	2.00	-3.763	0.00*
Without MSD	81	1.07	1.46	1.00	3.00		
Total	143						
Mean reduction of productivity							
Variable	Percentage (%)						
Efficiency	8.18						
Days of sick at work	50.00						
Daily Quantity	14.56						

* significant (p<0.05)

*Daily Harvesting Income, N =143, 56 respondents had missing data.

For the productivity indicators with the reduced mean or median, by comparing group with MSD and group without MSD, the calculated mean reduction of productivity for efficiency is 8.18%, presenteeism is 50 % and daily quantity is 14.56.

4.5 Association between musculoskeletal disorders (in the past 12 months) and risk factors

Referring to table 4.8, BMI, age, history of accident, duration of work, working on rest days, medical history of rheumatoid arthritis, smoking , psychosocial risk factors and ergonomics risk factor have no significant association with MSD.

Table 4.8: Association between risk factors and Musculoskeletal Disorders (in the past 12 months) .

Variables	MSD symptoms (Past 12 Days)		χ^2	P value
	Yes	No		
BMI				
Under Weight	8 (5.6)	1 (0.7)	2.673	0.263 ^b
Normal Weight	116 (81.1)	7 (4.9)		
Pre-obese	9 (6.3)	2 (1.4)		
Age				
<30	86 (60.1)	6 (4.2)	0.088	0.767 ^b
≥30	47 (32.9)	4 (2.8)		
Education				
Educated	121 (84.6)	7 (4.9)	4.359	0.072 ^b
Not educated	12 (8.4)	3 (2.1)		
History of Accident				
Yes	38 (43.2)	3 (3.4)	3.560	0.097 ^b
No	47 (53.4)	0 (0)		
Duration of work				
<1 year	46 (32.2)	3 (2.1)	0.087	1.00 ^b
≥1 year	87 (60.8)	7 (4.9)		
Working in Rest Day				
Yes	125 (87.4)	9 (6.3)	0.250	0.489 ^b
No	8 (5.6)	1 (0.7)		
Rheumatoid Arthritis				
Yes	18 (12.6)	0 (0.0)	1.548	0.363 ^b
No	115 (80.4)	10 (7.0)		
Smoking				
Yes	117 (81.8)	8 (5.6)	0.537	0.615 ^b
No	16 (11.2)	2 (1.4)		
Psychosocial Risk Factors				
Yes	14 (9.8)	1 (0.7)	0.003	1.000 ^b
No	119 (83.2)	9 (6.3)		
Ergonomics Risk Factors				
Medium Risk (4-7)	0 (0.0)	1 (0.7)	0.396	0.821 ^b
High Risk (8-10)	26 (18.2)	47 (32.9)		
Very High Risk (11+)	36 (25.2)	33 (23.1)		

b = Fisher Exact Value

4.6 Association between musculoskeletal disorders in the past 7 days and productivity

Daily harvesting income, efficiency of work and absenteeism have no significant association with musculoskeletal disorders of the past 7 days. Only presenteeism and daily quantity of all the plantations have significant association with MSD of the past 7 days (Table 4.9).

Table 4.9 : Association between musculoskeletal disorders(in the past 7 days) and productivity

Variables	Productive	Not Productive	χ^2	P value
Daily Harvesting Income				
With MSD	20 (23.0)	15 (17.2)	0.428	0.513
Without MSD	26 (29.9)	26 (29.9)		
Daily Quantity				
With MSD	19 (13.3)	43 (30.1)	5.088	0.024*
Without MSD	40 (28.0)	41 (28.7)		
Efficiency				
With MSD	33 (23.1)	29 (20.3)	1.630	0.202
Without MSD	55 (38.5)	26 (18.2)		
Absenteeism				
With MSD	11 (7.7)	51 (35.7)	0.072	0.788
Without MSD	13 (9.1)	68 (47.6)		
Presenteeism				
With MSD	46 (32.2)	16 (11.2)	7.406	0.006*
Without MSD	42 (29.4)	39 (27.3)		

*significant (p<0.05)

4.7 Logistic Regression model of musculoskeletal disorders in the past 7 days with productivity indicators

Productivity variables such as presenteeism and quantity that have significant association ($p<0.05$) with MSD in the past 7 days were further analyzed using logistic regression with the “enter” method. In Table 4.10, the association between productivity and MSD was shown using logistic regression analysis adjusted for age, BMI and smoking. The result showed that a harvester with MSD in the past 7 days compared to a harvester without MSD in the past 7 days is 2.09 (95% CI 1.02 to 4.29) times more likely to be not productive in terms of quantity. For presenteeism, a harvester with MSD in the past 7 days compared to a harvester without MSD in the past 7 days is 2.87 (95% CI 1.34 to 6.14) times more likely to have presenteeism.

Table 4.10 : Logistic Regression Model Examining Productivity IndicatorsAssociated with MSD.

Variables	OR	95% CI		P value
		Upper	Lower	
Daily Quantity				
With MSD	2.09	1.02	4.29	0.044*
Without MSD	1.00			
Presenteeism				
With MSD	2.87	1.339	6.135	0.007*
Without MSD	1.00			

*significant ($p<0.05$), odd ratios are for “Without MSD”

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Study Background

This study was participated by 154 harvesters, however 7.14% of the respondents were excluded as one or more of the exclusion and inclusive criteria was not fulfilled. In this study population, there was a high number of foreigners from Indonesia, 96.5 %, mainly due to the nature of the job is strenuous and most of the locals are not interested.

The age range is quite high, which is between 19 to 55, this is because different plantations have different restrictions in hiring their harvesters. Some of the plantations require the workers to work as other positions first such as loaders, sprayers and other general work before they can become harvesters, as harvesters are considered the most hard core task in the plantation and it requires high skilled

workers, so by the time they are able to handle the task of a harvesters, some of them might already past 30 or 40 years old. However, due to lack of manpower, some plantations will just assign the harvesters task to the new workers.

89.5% of them had at least attended school before, whereby the highest education is the upper secondary school. For BMI, no respondent was in the obese category, this may due to the nature of work requires high physical activity. Pay range for harvesting income is quite wide as lowest is RM 288.79, and maximum is RM 956.64. A few factors influence this, harvesters income is based on the weight of quantity of the FFB they harvest in a month, so it is based on effort basis. Another factor is that not every day a harvester might have the chance to harvest as it all depends on the ripeness of FFB; it will bring loss to the company if they harvest unripe fruit. The last factor is that weight varies between FFB and plantation, all the plantations in the study are under the same parent company, the harvesting income was adjusted with the formula of the company system to resolve the weight variation issue. Generally, a harvester will be given one day off each week as their rest day, however, some harvesters choose not to rest and work every day, as the pay is based on effort and performance basis, those harvesters that do not rest may get higher pay.

Most of the respondents had working experience as some of them already worked at other places before, majority worked as harvesters. Work time and rest time is flexible, as long as the harvesters finish harvesting the block they were being assigned for the day, most of the harvesters choose to rest half an hour and more. 97.2% of the harvesters do not do part time so part time will not become a confounding factor in this study.

Generally, harvesters in this study smoke to keep themselves alert during work and also to relax after work, so there is a high percentage of respondents that smoke, which is 87.4 %. Harvesters will usually cook as kitchen is provided in their dormitory, but low number of harvesters (18.9%) had MSD related injury from their leisure activities.

For their medical condition, most of them have asthma, which may largely due to most of them are smokers and they smoke at work and when they are resting in the dormitory. Some of them have rheumatoid arthritis, which might due to old age.

Psychosocial risk factors were detected using the general health questionnaire, so whether the respondents were determined having the psychosocial risk factor with their score of the questionnaire. The cut off point for caseness and non caseness is 3 and above (Yusoff, 2009). Caseness means having the status of a psychiatric case. 89.5 % of the respondents do not have psychosocial risk factors as the work is not as stressful, but rather physical demanding.

5.2 Musculoskeletal Disorders (MSD)

For the first objective, high percentage of respondents had musculoskeletal disorder; this was 93%, which is similar to the result from a study done for the harvester in Indonesia , the MSD prevalence is 71.4% for harvesters. (Hendra & Rahardjo, 2009). The prevalence of MSD also is high in other agriculture plantation, which is the rubber plantation, whereby 85.7% of the workers had MSD. (Chow et al., 2012). Comparing to the prevalence of MSD other industries such as nurses (78%), computer workers(86%) , factory workers (73.6%) and office workers (63%), the prevalence of MSD in this study was higher.

The prevalence of lower back is 42.2% and in another study which is conducted locally, the prevalence of lower back pain is 82.6 % (Mohd Nizam and Rampal, 2005) . The difference between the prevalence of lower back pain is due to the working years, the median working years in the study by Mohd Nizam and Rampal is 10 years, in this study, the working year is mostly in 1 to 5 years, only one person work more than 5 years. Due to this factor, it is logic to assume that time factor is an important part to have to signs and symptoms, in term of musculoskeletal disorder, one of the signs and symptoms is pain.

Other than that, it is being observed that the harvesters worked with awkward posture, as they need to adjust their position to suit the height of the oil palm tree in order to cut the fruit, so it is inevitably that frequently bending and trunk twisting is observed in a harvester working posture. This is supported by the data that most of the respondents experienced pain at the lower back (42.2%) and upper back (35%). Other than that, REBA score also contribute as one of the evidence that awkward posture was observed in this study as 62.4% of the respondents is in the high risk level, REBA score 8-10, similar to study by Hendra and Rahardjo (2009), where the REBA score is 9.

5.3 Work Productivity

For the second and third objective of the study, overall, out of 5 indicators, most of the harvesters are not productive in terms of income (47.1%), daily quantity (41.3%) and presenteeism (61.5%). In contrast, harvesters seem to be productive in terms of low absenteeism rate whereby 83.2% of the harvesters did not take sick leave of the past 30 days. More than half of the harvesters are productive in terms of efficiency. The reason for low absenteeism rate is that since the payment of the harvesters is performance based, so if harvester absent for the day will be meaning he did not generate any income at all for the day. Most of the harvesters stated that they will still go to work even they were sick. Oppose to the absenteeism rate, there is high presenteeism (61.5%) in this study, which is similar with the rate (63-83%) reported by Bergström et al. (2009). More than half of the harvesters were productive in term of efficiency might due to the tendency for the harvesters to rate themselves higher for the efficiency score, as it is a self rating score.

After categorize workers productivity in the group with MSD and another group without MSD and compare, it is found out that group of harvesters with MSD are having lower productivity for the indicators of presenteeism, daily quantity and efficiency score. However, though there is lower daily quantity produced by harvesters with MSD compared to harvesters without MSD, there is no significant difference ($p=0.241$), this might due to small sample size.

There is mean productivity reduction for the harvesters with MSD, as efficiency has a mean reduction of productivity of 8.18%, daily quantity has a mean reduction of productivity of 14.56% and presenteeism with the mean reduction of production of 50%. The result is lower compared to the Meerding et al. (2005) reported an average productivity loss of 25% for construction workers (floor layers and road pavers) with MSD. However it is similar with the study among the white collar workers, which is about the computer users by Hagberg et al. (2002) that reported a mean reduction of productivity of about 15% for women and 13% for men due to MSD. Brouwer et al. also reported that, on an average day, part of the workers in a trade company that experienced health problems while being at work, have an estimated productivity loss of 13% per worker with health problems. Such difference arise might due to the construction workers (floor layers and road pavers) in another study exposed to vibration whereas respondents in this study did not exposed to vibration.

There is no reduced productivity for absenteeism and income. When interviewed, the harvesters shared that they seldom take day off for resting unless they really feel very sick, resulting in low absenteeism rate, which is only 16.8%, and this result contradict with the result of presenteeism. This might due to harvesters that with MSD will still go to work if it is not too severe cause they just treat musculoskeletal problem as mild health condition. Sick leave reduces their salary and sick-leave would not be compensated.

For income, surprisingly, the group that is with MSD earns more compared to the group that have MSD. Reville et al. (2002) had reported that workers with musculoskeletal injuries for the upper extremity had a sharp drop-off in wages of 10.6% loss relative to control workers. Such contrary of the result might due to the musculoskeletal disorders condition in this study had not developed to the stage of injuries as in the study of Reville et al. Due to this; it might not affect the productivity in terms of income at such stage. Furthermore the income data in this study might not be reliable as the one of the plantation used self report method for the quantity (income based on the weight of FFB harvested) even there is receipt to refer for quantity.

5.4 Association between musculoskeletal disorders and risk factors

For the fourth objective, there is no association between all the risk factors with musculoskeletal disorders in this study.

A recent study on the neck pain in Malaysia rubber plantation had revealed that there is no significant association of neck pain with working hours per day, BMI, ethnic, marital status, education level, smoking habit and length of working (Chow et al., 2012).

In contrary, Hendra and Rahardjo (2009) had found out that age of 35 ($p=0.046$) is the cut off point for the increased risk of MSD, the result of this study did not match as in no particular age, the MSD risk will increase. There is also significant association between working years and MSD ($p=0.017$). Such difference arised may due to education level difference between the two study, generally, respondents in Hendra's study have lower education, 83.8 % of the respondent have attend primary school or lower compared to 37.8 % of respondent in this study. Most of the respondents (93.7%) in this study working on rest day compared to 31.6 % in Hendra and Rahardjo's study.

There is also a statistically significant positive association between the level of obesity (BMI) and the likelihood that an individual has a MSD in a study by Kortt and Baldry (2002). Another local study by Mohd Nizam and Rampal, 2005 had shown that smoking and age had association with low back pain , the result of this study did not match with other study because of socio demography difference. Harvesters in this study were mostly Indonesian (96.5%) compared to 56.2% Indian and local people in the study by Mohd and Rampal (2005). The sample size in this study is too small and did not meet the minimum sample size requirement. According to the formula Danial (1999) , the minimum sample size is 345, however, due to time and budget constraint , only 143 respondents were involved in this study.

5.5 Association between musculoskeletal disorders and productivity

There is no association between income and MSD in this study, in other study about rubber tappers, income were statistically significant ($P=0.03$) with MSD (Meksawi et al., 2012). Another study suggests that households where the head has a disability also have a lower per capita consumption (Hoogeven, 2005). In the United Kingdom, 23 percent of households with people with disabilities had less than 60 percent of the median income (Kuklys, 2005). The contradiction of the result in this study with others might caused by the confounding factors in the income data as reported in study limitation.

Although there is significant difference between the efficiency score among group with MSD and without MSD, it does not have association with MSD which contradict with the study by Meerding et al. (2005) where 50% of the workers who reported reduced work performance was due to health problems. This might due to the self-rating bias might exist in this study because harvesters did not seems to understand self-rating question.

There is no association between MSD and absenteeism, a number of studies have shown that, on average, workers who suffer from any of a number of health problems have higher absenteeism levels. (Burton et al., 2001; Aldana & Pronk, 2001; Dewa & Lin, 2000). In this study, such association did not present might due to this may due low absenteeism rate. A few studies also had examined the relation with sickness absence due to musculoskeletal symptoms, and their results were conflicting (Ariens et al., 2002; IJzelenberg, Molenaar, & Burdorf, 2004). Conflicting result might due to different policy in different workplace regarding paid and unpaid sick leave.

There is a significant association between presenteeism and quantity with MSD, in line with the result of Meerding et al. (2005) whereby the occurrence of production loss (quantity) was significantly associated with the occurrence of musculoskeletal complaints. These two productivity indicators (daily quantity and presenteeism) were further analysed with logistic regression. Harvesters with MSD in the past 7 days compared to harvesters without MSD in the past 7 days is 2.87 times more likely to have presenteeism and 2.09 times more likely to be not productive in terms of daily quantity. Burton et al. (2004) stated that physical function limitations as a result of work related musculoskeletal disorders (WMSD) can lead to work limitations and can constitute an unfavorable effect on work productivity. Lerner's study found that there was a 4% to 5% decrease in work productivity for every 10% increase in limitations while at work. (Lerner et al., 2003)

5.6 Study Limitation

Time and budget constraint was the biggest study limitation in this study as it results in low sample size. Low sample size also contributed by the difficulty to track all the harvesters for video recording when they are working in the plantation as they move around very fast because they are familiar with the terrain of the plantation.

It is most likely that blue collar workers are having difficulty to understand questions that involve scale and rating. There is a tendency of giving oneself higher score when self rating method was used among the harvesters. Self-rating bias might exists whereby every respondent's self-rating may be higher than that respondent's actual score.

There were too many confounders for the data of income. As all the harvesters are working in groups/gangs in the block they are being assigned to, the income is divided equally in a harvesting gang regardless whether the person has MSD, due this factor, it is hard to differentiate whether the respondent is productive or not from the income indicator. It is also affected by the availability of fruit to harvest and that that's varies among plantations. Out of 4 plantations, one of the plantation used self-report method for the quantity harvesters produced without

checking with the daily receipt whereby dishonest may occurred and affect the objectivity of the data.

5.7 Conclusion

In conclusion, this study showed that there is no association between risk factors and MSD although there is significant association between presenteeism and quantity (work productivity indicators) with MSD.. MSD is the predictor for reduced productivity in this study.

5.8 Recommendation

5.8.1 Recommendation for further study

It is suggested in future study , more time and budget should be located in order to meet the minimum sample size requirement. For study that conducted among blue collar workers, , self-rating question should be avoided but based on objective or secondary data instead.

5.8.2 Recommendation for the oil plam plantation management

1. Instead of using manual labour , the management can consider using the mechanized harvesting machine
2. Better design for the harvesting tool should be developed so that it is lighter to carry around when working
3. Training should be provided to educate the workers about body mechanics so that proper posture is used and reduce the ergonomics risk
4. Increase worker awareness about the severity of the ergonomics risk by training , so that they will take appropriate rest while working
5. Further study need to be done on presenteeism versus sickness absence to contribute to the planning and development of measures to improve the work environment and to health policy making.

REFERENCES

- Alavinia, S.M., Molenaar, D. & Burdorf, A. (2009). Productivity Loss in the Workforce: Associations With Health, Work Demands, and Individual Characteristics. *American Journal of Industrial Medicine*, 52(1):49-56.
- Aldana, S.G. & Pronk, N.P. (2001). Health promotion programs, modifiable health risks, and employee absenteeism. *J. Occup Environ Med*, 43, 36-46.
- Ariens, G.A., Bongers, P.M., Hoogendoorn, W.E., van der Wal, G. & van Mechelen, W. (2002). High physical and psychosocial load at work and sickness absence due to neck pain. *Scandinavian Journal of Work Environment & Health*, 28, 222-231.
- Aronsson, G., Gustafsson, K. & Dallner, M. (2000). Sick but yet at work. An empirical study of sickness presenteeism. *J Epidemiol Community Health*, 54, 502-509.
- Bergström, G., Bodin, L., Hagberg, J., Aronsson, G. & Josephson, M. (2009). Sickness presenteeism today, sickness absenteeism tomorrow? A prospective study on sickness presenteeism and future sickness absenteeism. *J Occup Environ Med*, 51(6), 629-38.
- Bernard, B. (1997). Musculoskeletal disorders and workplace factors: A critical review of epidemiology evidence for work related musculoskeletal disorders of the neck, upper extremity; and low back. *Washington, DC : U.S. Government Printing Office* (DHHS/NIOSH Publication No. 97-141).
- Brage, S. & Bjerkedal, T. (1996). Musculoskeletal pain and smoking in Norway. *J Epidemiol Community Health* 1996, 50, 166-169
- Brouwer, W.B., Koopmanschap, M.A. & Rutten, F.F. (1999). Productivity losses without absence: Measurement validation and empirical evidence. *Health Policy*, 48, 13-27.

- Burri, G.J., Jr., A. & Helander, M.G. (1991). A field study of productivity improvements in the manufacturing of circuit boards. *International Journal of Industrial Ergonomics*, Vol.7, 207-215
- Burton, W. N., Conti, D. J., Chen, C., Schultz, A.B. & Edington, D.W. (1999). The Role of Health Risk Factors and Disease on Worker Productivity. *Journal of Occupational & Environmental Medicine*, 41(10), 863-877.
- Burton, W.N., Conti, D.J., Chen, C., Schultz, A.B & Edington, D.W. (2001). The impact of allergies and allergy treatment on worker productivity. *J. Occup. Environ Med*, 43,36- 46.
- Centers for Disease Control and Prevention. (2011). About BMI for Adults. Retrieved May 21, 2012, from http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html.
- Chapman, L. & Meyers, J. (2001). Ergonomics and musculoskeletal injuries in agriculture: Recognizing and preventing the industry's most widespread health and safety problem. *Baltimore, MD: Agricultural Safety and Health Conference Proceedings*.
- Chin, M. (2010). Biofuels in Malaysia: An analysis of the legal and institutional framework. *CIFOR: Center for International Forestry Research*. 1-30
- Choi, W., Kang, Y., Kim, J. & Han, S. (2009). Symptom Prevalence of Musculoskeletal Disorders and the Effects of Prior Acute Injury among Aging Male Steelworkers. *Journal of Occupational Health* 2009, 51, 271-282.
- Choo, Y.M. (2011). Overview of the Malaysian oil palm industry 2010. *Malaysian Palm Oil Board*. Retrieved on October 21 2011 from http://econ.mpob.gov.my/economy/Overview_2010_final.pdf
- Choobineh, A., Tabatabaei, S.H., Mokhtarzade, A. & Salehi, M. (2007). Musculoskeletal Problems among Workers of an Iranian Rubber Factory. *Journal of Occupational Health*, Volume 49.418-423.

- Chow, L.S., Adon, M.Y., Abdul Rahman, A., Syed Hassan, S.T. & Ismail, K. (2012). Prevalence of Neck Pain and Associated Factors with Personal Characteristics, Physical Workloads and Psychosocial among Male Rubber Workers in FELDA Settlement Malaysia. *Global Journal of Health Science*, 4(1), 94-104.
- Cole, D.C. & Hudak, P.L. (1996). Prognosis of nonspecific work-related musculoskeletal disorders of the neck and upper extremity. *American Journal of Industrial Medicine*, 29, 657-668.
- Daniel, W.W. (1999). Biostatistics: A Foundation for Analysis in the Health Sciences. (7th ed.). *John Wiley & Sons*.
- Davis, K.G & Kotowski, S.E. (2007). Understanding the Ergonomic Risk for Musculoskeletal Disorders in the United States Agricultural Sector. *American Journal of Industrial Medicine*, 50, 501-511.
- Demers, P. & Rosenstock, L. (1991). Occupational injuries and illness among Washington State agricultural workers. *Public Health Briefs*, 81, 1656-1658.
- DeRango, K., Benjamin, C. A., Michelle, R., Ted, R. & Moore, A. (2003). "The Productivity Consequences of Two Ergonomic Interventions." *Upjohn Institute Working Paper*, 03- 95.
- Dewa, C.S. & Lin, E. (2000) Chronic physical illness, psychiatric disorder and disability in the workplace. *Soc Sci Med*, 51, 41-51.
- Earle-Richardson, G., Jenkins, P.L., Slingerland, D.T., Mason, C., Miles, M. & May, J.J. (2003). Occupational injury and illness among migrant and seasonal farm workers in New York State and Pennsylvania, 1997-1999: pilot study of a new surveillance method. *Am. J. Ind. Med.*, 44 (1), 37-45.
- Ekberg, K. & Wildhagen, I. (1996). Long-term sickness absence due to musculoskeletal disorders: The necessary intervention of work conditions. *Scandinavian Journal of Rehabilitation Medicine*, 28, 39-47.

Escorpizo, R., Bombardier, C., Boonen, A., Hazes, J.M., Lacaille, D., Strand, V, et. al. (2007). Worker productivity outcome measures in arthritis. *J Rheumatol*, 34, 1372–1380.

European Agency for Safety and Health at Work. (2012). *Musculoskeletal Disorder*. Retrieved March 10, 2012, from http://osha.europa.eu/en/topics/msds/index_html.

Eurostat. (1999). *Labour Force Survey, Work-related health problems and occupational accidents module*. Retrieved from: http://epp.eurostat.ec.europa.eu/portal/page/portal/health/health_safety_work/data/database

Fathallah, F.A., Miller, B.J. & Miles, J.A. (2008). Low back disorders in agriculture and the role of stooped work: scope, potential interventions, and research needs. *J Agric Safety Health*, 14, 221–245.

Fathallah, F.A. (2010). Musculoskeletal disorders in labor-intensive agriculture. *Applied Ergonomics*, 41, 738-743.

Feeney, A., North, F., Head, J., Canner, R. & Marmot, M. (1998) Socioeconomic and sex differentials in reason for sickness absence from the Whitehall II study. *Occupational and Environmental Medicine*, 55 (2), 91–98.

Feyera, A., Herbisona, P., Williamsonb, A.N., Silvaca, I., Mandrykd, J., Hendried, L. & Helye, M.C.G. (1999). The role of physical and psychological factors in occupational low back pain: a prospective cohort study. *Occup Environ Med*, 57, 116-120.

Freek, L., Willem-Jan, M. & Alex, B. (2005). Reduced productivity after sickness absence due to musculoskeletal disorders and its relation to health outcomes. *Scandinavian journal of work, environment & health*, Vol. 31, 367-374.

Frymoyer, J.W. & Mooney, V. (1986). Current concepts review, occupational orthopaedics. *J. Bone Joint Surg*, 68A, 469-474.

- Guo, H.R., Tanaka, S., Cameron, L.L., Seligman, P.J., Behrens, V.J., Ger, J., et al. (1995). Back pain among workers in the United States: National estimates and workers at risk. *Am. J. Indus. Med.*, 28, 591-602.
- Guo, H.R. (2002). Working hours spent on repeated activities and prevalence of backpain. *Occup. Environ. Med.* 59 (10), 680-688.
- Guo, H.R., Chang, Y.C., Yeh, W.Y., Chen, C.W. & Guo, Y.L. (2004). Prevalence of Musculoskeletal Disorder among Workers in Taiwan: A Nationwide Study. *Journal of Occupational Health* 2004. 46,26-36
- Hagberg, M., Tornqvist, E.W. & Toomingas, A. (2002). Self-reported reduced productivity due to musculoskeletal symptoms: Associations with workplace and individual factors among white-collar computer users. *J Occup Rehabil*, 12,151-162.
- Hai, T.C. (2002). The Palm Oil industry in Malaysia : from seed to frying pan. *WWF Switzerland*. 1-145.
- Harcombe, H., McBride, D., Derrett, S. & Gray, A. (2009). Physical and psychosocial risk factors for musculoskeletal disorders in New Zealand nurses, postal workers and office workers. *Inj Prev* 2010, 16, 96-100.
- Heliövaara, M., Mäkelä, M., Knekt, P., Impivaara, O. & Aromaa, A. (1991). Determinants of sciatica and low-back pain. *Spine* 1991, 16(6), 608-14
- Hendra & Rahardjo, S. (2009). Risiko Ergonomi dan Keluhan Musculoskeletal Disorders (MSDs) pada Pekerja Panen Kelapa Sawit. *Prosiding Seminar Nasional Ergonomi, IX*. D11-1-D11-8.
- Heuvel, S.G.V.D., Ijmker, S., Blatter, B. M. & Korte, E.M.D. (2007). Loss of Productivity Due to Neck/Shoulder Symptoms and Hand/Arm Symptoms: Results from the PROMO-Study. *Journal Occupational Rehabilitation*, 17, 370-382
- Hignett S. & McAtamney L. (2000). Rapid Entire Body Assessment (REBA). *Applied Ergonomics* 31, 201-205.

- Hildebrandt, V. H., Bongers, P. M., Dul, J., van Dijk, F. J. H. & Kemper, H. C. G. (2000). The relationship between leisure time, physical activities and musculoskeletal symptoms and disability in worker populations. *International Archives Of Occupational and Environmental Health*, 73 (8), 507-518.
- Hoogendoorn, W.E., Van Poppel, M.N.M., Bongers, P.M., Koes, B.W. & Bouter, L.M. (1999). Physical load during work and leisure time as risk factors for back pain. *Scand J Work Environ Health*, 25(5), 387-403
- Hoogeveen, J.G. (2005). Measuring welfare for small but vulnerable groups: poverty and disability in Uganda. *J. Afr. Econ.*, 14, 603-631.
- Houtman, I.L., Bongers, P.M., Smulders, P.G. & Kompier, M.A. (1994). Psychosocial stressors at work and musculoskeletal problems. *Scand J Work Environ Health*, 20(2), 139-145.
- Huang, D.T. (2008). *A new tool to measure the relationship between health-related quality of life and workforce productivity*. Georgia Institute of Technology, 1-166.
- IJzelenberg, W., Molenaar, D. & Burdorf, A. (2004). Different risk factors for musculoskeletal complaints and musculoskeletal sickness absence. *Scandinavian Journal of Work Environment & Health*, 30, 56-63.
- IOWA State University. (2005). Risk Factors. *Department of Environmental Health and Safety, Health & Safety*.
- Janwantanakul, P., Pensri, P., Jiamjarasrangsi, V. & Sinsongsook, T. (2008). Prevalence of self-reported musculoskeletal symptoms among office workers. *Occup Med (Lond)*, 58 (6), 436-438.
- Jelani, A.B. (1998). *Design And Development Of An Oil Palm Fresh Fruit Bunch Cutting Device*. Unpublished master's thesis Universiti Putra Malaysia, Malaysia.

- Kamaruddin, M.I. (2007). Ergonomics: A study of lifting device for palm fruit bunch. *Universiti Teknikal Malaysia Melaka*.
- Katz, J.N. , Keller, R.B., Fossel, A.H., Punnett, L., Bessette, L., Simmons, B.P. & Mooney, N. (1997). Predictors of return to work following carpal tunnel release. *American Journal of Industrial Medicine*, 31, 85–91.
- Keyserling, W.M., Armstrong, T.J. & Punnett, L. (1991). Ergonomic Job Analysis: A structured approach for identifying risk factors associated with overexertion injuries and disorders. *Applied Occupational & Environmental Hygiene*, 6(5), 353-363.
- Kirkhorn, S.R. & Earle-Richardson, G. (2006) Repetitive motion injuries. In J.L. Lessenger (Ed.), *Agricultural Medicine: A Practical Guide* (pp. 324–338). New York: Springer.
- Kirkhorn, S.R., Earle-Richardson, G. & Banks, R.K. (2010). Ergonomic Risks and Musculoskeletal Disorders in Production Agriculture: Recommendations for Effective Research to Practice. *Journal of Agromedicine*, 15, 281–299.
- Kogi, K., Itani, T., & Batino, J. M. (2006). Productivity increase from low-cost ergonomic improvements through participatory training in small enterprises. *Proceedings of the IEA Congress*. Elsevier.
- Kortt, M. & Baldry, J. (2002). The association between musculoskeletal disorders and obesity. *Australian Health Review*, 25(6), 239-246.
- Kuklys, W. (2005). *Amartya Sen's Capability Approach: Theoretical Insights and Empirical Applications*. Studies in Choice and Welfare. New York: Springer-Verlag.
- Kuorinka, I., Jonsson, B., Kilbom, A., Vinterberg, H., Biering-Sørensen, F., Andersson, G. & Jørgensen, K. (1987). Standardized Nordic questionnaires for the analysis of musculoskeletal symptoms. *Applied Ergonomics*, 18, 233-237

- Lal, A. (2008). *Musculoskeletal Pain and Level of Education- A Cross Sectional Study from Ullensaker, Norway*. Norway: Nordic School of Public Health.
- Leino-Arjas, P. (1998). Smoking and musculoskeletal disorders in the metal industry: a prospective study. *Occup Environ Med*, 55(12), 828–833.
- Lerner, D., Amick III, B.C., Lee, J.C., Rooney, T., Rogers, W.H., Chang, H. & Berndt, E. (2003). Relationship of employee-reported work limitations to work productivity. *Medical Care*, 41 ,649–659.
- Liira, J.P., Dhannon, H.S., Chambers L.W. & Haines, T.A. (1996). Long-term back problems and physical work exposures in the 1990 Ontario Health Survey. *Am J Public Health*, 86, 382–7
- Lipscomb, J.A, Trinkoff, A.M, Geiger-Brown, J. & Brady, B. (2002). Work-schedule characteristics and reported musculoskeletal disorders of registered nurses. *Scand J Work Environ Health*, 28(6), 394-401.
- Lötters, F., Meerding, W.J. & Burdorf, A. (2005). Reduced productivity after sickness absence due to musculoskeletal disorders and its relation to health outcomes. *Scandinavian Journal of Work, Environment & Health*, 31(5), 367-74.
- Loeppke, R., Taitel, M., Haufle, V., Parry, T., Kessler, R.C. & Jinnett, K. (2009). Health and Productivity as a Business Strategy: A Multiemployer Study.
- Mahmud, F., Md Deros, B. & Abdul Wahab, D. (2009). Determination of Oil Palm Processing Activities for Benchmarking. *AMReG, Seminar 3*. 1-12.
- Malaysian Palm Oil Board. (2003). *Oil Palm Fruit Grading Manual* (3rd ed.). Malaysia:
- Martimo, K.F. (2010). Musculoskeletal disorders, disability and work. *People and Work Research Reports*, 89, 1-127.

- McCurdy, S.A., Samuels, S.J., Carroll, D.J., Beaumont, J.J. & Morrin, L.A. (2003). Agricultural injury in California migrant Hispanic farm workers. *Am. J. Ind. Med*, 44 (3), 225-235.
- Meksawi, S., Tangtrakulwanich, B. & Chongsuvivatwong, V. (2011). Musculoskeletal problems and ergonomic risk assessment in rubber tappers: A community-based study in southern Thailand, *International Journal of Industrial Ergonomics*, 1-7.
- McCunney, R.J. (2001). Health and productivity: A role for occupational health professionals. *J Occup Environ Med*, 43, 30-35.
- Meerding, W.J., IJzelenberg, W., Koopmanschap, M.A., Severens, J.L. & Burdorf, A. (2005). Health problems lead to considerable productivity loss at work among workers with high physical load jobs. *J Clin Epidemiol*, 58, 517-523.
- Meyers, J.M., Miles, J.A., Faucett, J., Janowitz, I., Tejeda, D.G. & Kabashima, J.N. (1997). Ergonomics in Agriculture: Workplace Priority Setting in the Nursery Industry. *AIHA Journal*, 58, 122-126.
- Minnesota Department of Employee Relations Safety and Industrial Hygiene Unit. (2001). *Ergonomics Guideline*. Retrieved from http://www.admin.state.mn.us/risk/publications/ergonomics_guideline.pdf
- Mohd Hafzi, M.I., Rohayu, S., Noor Faradila P. & Wong S.V. (2011). Prevalence and risk factors of musculoskeletal disorders of motorcyclists. *Asia Pacific Symposium on Advancements in Ergonomics and Safety (ERGOSYM2011)*, 1-10.
- Mohd Nizam, J. & Rampal, K.G. (2005). Study of Back Pain and Factors Associated with it Among Oil Palm Plantation Workers in Selangor. *NIOSH Malaysia. The Journal of Occupational Safety and Health (JOSH)*, Vol. 2, 36-41.
- Morken, T., Magerøy, N. & Moen, B.E. (2007). Physical activity is associated with a low prevalence of musculoskeletal disorders in the Royal Norwegian Navy: a cross sectional study. *BMC Musculoskeletal Disord*, 8, 56.

- National Research Council. (2001). *Musculoskeletal disorders and the workplace: Low back and upper extremities*. Washington: National Academy Press
- NIOSH. (1997). *Elements of Ergonomics Programs: A Primer Based on Ergonomic Assessments of Musculoskeletal Disorders*. Retrieved on October 24 2011, from <http://www.cdc.gov/niosh/docs/97-117/default.html>
- Oh, I.H., Yoon, S.J., Seo, H.Y., Kim, E.J. & Kim, Y.A. (2011). The economic burden of musculoskeletal disease in Korea: A cross sectional study. *BMC Musculoskeletal Disorders*, 12, 1-9.
- Organisation for Economic Co-operation and Development. (2001). *Measuring productivity: OECD manual measurement of aggregate and industry-level productivity growth*. OECD.
- OSHA, Occupational Safety and Health Administration. (2004). Recording and Reporting Occupational Injuries and Illness. *Regulations (Standards - 29 CFR)*
- Palmer, K.T., Syddall, H., Cooper, C. & Coggon, D. (2003). Smoking and musculoskeletal disorders: findings from a British national survey. *Ann Rheum Dis*, 62, 33-36.
- Papea, E., Brox, J.I., Hagend, K.B., Natvig, B. & Schirmer, H. (2007). Prognostic factors for chronic neck pain in persons with Minor or moderate injuries in traffic accidents. *Accident Analysis & Prevention*, 39(1), 135-146.
- Picavet, H.S.J., & Schouten, J.S.A.G. (2000). Physical Load in Daily Life and Low Back Problems in the General Population—The MORGEN Study. *Preventive Medicine*, 31, 506-512.
- Prime Minister Department of Malaysia. (2010). Chapter 9 : Deepening Malaysia's Palm Oil Advantage. *Economic Transformation Programme : A roadmap for Malaysia* .283- 314

- Punnett, L. & Wegman, D.H. (2004). Work-related musculoskeletal disorders: the epidemiologic evidence and the debate. *Journal of Electromyography and Kinesiology*, 14, 13–23
- Rankine, I.R. & Fairhurst, T.H. (1999). Field Handbook: Oil Palm Series Volume 1 – Nursery. *Potash & Phosphate Institute (PPI), Potash & Phosphate Institute of Canada (PPIC) and 4T Consultants (4T), Singapore.*
- Reville, R.T., Neuhauser, F.W., Bhattacharya, J. & Martin, C. (2002). Comparing Severity of Impairment for Different Permanent Upper Extremity Musculoskeletal Injuries. *Journal of Occupational Rehabilitation*, 12(3), 205–221.
- Roquelaure, Y., Ha, C., Rouillon, C., Fouquet, N., Leclerc, A., Descath, A., et al. (2009). Risk factors for upper-extremity musculoskeletal disorders in the working population. *Arthritis Rheum*, 61 (10), 1425–1434.
- Sbriccoli, P., Yousuf, K., Kupershtein, I., Solomonow, M., Zhou, B.H., Zhu, M.P. & Lu, Y., (2004). Static load repetition is a risk factor in the development of lumbar cumulative musculoskeletal disorder. *Spine* 29 (23), 2643–2653.
- Schneider, E. & Irastorza, X. (2010). *European Risk Observatory Report*. Luxembourg: Publications Office of the European Union.
- Shikdar, A. A. & Das, B. (2003). The Relationship between worker satisfaction and productivity in a repetitive industrial task. *Applied Ergonomics*, 34 , 603–610.
- Shiri, R. , Solovieva, S., Husgafvel-Pursiainen, K., Viikari, J., Raitakari, O.T. & Viikari-Juntura, E. (2010). Incidence of nonspecific and radiating low back pain: follow up of 24–39-year-old adults of the Young Finns Study. *Arthritis Care Res*, 62(4), 455–9.
- Skov, T., Borg, V. & Orhede, E. (1996). Psychosocial and physical risk factors for musculoskeletal disorders of the neck, shoulders, and lower back in salespeople. *Occup Environ Med* 1996, 53, 351–356.

- Smith, M. J., & Bayehi, A. D. (2003). Do ergonomics improvements increase computer workers' productivity? An intervention study in a call centre. *Ergonomics*, 46, 3–18.
- Smith, D.R., Leggat, P.A. & Speare, R. (2009). Musculoskeletal disorders and psychosocial risk factors among veterinarians in Queensland, Australia. *Australian Veterinary Journal*, 87 (7), 260-265.
- Steven, R. K., Earle-Richardson, G. & Banks, R.J. (2010). Ergonomic Risks and Musculoskeletal Disorders in Production Agriculture: Recommendations for Effective Research to Practice. *Taylor & Francis, Journal of Agromedicine*, 15, 281–299
- Stewart, W. F., Ricci, J. A., Chee, E., Morganstein, D., & Lipton R. (2003). Lost productive time and cost due to common pain conditions in the US workforce. *JAMA*, 290(18), 2443–2454.
- Tanaka, S., Petersen, M.R. & Cameron, L.L. (2001). Prevalence and risk factors of tendinitis and related disorders of the distal upper extremity among US workers: comparison to carpal tunnel syndrome. *American Journal of Industrial Medicine*, 39, 328–335.
- The Bone and Joint Decade Organization. (2011). *The Burden of Musculoskeletal Diseases in the United States*. Retrieved from http://www.boneandjointburden.org/pdfs/BMUS_chpt1_overview.pdf
- Tinubu , B.M., Mbada, C.E., Oyeyemi, A.L. & Fabunmi, A.A. (2010). Work-Related Musculoskeletal Disorders among Nurses in Ibadan, South-west Nigeria: a cross-sectional survey. *BMC Musculoskeletal Disorders* 2010, 11(12).
- Ueno, S., Hisanaga, N., Jonai, H., Shibata, E. & Kamijima, M. (1999). Association between musculoskeletal pain in Japanese construction workers and job, age, alcohol consumption, and smoking. *Ind Health*. 1999 Oct;37(4):449-56.
- Van Leeuwen, M. T., Blyth, F. M., March, L. M., Nicholas, M. K., & Cousins, M. J. (2006). Chronic pain and reduced work effectiveness: The hidden cost to Australian employers. *European Journal of Pain*, 10, 161–166.

- Vieira, R., Kumar, S. & Narayan, Y. (2008). Smoking, no-exercise, overweight and low back disorder in welders and nurses. *International Journal of Industrial Ergonomics*, 38(2), 143–149.
- Villarejo, D., & Baron, S.L. (1999). The occupational health status of hired farm workers. *Occupational Medicine: State of the Art Reviews*, 114(3), 613-35.
- Walker-Bone, K. & Palmer, K.T. (2002). Musculoskeletal disorders in farmers and farm workers. *Occup Med*, 52, 441–450.
- Watkins, J. (2010). *Structure and Function of the Musculoskeletal System (2nd edition)*. United States of America: Human Kinetics.
- Wolfe, F., Hawley, D.J. & Wilson, K. (1996). The prevalence and meaning of fatigue in rheumatic disease. *J. Rheumatol.* 23 (8), 1407-1417.
- Woods, V. (2005). Musculoskeletal disorders and visual strain in intensive data processing workers. *Occupational Medicine* 2005, 55, 121–127.
- Woolf, A. D. & Pfleger, B. (2003). Burden of major musculoskeletal conditions. *Bulletin of the World Health Organization*, 81 (9), 646-656.
- Workers' Compensation Board of British Columbia. (2009). *Preventing Musculoskeletal Injury (MSI), a guide for employers and joint committees*. British Columbia : WorkSafeBC Publications.
- World Health Organization. (2000). Obesity: preventing and managing the global epidemic. *Report of a WHO Consultation, WHO Technical Report Series 894*.
- Yu, W.Z., Yu, I.T.S., Li, Z.M., Wang, X.R., Lin, H., Wan, S., et al. (2012). Work-related injuries and musculoskeletal disorders among factory workers in a major city of China. *Accident Analysis and Prevention*, 1-6.
- Yusoff, M. S. B., Abdul Rahim, A.F. & Yaacob, M.J. (2009). The sensitivity, specificity and reliability of the malay version 12-items general health questionnaire (GHQ-12) in detecting distressed medical students. *ASEAN Journal of Psychiatry*, 11(1).

APPENDICES



APPENDIX 1



APPENDIX 2





BORANG PERSETUJUAN RESPONDEN

TAJUK KAJIAN : KESIHATAN DAN KESELAMATAN PEKERJAAN DI LADANG KELAPA SAWIT FELDA LOK HENG

Saya No.K/P

bersetuju / tidak bersetuju * untuk menyertai kajian bertajuk seperti di atas.

*** (sila bulatkan mana-mana yang berkenaan/potong mana-mana yang tidak berkenaan)**

Saya telah membaca dan memahami isi kandungan kajian berdasarkan apa yang telah dinyatakan di dalam 'PENERANGAN KEPADA PESERTA' yang telah dilampirkan bersama surat kebenaran ini dan penerangan tambahan daripada penyelidik.

Saya juga faham bahawa segala maklumat yang diberikan dan segala keputusan yang saya perolehi adalah sulit dan hanya akan digunakan untuk tujuan penyelidikan dan rujukan penyelidik. Saya juga faham bahawa maklumat ini boleh digunakan untuk penerbitan tetapi setiap individu tidak akan dinyatakan identitinya.

Saya faham bahawa saya mempunyai hak untuk menarik diri dan juga mempunyai hak untuk menarik semula keizinan pada bila-bila masa sekiranya perlu apabila merasa tidak selesa pada mana-mana ujian atau aktiviti yang dijalankan oleh penyelidik semasa kajian dijalankan dan tiada sebarang tindakan boleh dikenakan ke atas saya atas tindakan tersebut.

Tandatangan
(Responden)

Tandatangan
(Saksi)

Tarikh :

Nama :

No. K/P :

Saya mengesahkan bahawa saya telah menjelaskan kepada responden sifat dan tujuan penyelidikan yang tersebut di atas.

Tarikh

Tandatangan
(Penyelidik)

RESPONDENT ID:

--	--	--

BAHASA: A: B: C: DATA:

APPENDIX 3



OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN
PENYELIDIK

RESPONDENT ID:

BAHAGIAN A: BIODATA

1.1 Nama :

1.2 No. tel. :

1.3 Umur :

tahun

A1

1.4 Warganegara : 1

☐

Warganegara

2

☐

Bukan warganegara

A2

1.5 Suku : 1

☐

Jawa

2

☐

Banjar

A3

3

☐

Bugis

4

☐

Lain-lain

1.6 Status : 1

☐

Tidak menikah

2

☐

Menikah

A4

1.7 Jumlah :

orang

Tanggungan (termasuk ayah, ibu, isteri, anak)

A5

1.8 Pendidikan : 1

☐

Tidak bersekolah

2

☐

Sekolah Desa
(6 – 11 tahun)

A6

3

☐

Sekolah Menengah
Pertama (12 – 14 tahun)

4

☐

Sekolah Menengah Atas
(15- 17 tahun)

5

☐

Universitas ($\geq$ 18 tahun)

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN
PENYELIDIK

1.8 Pendapatan pokok :

A7

1.8 Pendapatan komisi :

A8



OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN
PENYELIDIK

BAHAGIAN B: DATA PEKERJAAN

2.1 Data pekerjaan terdahulu

2.1.1 Pernahkah anda bekerja di tempat lain sebelum ini?

1 ☐ Ya 0 ☐ Tidak

B1 ☐

2.1.2 Jika Ya, nyatakan jenis pekerjaan dan lama bekerja :

Jenis pekerjaan	Lama bekerja (jam)	Tahun bekerja
Total		

B1a ☐
B1b ☐

2.1.3 Pernahkah anda mengalami kecelakaan di tempat kerja sebelum ini?

1 ☐ Ya 0 ☐ Tidak

B2 ☐

Jika ya, nyatakan bahagian badan yang terluka :

		Ya	Tidak	
2.1.3.1	Kepala	1 ☐	0 ☐	B3 ☐
2.1.3.2	Tenguk/leher	1 ☐	0 ☐	B4 ☐
2.1.3.3	Bahu	1 ☐	0 ☐	B5 ☐
2.1.3.4	Tangan/lengan	1 ☐	0 ☐	B6 ☐
2.1.3.5	Jari	1 ☐	0 ☐	B7 ☐
2.1.3.6	Siku	1 ☐	0 ☐	B8 ☐
2.1.3.7	Punggung atas	1 ☐	0 ☐	B9 ☐
2.1.3.8	Punggung bawah	1 ☐	0 ☐	B10 ☐
2.1.3.9	Paha	1 ☐	0 ☐	B11 ☐
2.1.3.10	Lutut	1 ☐	0 ☐	B12 ☐

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN
PENYELIDIK

2.1.4 Pernahkah anda menerima perawatan untuk kecelakaan tersebut?

1 ☐ Ya

0 ☐ Tidak

B13 ☐

2.2 Data pekerjaan sekarang

2.2.1 Apakah pekerjaan anda sekarang?

1 ☐ Kilang

2 ☐ Ladang

B14 ☐

i) ☐ Continuous sterilizer

i) ☐ Pengambil

ii) ☐ Thresher

ii) ☐ Pemutik

iii) ☐ Digester

iii) ☐ Pembasmi hama

iv) ☐ Press

iv) ☐ Lain-lain _____

v) ☐ Depericarper

vi) ☐ Nut silo

vii) ☐ Nut cracker

viii) ☐ Kernel silo

ix) ☐ Oil room

x) ☐ Boiler and engine room

xi) ☐ Workshop

xii) ☐ Effluent

xiii) ☐ Rumah abu

xiv) ☐ Store

xv) Lain-lain (sila nyatakan) _____

2.2.2 Berapa lamakah anda telah bekerja sebagai (pekerjaan seperti di atas)?

_____ tahun

B15 ☐

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN
PENYELIDIK

2.2.3 Adakah anda bekerja pada hari libur?

1 ☐ Ya

0 ☐ Tidak

B16 ☐

Jika ya, berapa lama anda bekerja pada hari libur?

1 ☐ Sekali sebulan

2 ☐ Dua kali sebulan

B17 ☐

3 ☐ Tiga kali sebulan

4 ☐ Empat kali sebulan

2.2.4 Secara keseluruhan, berapa jam anda bekerja dalam sehari?

_____ jam

B18 ☐

2.2.5 Adakah kerja anda sekarang mengikut syif?

1 ☐ Ya

0 ☐ Tidak

B19 ☐

2.2.5 Berapa lamakah anda beristirihat dalam masa sehari anda bekerja?

_____ jam

B20 ☐

2.2.6 Apakah anda membuat kerja sambilan?

1 ☐ Ya

0 ☐ Tidak

B21 ☐

Jika ya, sila nyatakan data sebagai berikut:

Jenis pekerjaan	Lama bekerja (jam)	Tahun bekerja
Total		

B21a ☐

B21b ☐

BAHAGIAN C: DATA SOSIAL/GAYA HIDUP

3.1 Sejarah penggunaan nikotin

3.1.1 Adakah anda pernah merokok?

1 ☐ Ya

0 ☐ Tidak

C1 ☐

3.1.2 Jika Ya, adakah anda masih merokok sekarang?

1 ☐ Ya

0 ☐ Tidak

C2 ☐

3.1.4 Jika Tidak, berapa lamakah anda telah berhenti merokok?

_____ tahun

C3 ☐

3.2 Sejarah penggunaan alkohol

3.2.1 Apakah anda pernah meminum minuman beralkohol?

1 ☐ Ya

0 ☐ Tidak

C4 ☐

3.2.2 Apakah anda masih meminum minuman beralkohol?

1 ☐ Ya

0 ☐ Tidak

C5 ☐

**OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY**

**KEGUNAAN
PENYELIDIK**

3.3 Aktiviti Waktu Luang

3.3.1 Pada masa luang anda, apakah anda melakukan aktiviti-aktiviti yang berikut:

		<u>Ya</u>	<u>Tidak</u>	
3.3.1.1	Memburu	1 ☐	0 ☐	C6 ☐
3.3.1.2	Berkebun	1 ☐	0 ☐	C7 ☐
3.3.1.3	Memasak	1 ☐	0 ☐	C8 ☐
3.3.1.4	Kerja-kerja rumah	1 ☐	0 ☐	C9 ☐
3.3.1.5	Memancing	1 ☐	0 ☐	C10 ☐
3.3.1.6	Berkaraoke	1 ☐	0 ☐	C11 ☐
3.3.1.7	Berolahraga	1 ☐	0 ☐	C12 ☐

3.3.2 Adakah anda pernah mengalami kecelakaan sebagai berikut dalam melakukan mana-mana aktiviti-aktivitas (3.3.1.1 – 3.3.1.7) di bahagian tersebut yang membataskan pekerjaan anda?

1 ☐ Ya

0 ☐ Tidak

C13 ☐

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN
PENYELIDIK

BAHAGIAN D: MAKLUMAT PERUBATAN

4.1 Apakah anda menghidap penyakit sebagai berikut?

		<u>Ya</u>	<u>Tidak</u>
4.1.1	Sakit jantung	1 ☐	0 ☐
4.1.2	Darah Tinggi (Hypertension)	1 ☐	0 ☐
4.1.3	Kencing Manis (Diabetes)	1 ☐	0 ☐
4.1.4	Skizofrenia (Mental)	1 ☐	0 ☐
4.1.5	Insomnia (Sukar tidur)	1 ☐	0 ☐
4.1.6	Asma (lelah/semput)	1 ☐	0 ☐
4.1.7	Rheumatoid arthritis (sakit sendi)	1 ☐	0 ☐

D1 ☐

D2 ☐

D3 ☐

D4 ☐

D5 ☐

D6 ☐

D7 ☐

4.2 Adakah anda pernah menggunakan obat-obatan untuk penyakit tersebut:

		<u>Ya</u>	<u>Tidak</u>
4.1.1	Sakit jantung	1 ☐	0 ☐
4.1.2	Darah Tinggi (Hypertension)	1 ☐	0 ☐
4.1.3	Kencing Manis (Diabetes)	1 ☐	0 ☐
4.1.4	Skizofrenia (Mental)	1 ☐	0 ☐
4.1.5	Insomnia (Sukar tidur)	1 ☐	0 ☐
4.1.6	Asma (lelah/semput)	1 ☐	0 ☐
4.1.7	Rheumatoid arthritis (sakit sendi)	1 ☐	0 ☐

D8 ☐

D9 ☐

D10 ☐

D11 ☐

D12 ☐

D13 ☐

D14 ☐

4.3 Soal Kesehatan Umum (General Health Questionnaire: GHQ-12)

4.3.1 Pernahkah anda kekurangan tidur kerana risau?
(Contoh: Hati tidak tenteram, tidak aman, berasa gelisah dan cemas)

0 ☐	Tiada langsung	0 ☐	Tidak lebih dari biasa
1 ☐	Lebih dari biasa	1 ☐	Sangat lebih dari biasa

D15

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN
PENYELIDIK

4.3.2 Apakah anda sentiasa berasa tertekan/tegang ?
(Contoh: menyabarkan diri supaya tidak marah)

0 ☐ Tiada langsung

0 ☐ Tidak lebih dari biasa

1 ☐ Lebih dari biasa

1 ☐ Sangat lebih dari biasa

D16

4.3.3 Apakah anda boleh berkonsentrasi untuk apa yang anda lakukan?
(Contoh: memusatkan fikiran untuk menghabiskan sesuatu tugas)

0 ☐ Tiada langsung

0 ☐ Tidak lebih dari biasa

1 ☐ Lebih dari biasa

1 ☐ Sangat lebih dari biasa

D17

4.3.4 Apakah anda merasakan bermanfaat untuk sesuatu yang anda lakukan?
(Contoh: ramai orang memerlukan/mengharapkan saya, saya adalah penting kepada seseorang)

0 ☐ Tiada langsung

0 ☐ Tidak lebih dari biasa

1 ☐ Lebih dari biasa

1 ☐ Sangat lebih dari biasa

D18

4.3.5 Apakah anda dapat mengatasi masalah-masalah anda?
(Contoh, berurusan dengan hal, orang dan materi yang payah)

0 ☐ Tiada langsung

0 ☐ Tidak lebih dari biasa

1 ☐ Lebih dari biasa

1 ☐ Sangat lebih dari biasa

D19

4.3.6 Apakah anda merasa mampu membuat keputusan?
(Contoh: membuat pilihan yang baik untuk bila nak makan, makan apa, pakai baju apa dan lain-lain keputusan harian dalam hidup)

0 ☐ Tiada langsung

0 ☐ Tidak lebih dari biasa

1 ☐ Lebih dari biasa

1 ☐ Sangat lebih dari biasa

D2

4.3.7 Apakah anda berasa tidak dapat mengatasi kesukaran/ masalah anda?
(Contoh: masalah kesihatan, kewangan, dan keluarga)

0 ☐ Tiada langsung

0 ☐ Tidak lebih dari biasa

1 ☐ Lebih dari biasa

1 ☐ Sangat lebih dari biasa

D21

4.3.8 Apakah anda merasa cukup gembira dalam segala hal yang difikirkan ?
(Contoh, tentang kehidupan, hal dan orang sekitar)

0 ☐ Tiada langsung

0 ☐ Tidak lebih dari biasa

1 ☐ Lebih dari biasa

1 ☐ Sangat lebih dari biasa

D22

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN
PENYELIDIK

4.3.9 Apakah anda dapat menikmati kegiatan hari-hari anda?
(Contoh: pergi berjalan-jalan, mendengar musik, tengok cerita)

0 ☐ Tiada langsung

0 ☐ Tidak lebih dari biasa

1 ☐ Lebih dari biasa

1 ☐ Sangat lebih dari biasa

D23

4.3.10 Apakah anda berasa tidak gembira dan sedih?
(Contoh : susah hati tanpa sebab)

0 ☐ Tiada langsung

0 ☐ Tidak lebih dari biasa

1 ☐ Lebih dari biasa

1 ☐ Sangat lebih dari biasa

D24

4.3.11 Apakah anda telah hilang kepercayaan pada diri anda sendiri?
(Contoh: fikir sendiri tidak berkebolehan untuk melakukan perkara)

0 ☐ Tiada langsung

0 ☐ Tidak lebih dari biasa

1 ☐ Lebih dari biasa

1 ☐ Sangat lebih dari biasa

D25

4.3.12 Apakah anda memikirkan diri anda seorang yang tidak berguna?
(Contoh: berfikir sendiri sebagai orang yang selalu menyusahkan orang lain dan tidak berkemampuan)

0 ☐ Tiada langsung

0 ☐ Tidak lebih dari biasa

1 ☐ Lebih dari biasa

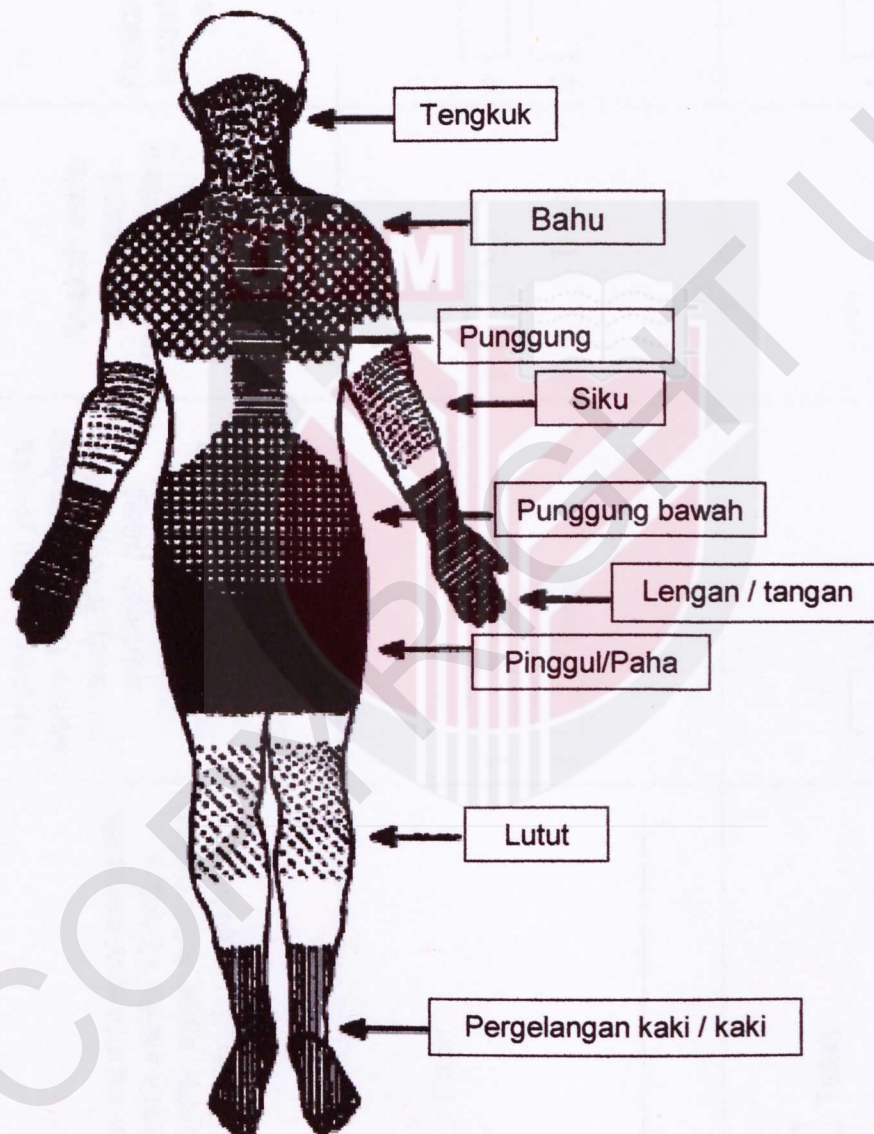
1 ☐ Sangat lebih dari biasa

D26

D27

BAHAGIAN E: GEJALA OTOT SKELETAL PADA ORGAN LOKOMOTIF

- 5.1 lihatlah gambar di bawah ini dan dalam bagian-bagian badan yang terdapat pada soal di bawah ini.



☐	E1
☐	E2
☐	E3
☐	E4

☐	E5
☐	E6
☐	E7
☐	E8

Bagian dibawah ini hendaklah diisi oleh semua responden		Bagian ini hanya perlu diisi oleh mereka yang mempunyai masalah saja (menjawab Ya di bagian sebelah kiri)	
Bagian anggota badan	Apakah anda mempunyai masalah dalam jangka waktu 12 bulan terakhir ini (pedih, sakit, tidak sehat) pada bagian anggota berikut:	Apakah anda mengalami masalah dalam jangka waktu 7 hari belakangan ini?	Apakah anda merasakan masalah itu berawal dari pekerjaan anda?
5.1.1 Tengukuk/leher ☐ Ya ☐ Tidak			
Tahap kesakitan: _____		1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak
5.1.2 Bahu ☐ Ya ☐ Tidak			
Tahap kesakitan: _____		1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN
PENYELIDIK

Bagian dibawah ini hendaklah diisi oleh semua responden		Bagian ini hanya perlu diisi oleh mereka yang mempunyai masalah saja (menjawab Ya di bagian sebelah kiri)	
Bagian anggota badan Apakah anda mempunyai masalah dalam jangka waktu 12 bulan terakhir ini (pedih, sakit, tidak sehat) pada bagian anggota berikut:	Apakah dalam jangka waktu 12 bulan terakhir ini, anda menghadapi masalah yang menghalangi anda melakukan pekerjaan secara normal (baik ditempat kerja ataupun di rumah?) Apakah anda mengalami masalah dalam jangka waktu 7 hari belakangan ini? Apakah anda merasakan masalah itu berawal dari pekerjaan anda?		
5.1.3 Siku ☐ Ya ☐ Tidak Tahap kesakitan: _____	1 ☐ Ya ☐ Tidak 2 ☐ Ya ☐ Tidak	1 ☐ Ya ☐ Tidak 2 ☐ Ya ☐ Tidak	1 ☐ Ya ☐ Tidak 2 ☐ Ya ☐ Tidak
5.1.4 Lengan/Tangan ☐ Ya ☐ Tidak Tahap kesakitan: _____	1 ☐ Ya ☐ Tidak 2 ☐ Ya ☐ Tidak	1 ☐ Ya ☐ Tidak 2 ☐ Ya ☐ Tidak	1 ☐ Ya ☐ Tidak 2 ☐ Ya ☐ Tidak

E9

E10

E11

E12

E13

E14

E15

E16

Bagian dibawah ini hendaklah diisi oleh semua responden		Bagian ini hanya perlu diisi oleh mereka yang mempunyai masalah saja (menjawab Ya di bagian sebelah kiri)	
Bagian anggota badan	Apakah anda mempunyai masalah dalam jangka waktu 12 bulan terakhir ini (pedih, sakit, tidak sehat) pada bagian anggota berikut:	Apakah dalam jangka waktu 12 bulan terakhir ini, anda menghadapi masalah yang menghalangi anda melakukan pekerjaan secara normal (baik ditempat kerja ataupun di rumah?) 1 ☐ Ya 2 ☐ Tidak	Apakah anda mengalami masalah dalam jangka waktu 7 hari belakangan ini? 1 ☐ Ya 2 ☐ Tidak
5.1.5 Punggung atas ☐ Ya ☐ Tidak Tahap kesakitan: _____		Apakah anda merasakan masalah itu berawal dari pekerjaan anda? 1 ☐ Ya 2 ☐ Tidak	
5.1.6 Punggung bawah ☐ Ya ☐ Tidak Tahap kesakitan: _____		Apakah anda merasakan masalah itu berawal dari pekerjaan anda? 1 ☐ Ya 2 ☐ Tidak	

E17

E18

E19

E20

E21

E22

E23

E24

Bagian dibawah ini hendaklah diisi oleh semua responden		Bagian ini hanya perlu diisi oleh mereka yang mempunyai masalah saja (menjawab Ya di bagian sebelah kiri)	
Bagian anggota badan	Apakah anda mempunyai masalah dalam jangka waktu 12 bulan terakhir ini (pedih, sakit, tidak sehat) pada bagian anggota berikut:	Apakah anda mengalami masalah dalam jangka waktu 7 hari belakangan ini?	Apakah anda merasakan masalah itu berawal dari pekerjaan anda?
5.1.7 Satu atau kedua-duanya bagian paha ☐ Ya ☐ Tidak Tahap kesakitan: _____		1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak
5.1.8 Satu atau kedua-duanya bagian lutut ☐ Ya ☐ Tidak Tahap kesakitan: _____		1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak

☐ E25

☐ E26

☐ E27

☐ E28

☐ E29

☐ E30

☐ E31

☐ E32

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN
PENYELIDIK

Bagian dibawah ini hendaklah diisi oleh semua responden		Bagian ini hanya perlu diisi oleh mereka yang mempunyai masalah saja (menjawab Ya di bagian sebelah kiri)	
Bagian anggota badan	Apakah anda mempunyai masalah dalam jangka waktu 12 bulan terakhir ini (pedih, sakit, tidak sehat) pada bagian anggota berikut:	Apakah dalam jangka waktu 12 bulan terakhir ini, anda menghadapi masalah yang menghalangi anda melakukan pekerjaan secara normal (baik ditempat kerja ataupun di rumah?) 1 ☐ Ya 2 ☐ Tidak	Apakah anda mengalami masalah dalam jangka waktu 7 hari belakangan ini? 1 ☐ Ya 2 ☐ Tidak
5.1.9 Satu atau kedua-duanya pergelangan kaki ☐ Ya ☐ Tidak		Apakah anda merasakan masalah itu berawal dari pekerjaan anda? 1 ☐ Ya 2 ☐ Tidak	
Tahap kesakitan: _____			

E33	☐
E34	☐
E35	☐
E36	☐

5.2 Bagian berikut akan merujuk anda terhadap masalah ke bagian badan yang lain.
Jika anda menjawab **TIDAK** pada bagian soal 5.1.1 – 5.1.9, anda tidak perlu menjawab soal-soal yang lain:

Bagian badan	Pernahkan anda mengalami cedera pada bagian badan yang disebabkan oleh kecelakaan?	Pernahkan anda mendapatkan perawatan (bertemu dengan dokter, ahli fisioterapi, pengobatan tradisional atau ahli-ahli pengobatan yang lain untuk memulihkan sakit yang anda alami di bagian badan tersebut?	Pernahkan anda mendapatkan istrihat sakit bagi penyakit yang anda alami di bagian badan tersebut?	Pernakah anda terpaksa mengganti kerja atau tugas karena sakit pada bagian badan tersebut?
5.2.1 Tengkuuk/leher	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak
5.2.2 Bahu	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak
5.2.3 Siku	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak
5.2.4 Lengan/tangan	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak

TENGKUK

E37

E38

E39

E40

BAHU

E41

E42

E43

E44

SIKU

E45

E46

E47

E48

LENGAN

E49

E50

E51

E52

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN
PENYELIDIK

B. ATAS

E53

E54

E55

E56

B. BAWAH

E57

E58

E59

E60

PAHA

E61

E62

E63

E64

KAKI

E65

E66

E67

E68

Bagian badan	Pernahkan anda mengalami cedera pada bagian badan yang disebabkan oleh kecelakaan?	Pernahkan anda mendapatkan perawatan (bertemu dengan dokter, ahli fisioterapi, pengobatan tradisional atau ahli-ahli pengobatan yang lain untuk memulihkan sakit yang anda alami di bagian badan tersebut?	Pernahkan anda mendapatkan istirahat sakit bagi penyakit yang anda alami di bagian badan tersebut?	Pernahkan anda terpaksa mengganti kerja atau tugas karena sakit pada bagian badan tersebut?
5.2.6 Punggung bawah/pinggang	1 Ya 2 Tidak	1 Ya 2 Tidak	1 Ya 2 Tidak	1 Ya 2 Tidak
5.2.7 Satu atau kedua-duanya bagian paha	1 Ya 2 Tidak	1 Ya 2 Tidak	1 Ya 2 Tidak	1 Ya 2 Tidak
5.2.8 Satu atau kedua-duanya bagian lutut	1 Ya 2 Tidak	1 Ya 2 Tidak	1 Ya 2 Tidak	1 Ya 2 Tidak
5.2.9 Satu atau kedua-duanya bagian kaki	1 Ya 2 Tidak	1 Ya 2 Tidak	1 Ya 2 Tidak	1 Ya 2 Tidak

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN
PENYELIDIK

BAHAGIAN F: FAKTOR RISIKO ERGONOMIK

6.1 Faktor Risiko Ergonomik

6.1.1 Postur badan

Apakah anda melakukan macam-macam gerakan-gerakan badan seperti contoh gambar di bawah ini dalam waktu bekerja?

6.1.1.1 Membungkuk ke hadapan

1 ☐ Ya

0 ☐ Tidak

F1 ☐



6.1.1.2 Membungkuk dan memutar badan

1 ☐ Ya

0 ☐ Tidak

F2 ☐



6.1.1.3 Menegak

1 ☐ Ya

0 ☐ Tidak

F3 ☐



6.1.1.3 Mendongak

1 ☐ Ya

0 ☐ Tidak

F4 ☐



OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN
PENYELIDIK

6.1.2 Menggunakan tenaga berlebihan

Apakah pekerjaan anda memerlukan anda menggunakan tenaga yang berlebihan seperti ketika mengangkat, menolak, menarik atau aktivitas kerja yang lain?

1 ☐ Ya

2 ☐ Tidak

F5 ☐

6.1.3 Beban statik

Apakah dalam pekerjaan anda, memerlukan atau menggunakan posisi dan kedudukan badan anda dalam jangka waktu yang lama?

1 ☐ Ya

2 ☐ Tidak

F6 ☐

6.1.4 Tekanan (tingkatan) pada sentuhan/kendali

Adakah pekerjaan anda memerlukan anda untuk mengendalikan peralatan, mengangkat, menolak, menarik atau membawa beban yang mempunyai tingkatan yang tajam?

1 ☐ Ya

2 ☐ Tidak

F7 ☐

6.1.5 Getaran

Apakah pekerjaan anda memerlukan anda menggunakan peralatan tangan yang bergetar atau menaiki apa-apa kenderaan bermotor (motosikal, kereta, lori)?

1 ☐ Ya

2 ☐ Tidak

F8 ☐

6.1.6 Pergerakan kerja berulang-ulang

Adakah putaran gerak kerja anda berulang-ulang dalam waktu setiap 30 detik?

1 ☐ Ya

2 ☐ Tidak

F9 ☐

6.1.7 Lingkungan – suhu

Apakah kawasan tempat kerja anda mempunyai perlindungan yang secukupnya daripada panas (matahari) atau dingin (embun pagi dan hujan)?

1 ☐ Ya

2 ☐ Tidak

F10 ☐

6.1.8 Lingkungan – bunyi bising

Apakah kawasan tempat kerja anda bising sehingga mengganggu anda daripada bekerja seperti biasa?

1 ☐ Ya

2 ☐ Tidak

F11 ☐

APPENDIX 4



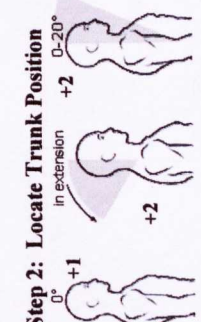
A. Neck, Trunk and Leg Analysis

Step 1: Locate Neck Position



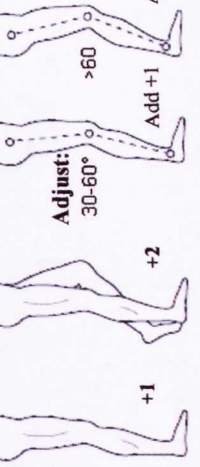
Step 1a: Adjust...
If neck is twisted: +1
If neck is side bending: +1

Step 2: Locate Trunk Position



Step 2a: Adjust...
If trunk is twisted: +1
If trunk is side bending: +1

Step 3: Legs



Step 4: Look-up Posture Score in Table A

Using values from steps 1-3 above, locate score in Table A

Step 5: Add Force/Load Score

If load < 11 lbs : +0
If load 11 to 22 lbs : +1
If load > 22 lbs : +2
Adjust: If shock or rapid build up of force: add +1

Step 6: Score A, Find Row in Table C

Add values from steps 4 & 5 to obtain Score A.
Find Row in Table C.

Scoring:

- 1 = negligible risk
- 2 or 3 = low risk, change may be needed
- 4 to 7 = medium risk, further investigation, change soon
- 8 to 10 = high risk, investigate and implement change
- 11+ = very high risk, implement change

SCORES

Table A	Neck		
	1	2	3
Legs	1 2 3 4	1 2 3 4	1 2 3 4
Trunk Posture Score	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9

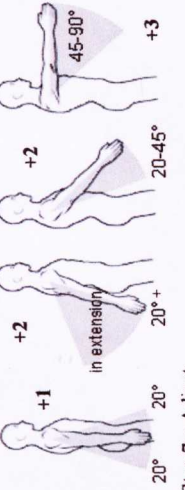
Table B	Lower Arm		
	1	2	3
Wrist	1 2 3 4	1 2 3 4	1 2 3 4
Upper Arm Score	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8 9

Score A (score from table A + load/force score)	Table C Score B, (table B value + coupling score)											
1	1	1	1	2	3	4	5	6	7	8	9	10
2	1	2	2	3	4	4	5	6	6	7	7	7
3	2	3	3	4	5	6	7	7	8	8	8	8
4	3	4	4	5	6	7	8	8	9	9	9	9
5	4	5	5	6	7	8	9	9	10	10	10	10
6	5	6	6	7	8	9	10	10	11	11	11	11
7	6	7	7	8	9	10	11	11	12	12	12	12
8	7	8	8	9	10	11	12	12	13	13	13	13
9	8	9	9	10	11	12	13	13	14	14	14	14
10	9	10	10	11	12	13	14	14	15	15	15	15
11	10	11	11	12	13	14	15	15	16	16	16	16
12	11	12	12	13	14	15	16	16	17	17	17	17

Table C Score + Activity Score = Final REBA Score

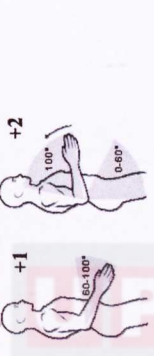
B. Arm and Wrist Analysis

Step 7: Locate Upper Arm Position:

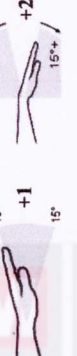


Step 7a: Adjust...
If shoulder is raised: +1
If upper arm is abducted: +1
If arm is supported or person is leaning: -1

Step 8: Locate Lower Arm Position:



Step 9: Locate Wrist Position:



Step 9a: Adjust...
If wrist is bent from midline or twisted: Add +1

Step 10: Look-up Posture Score in Table B

Using values from steps 7-9 above, locate score in Table B

Step 11: Add Coupling Score

Well fitting Handle and mid rang power grip, good: +0
Acceptable but not ideal hand hold or coupling acceptable with another body part, fair: +1
Hand hold not acceptable but possible, poor: +2
No handles, awkward, unsafe with any body part, Unacceptable: +3

Step 12: Score B, Find Column in Table C

Add values from steps 10 & 11 to obtain Score B. Find column in Table C and match with Score A in row from step 6 to obtain Table C Score.

Step 13: Activity Score

- +1 or more body parts are held for longer than 1 minute (static)
- +1 Repeated small range actions (more than 4x per minute)
- +1 Action causes rapid large range changes in postures or unstable base

Task name:

Reviewer:

Date:

This tool is provided without warranty. The author has provided this tool as a simple means for applying the concepts provided in REBA.

provided by Practical Ergonomics

rarker@ergosmart.com (816) 444-1667