UNIVERSITI PUTRA MALAYSIA

THE ASSOCIATION OF RISK FACTORS WITH THE PREVALENCE OF MUSCULOSKLELETAL SYMPTOMS AMONG HARVESTERS IN OIL PALM PLANTATION

BY
NOR HADIBAH BINTI TOKESNO

ACKNOWLEDGEMENT

Praise to Allah SWT for all His blessings and guidance of this project can be completed. Gratitude, I extend to Assoc. Professor Dr Shamsul Bahri Mohd Tamrin as supervisor of this project and Mister Ng Yee Guan as co-supervisor, for his invaluable advice, guidance that has been given. Appreciation is also extended to FELDA management for their guidance, cooperation and approval to precede this project. Special appreciation also goes to Miss Vivien How, who has given appropriate assistance in this project.

Gratitude also is addressed to Prof Dr. Zailina Hashim as the Head of Environmental and Occupational Health Department, and not forgetting the Final Year Project Coordinator, Dr. Saliza binti Elias for their encouragement and advice given. Our thanks also to our course mate of Bachelor of Environmental and Occupational Health Sciences for their help, cooperation and discussion in this project. Finally, infinite gratitude also goes to all involved in this study either directly or indirectly.

ABSTRAK

KELAZIMAN DAN FAKTOR RISIKO GEJALA OTOT SKELETAL DALAM KALANGAN PENUAI DI LADANG KELAPA SAWIT DI KOTA TINGGI

NOR HADIBAH BINTI TOKESNO

Pendahuluan: Gejala otot skeletal dikenali memberi kesan kesihatan yang ketara kepada pekerja-pekerja yang bekerja di sektor pertanian. Faktor risiko ergonomik seperti postur janggal dan faktor-faktor individu seperti umur, jantina, tabiat merokok dan faktor psikologi diketahui memainkan peranan yang penting dalam kejadian MSD di kalangan pekerja. **Objektif**: untuk menentukan kelaziman gejala otot skeletal dan kaitannya dengan faktor-faktor risiko di kalangan penuai di ladang kelapa sawit. **Metodologi**: kajian keratan rentas telah dilakukan dikalangan 129 penuai di dua ladang dengan ciri-ciri inclusif dimana mereka adalah pekerja tetap dan telah bekerja sekurang-kurangnya 12 bulan di ladang dan berumur tidak lebih dari 65 tahun dan tidak termasuk mereka yang mempunyai sejarah kecederaan otot skeletal. Soal selidik telah dihasilkan untuk menentukan ciri-ciri penuai. Borang soal selidik NORDIC digunakan untuk mengenalpasti simptom-simptom MSD, Penilaian Pantas Anggota Badan Atas (RULA) digunakan untuk menilai analisis postur bagi risiko ergonomik, metod HIRARC diguna untuk menentukan faktor ergonomik dan Soal selidik Kesihatan Umum (GHQ) diguna untuk mengesan kekacauan emosi. **Hasil**: Hasilnya menunjukkan bahawa belakang bawah adalah bahagian tertinggi yang mengalami gejala otot skeletal yang terdiri daripada 60.5% berbanding di bahagian lain. Kelaziman keseluruhan MSD dikalangan penuai adalah 90%. Markah utama RULA menunjukkan 10% berisiko sederhana untuk pembentukan MSD manakala 90% daripada mereka terdedah berisiko tinggi membentuk MSD. Risiko ergonomik seperti postur janggal, berdiri lama, pengulangan dan beban yang melampau adalah peramal untu sakit belakang dan juga simptom lain MSD dikalangan penuai. Berdasarkan ujian chi-square menunjukkan kaitan yang ketara antara Indek Jisim Badan (BMI) (P =0.037) di kalangan penuai pokok kelapa sawit berumur 3 tahun dengan keseluruhan simptom MSD dan juga tahun bekerja (P=0.040) di kalangan penuai pokok kelapa sawit berumur 5 tahun dengan keseluruhan simptom MSD. **Kesimpulan**: kajian ini menunjukan faktor risiko ergonomic tidak menyumbang kepada pembentukan MSD sementara faktor individu seperti BMI dan tahun bekerja menyumbang kepada simptom-simptom MSD.

ABSTRACT

PREVALENCE AND RISK FACTOR OF MUSCULOSKELETAL SYMPTOMS AMONG HARVESTERS IN OIL PALM PLANTATION IN KOTA TINGGI

NOR HADIBAH BINTI TOKESNO

Introduction: Musculoskeletal disorders (MSD) has been recognized as a significant health effects to the workers in agricultural sectors. Ergonomic risks factor such as awkward postures and individual factors such as age, gender, smoking habits and psychosocial factors are known to play an important role in occurrence of MSDs among workers. **Objective**: To determine the prevalence of MSD symptoms and its association with risk factors among harvesters in oil palm plantation. **Methodology**: A cross-sectional study was done among 129 harvesters in two plantations with inclusive criteria of working permanently for at least 12 months in plantation and age not more than 65 years old and exclusive criteria of previous history of musculoskeletal injuries. Questionnaire was administered in determining worker characteristics. NORDIC questionnaire was used to identify MSD symptoms, Rapid Upper Limb Assessment (RULA) was used to evaluate the postural analysis for ergonomics risk, HIRARC method was used for determining ergonomics factors and emotional disorders detection assessed by using General Health Questionnaire (GHQ). **Results**: The result shows that the prevalence of low back pain (LBP) was the highest reported by the harvesters (60.5%) compared to the other body part. The overall prevalence of MSD among the harvesters was at 90%. RULA grand score shows that 10 % of them were exposed to medium risks of developing MSD while 90% of them exposed to high risks of developing MSD. Ergonomics risk factors such as awkward postures, prolonged standing, repetitiveness and excessive load were the predictor of back pain and others MSDs symptoms among harvesters. Based on chi- square test it shows a significant associations between Body Mass Index (BMI) (P =0.037) among 3 years old oil palm trees harvesters with total MSDs symptoms and years of employment (P=0.040) among 5 years old oil palm trees harvesters with total MSDs symptoms. **Conclusion**: This study shows that ergonomic risk factors not contribute to developing MSD while individual factors such as BMI and years of employment contributed to MSDS symptoms.

TABLE OF CONTENTS

Pages

CHAPTER 3: METHODOLOGY

LIST OF TABLES

Pages

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

°	Degree
<	Less than
>	More than
≤	Less than or equal
≥	More than or equal
BMI	Body Mass Index
DOSH	Department of Safety and Health
FELDA	Federation Land Development Authority
GHQ	General Health Questionnaire
HIRARC	Hazards Identification, Risk Assessment Risk Control
ILO	International Labor Organization
MSDs	Musculoskeletal disorders
NHIS	National Health Interview Survey
NIOSH	National Institute of Occupational SafetY and Health
RULA	Rapid Upper Limb Assessment
TKI	Tenaga Kerja Indonesia
WHO	World Health Organization
WMSD	Work related musculoskeletal disorders

CHAPTER 1

INTRODUCTION

1.1 Study Background

The Federal Land Development Authority, better known as FELDA is the foremost land development agency in Malaysia. FELDA was established on first July 1956 under the Land Development Act 1956 as a result of a recommendation of Government Working Committee. It was the brain of the second Prime Minister, Tun Abdul Razak as a means of eradicating poverty and providing land ownership to the landless. From a modest beginning, it has developed into a giant organization and manages 480 schemes with an area of 853 313 ha. Basically, FELDA is involved in agriculture business which mainly consisted of organized oil palm and rubber smallholdings (Arif et al, 2001).

Now, FELDA is known as the world's largest plantation operator of oil palms, mainly across Peninsular Malaysia and some in Sabah and Sarawak. As a largest plantation, it has very big number of workforce in this industry. There are approximately 330 000 workers working in oil palm plantations covering 3,313,393 hectares of land (Malaysia Palm Oil Agency, 1999). Based from number of workers, it shows that oil palm plantation in Malaysia still relies on manual labor for all key activities especially in harvesting fresh fruit bunch (FFB).

Other than exposure to manual labor, workers in oil palm plantation through interaction with tools brought forth the issue of occupational safety and health. In particular, there are five categories of hazards in concerned which were physical hazards, chemical hazards, biological hazards ergonomic hazards and psychosocial hazards (DOSH, 2008). This study will focus on ergonomics hazards where it contributed to musculoskeletal disorders (MSDs) in long terms exposures.

Musculoskeletal disorders (MSDs) or its symptoms is a common phenomenon experienced by workers who do the work in manual .This is because the work manually, tall palm trees, fresh fruit bunches (FFB) the heavy oil, and environmental conditions (Hendra & Suwandi, 2009). All factors that contributed to MSDs on agricultural workers especially of health components further impeding the sustainability of agriculture industry in Malaysia

1.2 Problem Statement

According to International Labor Organization (2007), MSD are recently recognized as a significant ergonomics health effects to the workers in occupational tree plantation such as oil palm plantation, rubber and crops. This is because those working as plantation workers are exposed to strenuous and dangerous postures, forceful movement while carrying the load, the range of postures and muscular work such as upper arm abduction and flexion while doing their tasks. Indirectly and unconsciously, these tasks burden and constrain the body, leading to 'disorders' in the musculoskeletal system such as neck and shoulder pain. (Brulin *et al.*, 1998)

Many studies have reported a higher percentage of workers in agriculture industry having musculoskeletal complains. A study by Walker and Palmer (2011), shows an estimation of 43 000 agricultural workers from Britain ascribe musculoskeletal symptoms to their work, including 27 000 with back pain, 10 000 with upper limb or neck complaints, and 11 000 with related musculoskeletal disorders (WMSDs) of the lower limb.

A study of individuals working on small, family farms in Colorado, where over 90% of the operations had fewer than 5 employees, detected a one year period prevalence rate for back pain lasting a week or more of 26.2% (Xiang et al., 1999). This rate for Colorado farm employees was about two and one –half times higher than all industry

average rate of back pain for males (10.7%) (Meyers et al., 2000). Other than that, Park et al. (2001) found that farmers have reported having daily low back pain for a week (31%), which is significantly greater than the general working population (18.5%).

According to Rampal. et al. (2005) the prevalence of work related back pains that was related to work, experienced throughout their work in the plantation and in the last 12 months was 76.7% and 67.0% respectively. The back pain mainly involved the lower back, 88.6% and 82.6% respectively. While, study by Hendra et al. (2009) shows the largest complaints of MSDs in harvesting oil palm were at the neck and lower back was felt by 98 workers. The next sequence the right shoulder, right wrist and left wrist felt by 95 workers, and at least at the bottom (67 workers).

These farm- related injuries and MSDs are very costly in terms of financial losses and human burden. Merchant et al. (1989) reported between 80 000 and 170 000 workers suffer a disabling injury each year at a cost of $2.5 billion for hospitalization and rehabilitation. Musculoskeletal injuries, which are cumulative in nature (not acute injuries), cost the agriculture industry in excess of $167 million, not including lost productivity and human costs to the workers, which are very likely to increase the cost significantly (Chapman & Meyers., 2001). Besides, Demers and Rosenstock (1991) reported that insurance claims in Washington State were 50% higher for agricultural workers than non- agricultural workers.

Moreover, It will result in disability, lost work time, and increased production costs. MSDs 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 *et al*, 2010). Therefore, MSDs as experience by harvesters can affects palm oil industries sustainability by affecting productivity.

1.3 Study Justification

Although safety and health programs has been acknowledge by the major agricultural industry in Malaysia, none of agencies have ever tried to implement any ergonomics intervention program in reducing or in investigating musculoskeletal disorders among the farm and plantation workers. In addition, focus of research was generally low on agricultural workers especially of health components further impeding the sustainability of agriculture industry in Malaysia.

The present study (Hartman et al., 2005) shows that an ergonomic analysis can take place at the level of working methods. On the basis of its finding, the effect of the use of other or new agricultural working methods that are supposed to decrease exposure to the physical load for examples; less twisting, less repetitive neck flexion and trunk flexion can be advised.

Based on literature review, the most common musculoskeletal injuries risk factors are exposed to repetitive task, awkward posture, forceful exertion, manual handling and psychosocial factors (Meyers et al., 2001 & Davis et al., 2007). The best way for ergonomics improvement can be achieved through a fundamental basic concept by proposing small modification with maximum impact to the changes

There is lack of research in determining the prevalence of MSDs among harvester in oil palm plantation despites increasing workforce of harvesters every year. Through research, a better understanding and awareness of WMSD among harvesters in oil palm plantation can be achieved. It would provide necessary information for management to decrease the ergonomics risk factors of developing MSDs through work practices and methods, and also their productivity.

Moreover, it is in line with the government policy to promote occupational health and safety in workplace that is cited in Occupational Safety Health Act 1994 (OSHA). Lastly, prevention and intervention strategies that address specific aspects of harvesters in palm oil plantation can be developed such that disability and lost work time, sick leave cause by musculoskeletal disorders can be reduced.

1.4 Conceptual Framework

From Figure 1.1, harvesters or workers who are work in oil palm plantation or agricultural industry are exposed into 1) injuries 2) accidents.

Then injuries and accidents are comprised from 1) musculoskeletal disorders 2) first degree injuries 3) disabilities 4) death.

Musculoskeletal disorders are recently recognized as a significant ergonomics health effects to the workers in oil palm plantation. There are 2 main factors that contribute to musculoskeletal disorders 1) ergonomics risk factors (occupational factors) 2) environmental factor (non- occupational factors).

Ergonomics risk factors consist of 1) forceful exertions, 2) awkward work postures, 3) repetitive motions or prolonged activities 4) static postures. While, for environmental risk factors divided into 1) health status 2) daily activities besides work.

These two factors can cause musculoskeletal symptoms and pain in low back, neck and shoulder, arm, knee and legs, thigh, upper back and foot. Other than these two factors, psychological factors also significantly contributed to musculoskeletal symptoms.

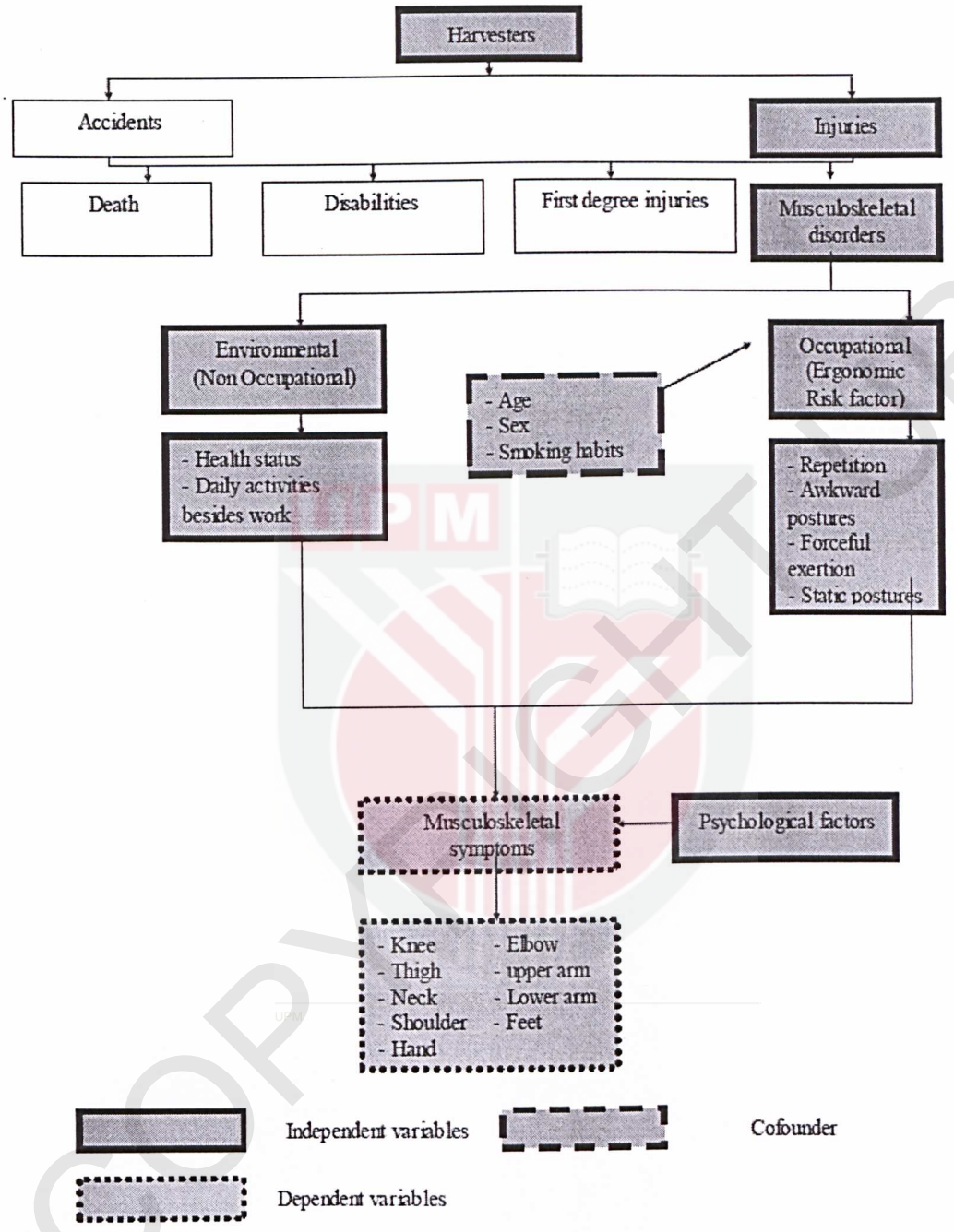


Figure 1.1 Conceptual framework

1.5 Definition of Terms

1.5.1 Conceptual definition

1.5.1.1 Musculoskeletal disorders

MSD is referred to as overexertion/overuse injuries, cumulative trauma disorders, repetitive strains injuries, and sprains and strains (Davis *et al.*, 2007). The stress takes the form of a symptom or a set of symptoms including pain, strain and often forms of dysfunction. The stress can be physical or psychological. Physical stresses act on the health and resilience of the tissues. Discomfort, fatigue and pain are the common first symptoms associated with work related musculoskeletal disorders (Hagberg *et al.*, 1995). It is also can be define as a group of injuries that affect the musculoskeletal system including the nerves, tendons, muscles, and supporting structures such as intervertebral discs (NIOSH, 1997).

1.5.1.2 Ergonomics risk factors

Ergonomics risk factors are the internal and external risk factors that can impose a biomechanical stress on the workers. (Lim, 2008). It is a work related exposures factors that are related to work environment or performance of work (WHO, 1989). Musculoskeletal disorders have been associated with six generic categories of

ergonomic risk factors which are found in a broad spectrum of manufacturing, agricultural and service jobs: 1) forceful exertions, 2) awkward work postures, 3) localized contact stresses, 4) whole-body or segmental vibration, 5) temperature extremes, and 6) repetitive motions or prolonged activities. (Keyserling *et al.*, 1999).

1.5.1.3 Body Mass Index (BMI)

Define as the weight in kilograms divided by the square of the height in meters (kg /m²). Using formula (Standard guideline by World Health Organization (WHO), 2000):

$$\textbf{BMI} = \textbf{Weight (kg)} / [\textbf{Height (m)}]^{2}$$

1.5.1.4 Awkward Postures

Awkward postures are the position of the body parts which is deviate from its neutral position (Burdof *et al.*, 1991). Awkward postures of the head and neck can be twisting or bending forward, backward or sideways while the arm raised more than 45 degree or above the shoulder level or the arm behind the body or flexion of the arm. Besides, the hand in the position of gripping, flexion, extension while the leg is bending or kneeling and the back is bending or kneeling; the ankle and feet in the position of prolonged standing, flexion or extension (Karhu *et al.*, 1977).

1.5.2 Operational definition

1.5.2.1 Musculoskeletal disorders

Musculoskeletal disorders (MSD) are referred to as overexertion/overuse injuries, cumulative trauma disorders, repetitive strains injuries, and sprains and strains. It was a form of a symptom or a set of symptoms including pain, strain and often forms of dysfunction due to occupational risk factors. The symptoms of musculoskeletal disorders were identified by using Nordic questionnaire (Kuorinka *et al.*, 1987) where the respondents answer either 'yes' or 'no'.

Yes = indicating pain

No = indicating no pain

1.5.2.2 Ergonomics risk factors

Ergonomics risk factors such as awkward postures, heavy workload, prolong standing, static postures, repetitive tasks, vibration from tools and also manual handling which were exposed during work. The ergonomics risk factors were identified by using HIRARC application (DOSH., 2008)

1.5.2.3 Body Mass Index (BMI)

Body Mass Index was calculated by dividing weight (kg) with height $(m)^2$. Then the readings will be classified according to the Table 1.1 (WHO, 2000)

Table 1.1: Classification of Body Mass index (BMI)

BMI (kg/m^2)	Classification
< 18.5	Underweight
18.5 – 22.9	Normal weight
≥ 23	Overweight
23.0 – 27.4	Pre- obese
27.5 – 34.9	Obese I
35.0 – 39.9	Obese II
≥ 40.0	Obese III

1.5.2.4 Awkward postures

Awkward postures were defined as a position of the body parts apart from its natural position. This variable was measure using the questionnaire to identify the postures and the amounts of time spend in awkward postures during harvesting activities. In the observation study, the Rapid Upper Limb Assessment (RULA) methods were used to study awkward postures in each activity. The risk is calculated into a score of 1 (low) to

7 (high). These scores are grouped into grand score where it was compared with the list of action levels. In most cases, to ensure that this guide was used as an aid in efficient and effective control of any risks identified, the actions lead to a more detailed investigation. The action levels are listed in Table 1.2 (McAtamney & Corlett., 1993)

Table 1.2: Classification Rapid Upper Limb Assessment (RULA) action levels

	RULA action levels
Action level 1	Scores of 1 or 2 indicates that the postures is acceptable if it is not maintained or repeated for long periods
Action level 2	Scores 3 or 4 indicates that further investigation is needed, and changes may be required
Action level 3	Scores of 5 or 6 indicates that investigation and changes are required soon
Action level 4	Scores of 7 indicates that investigation and changes are required immediately

1.6 Objective of the study

1.6.1 General objective

To determine the prevalence of MSD symptoms and its association with risk factors among harvesters in oil palm plantation

1.6.2 Specific objectives

1) To determine the socio- demographic, education level and economic status of harvesters in palm oil plantation.

2) To determine the prevalence of MSD among harvesters in oil palm plantation.

   a) FFB's harvesters in 3 years old oil palm plantation

   b) FFB's collectors in 3 years old oil palm plantation

   c) FFB's harvesters in 5 years old oil palm plantation

   d) FFB's collectors in 5 years old oil palm plantation

3) To determine the RULA score among harvesters in oil palm plantation

   a) FFB's harvesters in 3 years old oil palm plantation

   b) FFB's collectors in 3 years old oil palm plantation

   c) FFB's harvesters in 5 years old oil palm plantation

   d) FFB's collectors in 5 years old oil palm plantation

4) To identify the ergonomics risk factors of developing MSDs among harvesters in oil palm plantation by using Hazards Identification, Risk Assessment and Risk Control (HIRARC) method.

5) To determine the association of MSD with risk factors (age, weight, BMI, health status and daily activities,) among FFB's harvesters and collectors in oil palm plantation.

1.7 Hypotheses of study

1. There is significant association between MSDs symptoms with RULA score factors among FFB's harvesters and collectors in oil palm plantation.
2. There is significant association between MSDs symptoms with general risk factors (e.g.: age, health status, daily activities, etc) among FFB's harvesters and collectors in oil palm plantation.

CHAPTER 2

LITERATURE REVIEW

2.1 Workforce in Agriculture Industry

Agriculture sector such as tree plantation employs about half of the world entire workforce with approximately 1.3 billion of workers. (ILO., 2003). Researchers have estimated that the farm population range from 6.5 to 6.7 million farm workers. (Chapman & Meyers, 2001). In Malaysia, there are approximately 330,000 workers working in oil palm plantations covering 3,313,393 hectares of land (MPOB, 1999). Among entities managing these plantations are government agencies such as FELDA, FELCRA, and private companies such as Guthrie, Golden Hope Plantation, Sime Darby and individuals.

2.2 Problems in Agricultural Industry

According to Fathallah. (2009), agriculture sector is the most hazardous industries for the workers which can lead to different problems such as musculoskeletal disorders, respiratory disease, noise induce hearing loss, pesticide- related illnesses and increased of cancer cases. Kirkhorn & Schenker., (2002) and Woolf & Pleger, (2003) stated that musculoskeletal complaints are a major cause of work leaves in developed countries after respiratory disorders as a cause of short-term sickness absences. Approximately 2.3 million workers die as result of occupational accidents and work related diseases (ILO, 2008). For the oil palm workers, they are exposed to various risk factors related to back pain because their daily activities require active movements and involve manual material handling (Bongers *et al.*, 1999)

In Malaysia, oil palm harvesting is main process by which oil palm is collected. When the circumference of the tree trunk reaches approximately 150 cm, the harvesting process can be begun. Normally, the tree is divided into four aged circumferentially. First age which are 4 until 7 years, second age is 7 until 12 years, third age is 12 until 20 years and forth age is 20 above (MPOB, 2001). The harvesting process is usually started at the height 150 cm above the ground. A special chisel is used to harvest palm oil which at first age and in performing harvesting, harvesters' forearm, lower arms, and wrists must maintain a degree of flexion, while the trunk posture is in degree of forward

bending and laterally twisted which depends on the height of palm oil level. This work task often involves harvesters being in ergonomically awkward activities, such as the repetitive harvesting movement which is often repeated hundreds of times per day in awkward postures of the upper limbs, neck, trunk and legs. These ergonomics problems may be a cause of MSDs among harvesters. (Meksawi *et al.*, 2011).

The 1988 National Health Interview survey in Taiwan reported that workers in production agriculture were the most likely to report daily exposures to a variety of musculoskeletal injury hazards (Guo et al., 1999). Re- analysis of this data shows that the reported one year prevalence rate of back pain among individuals working in production agriculture was about one and one half times higher than the average for all US industries. Data from another NHIS follow up study reports that farming was the occupation most often associated with disability in females and the second most often in males. (Leigh & Fries., 1992)

2.3 Definition of Musculoskeletal Disorders

Musculoskeletal disorders (MSD) are referred to as overexertion/overuse injuries, cumulative trauma disorders, repetitive strains injuries, and sprains and strains (Davis *et al.*, 2007). While work related musculoskeletal disorders (WMSD) are defined as a group of injuries that affect the musculoskeletal system including the nerves, tendons, muscles, and supporting structures such as intervertebral discs (NIOSH, 1997).

The National Research Council and Institute of Medicine (2001) defines work related illness or disease as being caused by, aggravated, accelerated by workplace exposures, which result in impaired work capacity. The World Health Organization (1985) describes "work-related" disorders as being multi factorial in origin such that the work environment and performance of work contribute significantly to the cause or aggravation of the disorders.

MSD can be detected by symptoms that are appear to the workers prior any illness or abnormality. A factor which is trigger symptoms of musculoskeletal disorders such as external loads where it is produced in the physical work environment and are transmitted through the biomechanical forces of the body, specifically the limbs and trunk, to create internal loads on tissues and anatomical structures. Biomechanical variables include body position, exertions, forces and motions, as well as individual factors such as age, strength, agility and dexterity, and other factors that mediate the transmission of external loads to internal loads on anatomical structures. Tissue damage may occur when the imposing load exceeds the internal tolerance of the tissue and results in an outcome of discomfort, pain, impairment or disability. (Sesto, 2001)

Finding by Radwin *et al.*, (2001), shows that external loads are not a single event caused acute trauma for the workers, internal loads should be taken into consideration where is internal tolerance of tissues may be exceeded when accumulation of loading occurs due to repeated exposures, or exposures of long duration and it is explains why many MSDs

are associated with work, since throughout the workday, workers often repeat the same or similar actions.

2.4 Anatomy of Musculoskeletal System

Human movement is brought about by the musculoskeletal system which is consists of the skeletal muscles, joints and bones where it is under the control of the nervous system. The bones of the skeleton are linked together at the 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 joints, and in doing so, control the movement of the body as a whole. Through coordinated activity of the various muscles groups, the force generated by our muscles are transmitted by our bones and joints to enable us to maintain an upright or partially upright posture, move one place to the another, and manipulate objects, often simultaneously (Watkins, 2010)

The open chain arrangement of the bones of the skeleton such as two arms and two legs attached independently to the vertebral column allows us to adopt a wide range of body postures and perform a wide range of body movements. However, this movement capability is only possible at the expense of low mechanical advantages of the skeletal muscles (Watkins, 2010). Most muscles are attached to the bones very close to joints, such that in most postures and movements other than lying down, the muscles have to exert very large forces which, in turn, result in very large forces in joints (**Figure 2.1**).

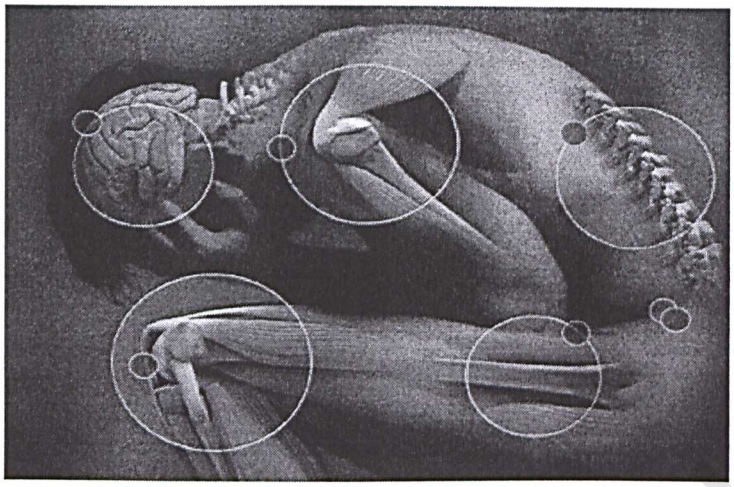


Figure 2.1 Forces in joints

In response to the forces exerted on them, the musculoskeletal components experienced strain which mean they are deformed. Under normal circumstances, the musculoskeletal components adapt their size, shape and structure, a process refereed as a structural adaptation to more readily withstand the time- averaged strain of everyday physical activity.

However, excessive strain will result in injury. Structural adaptation is continuous throughout life, but the capacity of structural adaptation decreased markedly with increasing in age. Strain would normally result in structural adaptation in young person or workers may result in tissue degeneration and dysfunction in older workers. Consequently, there is intimate relationship between the structure and function of the musculoskeletal system (Watkins, 2010)

2.5 Activities Related to MSD Symptoms in oil palm plantation

Oil palm harvesting process consists of several stages of task which is (1) cutting stems and FFB 2) collect FFB into rickshaw and then bring it to the revenue collection. Prior harvesting fresh fruit bunches: firstly, workers will clean stem and stem that block off of fresh fruit bunches to be cut (**Figure 2.2**). Then, FFB that had fallen near or around trees will be collected near the wheelbarrow where it will be used for the transport of fresh fruit bunches in the plantation to the collection point (**Figure 2.3**)(**Figure 2.4**). Harvester can loading wheelbarrow with 2 or 3 FFB, depending on the size and weight of the FFB. Generally, the weight of FFB is between 15-50 kg. If the size of the FFB is large, only 2 of FFB can be accommodated by wheelbarrow, but if it small in size, wheelbarrow can only accommodate 3 of FFB (Hendra & Suwandi, 2009).

Figure 2.2 FFB's Harvester

Figure 2.3 FFB's Collector

Figure 2.4 Collect loose seeds

When performing harvesting of fresh fruit bunch (FFB), certain activities increase the magnitude of MSD including postural stress, awkward posture, repetitive task and forceful exertion. Besides, environmental factors and psychosocial factors also contribute to these problems. (Frymoyer & Mooney., 1989).

Lifting heavy FFB into the wheelbarrow and load up into the truck causing the most complaints that are perceived at the neck and lower back of harvesters who are working at oil palm plantation (Hendra & Suwandi , 2009). A study by Hoogendoorn et al. (1999) shows that manual lifting is one of the most important aspects that should also be taken into consideration since it has been well established as a risk factor for back pain. Result revealed prevalence of back pain was significantly higher among workers who perceived materials handled to be too heavy of difficult to manage and among those who performed wrong lifting techniques (Nordin et al., 1997).

At the stage of FFB harvesting and lowering the stems, the body part that experienced repetitiveness is neck. Neck also experienced continuous extension for about 15 minutes. Repetitive movements of neck for a long duration will cause fatigue and excessive use of muscles, tendons, and joints of the neck that can cause muscle tension and increasing pressure on the nerve (Hendra & Suwandi, 2009).

Other than that, awkward postures also occur in harvesting process (cutting the stem and FFB, FFB collection, carry FFB to collecting place) and loading onto trucks. Awkward postures can cause mechanical stress on the muscles, ligaments and joints that causing pain in skeletal muscle (Hendra & Suwandi , 2009)

2.6 Ergonomic risk factors

Numerous studies have reported an association between certain risk factors and MSD symptoms. Occupational risk factors frequently mentioned as potentially causative for upper extremity musculoskeletal disorders include forceful hand and arm exertions, repetitive upper extremity activity, posture extremes, static postures, and vibration. Occupational risk factors associated with low back disorders include lifting, heavy physical work, static postures, such as stooping, whole body vibration and awkward postures, such as twisting (Sesto, 2001).

Repetitive work is defined as work activities which involve continuous arm or hand movements which generate loads on the neck and shoulder area. Evidence of association between the individual risk factors of repetition and forcefulness for neck and neck/shoulder symptoms was identified through 46 epidemiological studies investigating neck MSDs and 23 studies looking at neck/shoulder MSDs by NIOSH (1997). Whereas, forceful work is defined as work activities that involved forceful arm or hand movements and generated loads to the neck and shoulder area. Evidence of a strong association exists which shows that working with high levels of static contraction and/or extreme working postures involving the neck or shoulder muscles result in increased risk for neck and shoulder MSDs. (Sesto, 2001).

There is also evidence of association between a combination of risk factors such as repeated or sustained exertions and elevated shoulder postures which is more than 60 degrees of flexion or abduction and shoulder disorders with MSD symptoms in shoulder. There is insufficient evidence for an association between force and shoulder MSDs. The evidence for specific shoulder postures is strongest where there is combined exposure to several physical factors, such as holding a tool while working overhead (NIOSH, 1997). Palmer (1996) reported an OR=5.9 for neck and shoulder symptoms when comparing tomato trainers with other matched workers. The risk factors accompany this job include repetition, static contractions of the neck and shoulder muscles, and working at or above shoulder level.

For the symptoms of MSD in low back, five ergonomics risk factors included are: (1) heavy physical work which is defined as work that has high energy demands or requires some measure of physical strength, (2) lifting and forceful movements, (3) bending and twisting (awkward postures), (4) whole-body vibration (WBV), and (5) static work postures (NIOSH., 1997). Heavy physical work has been associated with increased risk of low back pain (LBP). Lifting heavy fresh fruit bunch into the wheelbarrow and load up into the truck causing the most complaints that are perceived at the neck and lower back (Hendra & Suwandi , 2009).

The main risks factors in oil palm plantation are lifting heavy load which is more than 50 lbs, sustained or repeated full body bending (stoop) and very high repetitive hand work (Meyers *et al.*, 2000). Harvesting process include forceful repetitive cutting, prolonged and repetitive stooping, lifting and carrying heavy load (Fathallah, 2009). Moreover, lifting, flexion or rotation of the trunk and neck flexion or neck rotation were shown that associated with sick leave due to musculoskeletal disorders. (Hoogendoorn et al.,2002) (Ariens *et al.*, 2002).

Musculoskeletal systems, nerve and circulatory tissues also can be affected by ergonomic risk factors such as repeated or forceful efforts, sustained static loading and anatomically non-neutral posture, accelerated movements, and externally applied compressive forces and vibration (Niu, 2010). Higher risks of shoulder pain have been reported in two surveys of farmers and this findings are consistent with the known risk

factors for MSDs of the upper limb and neck which working with the arms elevated, static loading, forceful exertion, repetitive work and heavy lifting. All of which are likely to present in the daily working lives of farm workers (Bone & Palmer., 2002).

Wickstorm & Pennti (1998) revealed an association between sick leave from back disorders and exposure to awkward postures. (Hoogendoorn et al., 2002) (Ariens et al., 2002) showed that lifting, flexion or rotation of the trunk and neck flexion or next flexions were associated with sick leave due to musculoskeletal disorders. In addition, the study revealed that sick leave due to back disorders appeared to be more strongly associated with 'combined biomechanical load' (a combination of lifting, carrying, pushing, pulling, awkward postures, standing and sitting) than with any individual risk factors.

2.7 Non – Occupational risk factors

Factors that perceived higher complaint were the type of work, age, and duration of work-related MSDs. Harvesting tasks like cutting, lifting FFB, and carry FFB to collecting place have a higher risk (3.438 times) than the loading task . This is because harvesting tasks has a longer duration than the loading task. Besides, loading FFB onto a truck is often carried out by two people. While working, harvesters with the age of 35 years or more had a 2.56 times greater risk for experiencing MSDs than workers with less than 35 years of age (Hendra & Suwandi, 2009).

Katowski., (2007) investigated that prevalence of workers having musculoskeletal symptoms was increased for 50% after their age more than 65 years old while for workers who in average age of 30 years old only have prevalence of 5 % having musculoskeletal symptoms. Other than that, workers who have works for more than 4 years had a risk of 2.755 times higher than workers who have years of employment ≤ 4 years. Another study shown that BMI which is classified as obese had significant relationship between BMI and MSD symptoms whereas smoking habits also found to be associated with MSD.

2.8 Consequences of Musculoskeletal Disorders in agriculture industry

Agriculture related strains and sprains related to the back and extremities were quite common in this sector (Bobick & Myers, 1994). Back pain and pain in the shoulders, arms and hands are the most common symptoms reported by farmers (NIOSH, 2001). Considerable variation exists among rates of musculoskeletal health problems due to cumulative trauma among farmers.

Gustafsson *et al.,* (1994) investigated the presence of musculoskeletal symptoms in Swedish dairy farmers during the preceding 12 months. Eighty-two percent of males and eight six percent of females reported musculoskeletal symptoms. Dairy farmers reported frequent symptoms in the shoulders, elbows, lower back, hips and knees. In addition,

female dairy farmers reported severe hand and wrist problems. As compared to women, men reported more back and knee problems. Women reported more symptoms in the neck, upper back and upper extremities than men. This is similar to the findings by Hildebrandt *et al.*, (1995) in which, 75% of farm workers reported experiencing musculoskeletal symptoms during the previous 12 months.

In the Netherlands, they are the most important category of disease in terms of production losses and the costs to society due to absenteeism from work and disablement and sick leave due to MSD is a huge problem among farmer (Van Tulder *et al.*, 1995). Hartman *et al.*, (2003), reported that disorders of the neck, shoulder, upper extremity and back accounted for 30.2% of sick leave claims of Dutch self- employed farmers from 1994 to 2001. A study by Rosecrance *et al.*, 2006 found more than 60% of Kansas farmers reported that they suffer from at least one farm related MSD symptoms.

In commodity plantation such as oil palm and rubber, the most common problem is MSD which are the common occupational non- fatal injuries. (Meyers *et al.*, 1997). Although, musculoskeletal injuries are not lethal cases but it can cause in disability, cost work time and increased production costs. (Kirkhon *et al.*, 2010; Van Tulder *et al.*, 1997). Moreover, economic costs of MSD place a considerable burden to industries. (Shengl, 2010). Annual losses result from lost of productivity, premium of insurance also increase in all over the world. (Takala & Niu.,2003).

The result of previous study by Nizam & Rampal, (2005) showed a high prevalence of work related back pain among oil palm plantation workers, which was 76.7% throughout their working experience in the plantation. A study among oil palm plantation in Bintulu, Sarawak showed prevalence rate of back pain at 34.8% (Kamaruddin *et al.*, 2001).

Research had been conducted and published that investigated whether individuals in agricultural occupations in the long term, more likely to suffer work-related disability, retire early, or change the type of work they did than individuals in other occupations. Result from an NHIS 2001 follow-up study was used to determine which occupations were associated with the greatest amount of musculoskeletal disability from the longest held jobs of individuals in a national probability sample. Farming was the occupation most often associated with disability in females and the second most often in males (Leigh & Fries, 1992). NHIS also found an increased risk of arthritis among farmers when compared to individuals in other occupations (Schenker, 1996).

Table 2.1 Summary of Literature Review

Author	Findings / Descriptions
Fathallah., (2009)	Agriculture sector is the most hazardous industries which can lead to problems such as musculoskeletal disorders, respiratory disease, noise induce hearing loss, pesticide- related illnesses and cancer.
Kirkhorn & Schenker., (2002)	Musculoskeletal complaints are a major cause of work leaves in developed countries that cause of short-term sickness absences.
Leigh & Fries., (1992)	One year prevalence rate of back pain among individuals working in production agriculture was about one and one half times higher than the average for all US industries.
Radwin et al., (2001)	Internal loads should be taken into consideration where is internal tolerance of tissues may be exceeded when accumulation of loading occurs due to repeated exposures, or exposures of long duration.
Hendra & Suwandi., (2009)	Lifting heavy FFB into the wheelbarrow and load up into the truck causing the most complaints that are perceived at the neck and lower back of harvesters who are working at oil palm plantation.
Hendra & Suwandi., (2009)	Repetitive movements of neck for a long duration will cause fatigue and excessive use of muscles, tendons, and joints of the

	neck that can cause muscle tension and increasing pressure on the nerve.
Hendra & Suwandi , (2009)	Awkward postures also occur in harvesting process and loading onto trucks and these postures can cause mechanical stress on the muscles, ligaments and joints that causing pain in skeletal muscle.
Sesto.,(2001)	Occupational risk factors associated with low back disorders include lifting, heavy physical work, static postures, such as stooping, whole body vibration and awkward postures, such as twisting.
Hendra & Suwandi., (2009)	Lifting heavy fresh fruit bunch into the wheelbarrow and load up into the truck causing the most complaints that are perceived at the neck and lower back.
Hendra & Suwandi., (2009)	Harvesters with the age of 35 years or more had a 2.56 times greater risk for experiencing MSDs than workers with less than 35 years of age.
Katowski., (2007)	Prevalence of workers having musculoskeletal symptoms was increased for 50% after their age more than 65 years old while for workers who in average age of 30 years old only have prevalence of 5 % having musculoskeletal symptoms.
Nizam & Rampal,	A high prevalence of work related back pain among oil palm

(2005)	plantation workers, which was 76.7% throughout their working experience in the plantation.
Kamaruddin *et al.*, (2001).	A study among oil palm plantation in Bintulu, Sarawak showed prevalence rate of back pain at 34.8%.
Kirkhon et al., (2010)	Musculoskeletal injuries are not lethal cases but it can cause in disability, cost work time and increased production costs.
Takala & Niu.,(2003).	Annual losses result from lost of productivity, premium of insurance also increase in all over the world.

CHAPTER 3

METHODOLOGY

3.1 Location of the study

The study was conducted in oil palm plantations namely the Gugusan Felda Lok Heng, in Kota Tinggi District, Johor and consists of 3 villages (Selatan, Timur and Barat) and Gugusan Waha. Kota Tinggi District had been choosen because most of economic activities involved in oil palm activities under the management of Federal Land Development Authority (FELDA).

3.2 Study design

A cross sectional study were conducted using face to face interviews, self administered questionnaires, direct observation of the harvesters work and a video- based analysis of the working postures by using the Rapid Upper Limb Assessment (RULA) method.

3.3 Sampling

3.3.1 Study population

The study population was harvesters from Gugusan Felda Lok Heng and Gugusan Felda Waha, Kota Tinggi District, Johor.

3.3.2 Study sample

3.3.2.1 Inclusive criteria

The study sample consists of harvesters who had fulfilled the inclusive criteria which are permanent workers who had been working for at least 12 months in the plantation. Only male workers were included and not more than 65 years old.

3.3.2.2 Exclusive criteria

Respondents who had history of major back trauma such as a motor vehicle accident, sport injury, fall from height, potentially serious spinal condition including cancer, compression fracture, spinal infection, drug abuse and mental disorders were excluded.

3.3.3 Sampling frame

The adopted sampling frames include the name lists of harvesters at plantation from Tenaga Kerja Indonesia (TKI) management.

3.3.4 Sampling unit

Study had been included harvesters who fulfill the inclusive and exclusive criteria.

3.3.5 Sampling method

Purposive sampling method was used and selection was based on inclusive and exclusive characteristic as in **3.3.2.3.**

3.3.6 Sample size

The sample size was determine by using formula (Daniel., 1999) which is :

$$\mathbf{n = Z^2\ P\ (1\text{-}P) / d^2}$$

Where; n = sample size

Z = statistic for a level of confidence

P = expected prevalence or proportion

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

Z statistic (Z): For the level of confidence of 95%, which is conventional, Z value is 1.96. This study were present the results with 95% confidence intervals (CI). The scale of P is from zero to one, and the sample size varies depending on the value of P. Therefore, in order to calculate the sample size, the estimation of prevalence (P) should be based on similar previous study.

Rosecrance et al. (2006) found more than 60% of Kansas farmers reported that they suffer from at least one farm related MSD symptoms. By using the previous prevalence, the estimation of sample size was;

$$\mathbf{n = (1.96)^2(0.6)(1\text{-}0.6) / (0.05)^2}$$

$$\mathbf{= 368.79}$$

$$\mathbf{\approx 369 \text{ workers}}$$

3.4 Variables

3.4.1 Dependent variable

Prevalence of musculoskeletal symptoms

3.4.2 Independent variable

- Occupational risk factor (Ergonomic risk factors; eg: awkward postures, repetition, forceful exertion and static postures)

- Environmental risk factor (eg; health status and daily activities besides work)

3.5 Data collection

3.5.1 Interview and Questionnaire

The interview session were conducted in the study to obtained information from respondent. Respondents were grouped together (about 15 people per group) in selected halls and they were interviewed to complete the self-administered questionnaire:

- The work tasks description on an ordinary working day and to identify what tasks them doing in ordinary work by interview session.

- The questionnaire included sections on respondents' personnel data (sociodemographic data, smoking habit, occupational history), and also postures while working. MSD symptoms were assessed using the modified Nordic

Musculoskeletal Questionnaire that has been widely used for assessment of musculoskeletal problem (Kuorinka *et al.*, 1987). The General Health Questionnaire (GHQ) was used to measure mental health status especially in detection of emotional disorders such as distress (Muhamad Saiful BY et al, 2009). As shown in Appendix 3.

3.5.2 Direct Postural Observation

In order to identify musculoskeletal exposure during the work task in oil palm plantation, direct postural observations were done. Firstly, the respondents were first screened for eligibility and then they were asked to perform their daily work activities. The working posture was recorded using a video recorder. Then scored by using RULA.

3.5.2.1 Rapid Upper Limb Assessment (RULA)

The RULA method (McAtamney & Corlett, 1993) was used to evaluate the level of ergonomic risk by observation of the posture of respondents while they were harvesting the oil palm at their plantations. Several scores evaluating the posture of different body parts were obtained through this method. The body parts assessed were primarily the upper limb (hand, wrist, elbow, shoulder), and also the neck and low back (due to trunk postures).

The procedure for using RULA was explained in three steps:

1. **The posture or postures for assessment were selected.**
2. **The postures were scored using the scoring sheet, body-part diagrams, and tables.**
3. **These scores were converted to one of the four action level.**

Body segment was divided into Group A and B. Group A includes the upper and lower arms and wrist, while for group B includes neck, trunk and legs.

For the first step, assessment was started by observing the postures adopted during the full work cycle or a significant working period prior to selecting the postures for assessment. Depending upon the type of study, the selection could be the longest held posture or what appear to be the worst postures adopted. It also can be useful to estimate the proportion of time spent in the various postures being evaluated (McAtamney & Corlett, 1992). An example of a RULA worksheet which includes the range of each body part is shown in Appendix 5.

Second step for RULA was decided whether the left, right, or both upper arms are at risk and need to be assessed. Then score the posture of each body part. Scoring for the group A which was includes the upper and lower arms and wrist. For upper arm position (**figure 3.1**), the score were added with 1 if shoulder was raised and upper arm was abducted and minus 1 score if arm was supported or person was leaning. While, for lower arm position (**figure 3.2**), would be added + 1 if either arm was working across

midline or out to side of body. Beside that, the score would be added +1 if wrist was bent from midline for wrist position (**figure 3.3**). For wrist twisted, + 1 if wrist was twisted in mid range and +2 if wrist was at or near end of range.

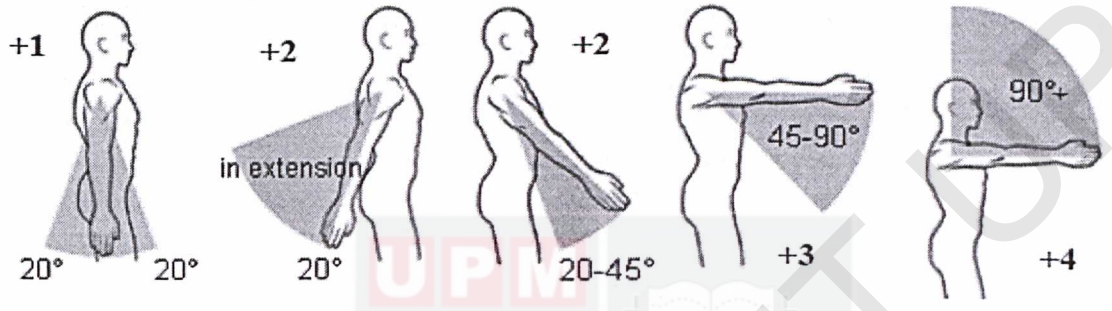


Figure 3.1 Upper arm position

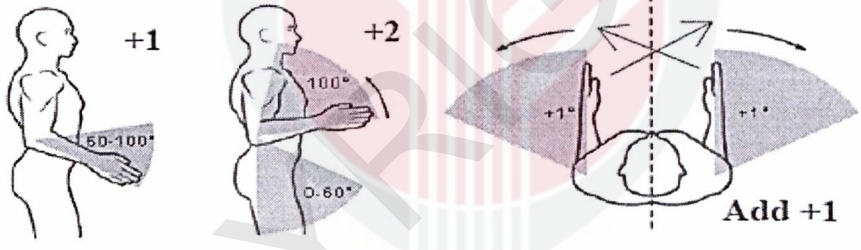


Figure 3.2 Lower arm position

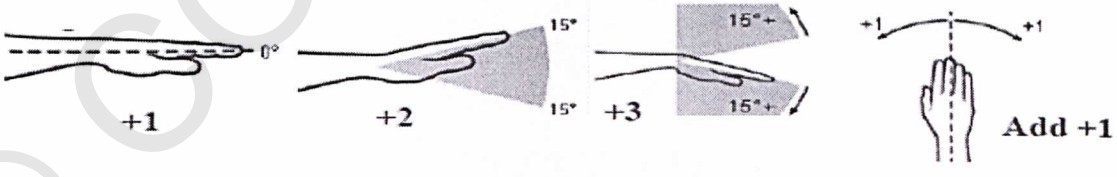


Figure 3.3 Wrist position

Neck, trunk and leg would be scored in part B where neck and trunk position (**figure 3.4** and **figure 3.5**) were added +1 if it was twisted or side bending and legs would be added +1 if it were supported and +2 if it were not supported. Then additional load and muscle used on the musculoskeletal system caused by excessive static muscle work, repetitive motion and the requirement to exert force or maintain an external load was also scored for each group A and B. The total for score A, muscle use and force produced score C, while the total for score B, muscle use and force produced score D. **Figure 3.6** shows the concept of the RULA scoring system.

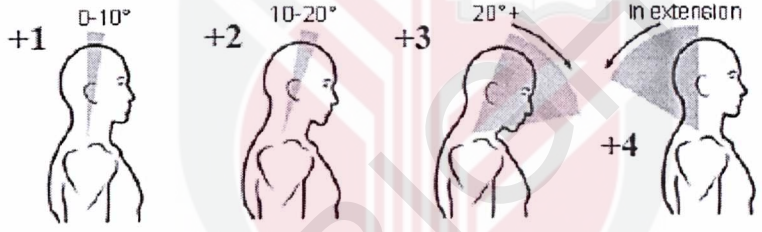


Figure 3.4 Neck position

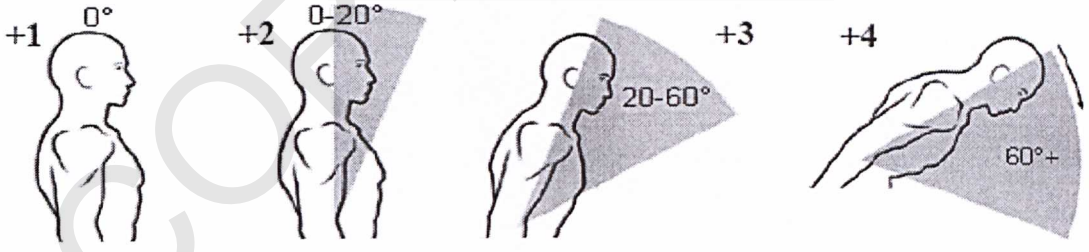


Figure 3.5 Trunk position

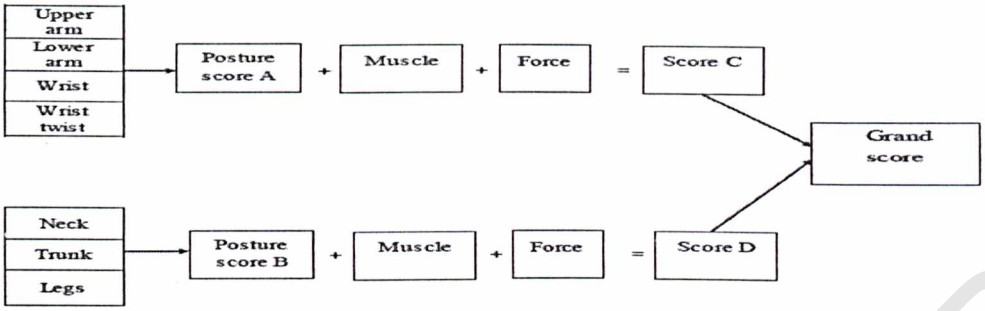


Figure 3.6 RULA scoring system

The third step was the grand score were compared with the list of action levels. It is obtained from score C and D. In most cases, to ensure that this guide was used as an aid in efficient and effective control of any risks identified, the actions lead to a more detailed investigation. The action levels were listed in Table 3.1.

Table 3.1 Classification Rapid Upper Limb Assessment action levels

	RULA action levels
Action level 1	Scores of 1 or 2 indicates that the postures is acceptable if it is not maintained or repeated for long periods
Action level 2	Scores 3 or 4 indicates that further investigation is needed, and changes may be required
Action level 3	Scores of 5 or 6 indicates that investigation and changes are required soon
Action level 4	Scores of 7 indicates that investigation and changes are required immediately

3.5.3 Ergonomic Assessment

Ergonomic assessment was done to determine the level of ergonomic hazards in oil palm plantation. In this assessment, Hazards Identification, Risk Assessment and Risk Control (HIRARC) guideline by DOSH (2008) were used as an application to identify ergonomic hazards. **Figure 3.7** shows the flowchart of HIRARC process and in Appendix 6 is a HIRARC form.

Hazards Identification, Risk Assessment and Risk Control (HIRARC) assessment at oil palm plantation were divided into four main steps:

i- Classification of the oil palm plantation's activities

ii- Identification of ergonomic hazards from tasks that were posing significant risks to the health.

iii- Analyze and estimate risks from each ergonomic hazards by calculating and estimating the likelihood of occurrence and severity of each ergonomic hazards which were identified.

iv- Decided whether risks were acceptable or not. If no acceptable control measure should be applied.

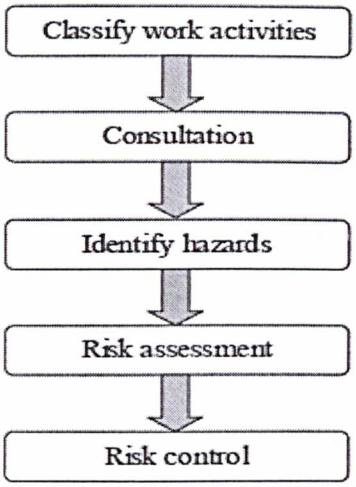


Figure 3.7 Flowchart of HIRARC process

3.5.3.1 Technique to identify hazards

There were multiple approached to identify ergonomic hazards were included:

i- Observations through a 'walk through' survey

ii- interview with harvesters

iii- MSD complaints

3.5.3.2 Estimating risk assessment

Then the potential risks which were identified were estimated by using a qualitative risk assessment method. Likelihood refers to an event occurring in a given period of time

(DOSH, 2008). Likelihood was based on the interview with harvesters and also through MSD complaint. Table 3.2 showed the descriptions of likelihood and its rating.

Table 3.2 Description of likelihood level and its rating

Likelihood (L)	Example	Rating
Most likely	The most likely result of the hazard /even being realized	5
Possible	Has a good chance of occurring and is not unusual	4
Conceivable	Might be occur at some time in future	3
Remote	Has not been known to occur after many years	2
Inconceivable	Is practically impossible and has never occurred	1

(Source: DOSH, 2008)

Severity refers to any forms of human impact criteria by referring to literature reviews. Table 3.3 indicates the descriptions of severity and its rating.

Table 3.3 Descriptions of severity and its rating

Severity (S)	Example	Rating
Catastrophic	Numerous fatalities, irrecoverable property damage and productivity	5
Fatal	Approximately one single fatality, major property damage if hazard is realized	4
Serious	Non-fatal injury, permanent disability, chronic MSD, in-patient MSD	3
Minor	Disabling but not permanent injury, acute MSD and prevention from doing normal activities	2
Negligible	Minor abrasions, bruises, cuts, first aid-type injury	1

(Source: DOSH, 2008)

By using likelihood rating and also severity rating, the relative risk was calculated by using the following formula:

Relative Risk (RR) = Likelihood (L) x Severity (S)

The relative risk value that obtained was used to prioritize necessary actions to effectively manage the ergonomics hazard identified. Table 3.4 describes relatives risk levels.

Table 3.4 Descriptions of relative risk levels

Risk	Description	Action
15-25	High	A **High** risk requires immediate action to control the hazard as detailed in the hierarchy of control. Actions taken must be documented on the risk assessment form including date for completion.
5-12	Medium	A **Medium** risk requires a planned approach to controlling the hazard and applies temporary measure if required. Actions taken must be documented on the risk assessment form including date for completion.
1-4	Low	A risk identified as **Low** may be considered as acceptable and further reduction may not be necessary. However, if the risk can be resolved quickly and efficiently, control measures should be implemented and recorded.

(Source: DOSH, 2008)

3.5.4 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 (Muhamad et al, 2009). The total question was 12 questions and it is on Malay language. The Malay version of GHQ-12 was derived based on two sources which were

the original version GHQ-12 (Goldberg D,1978) and the validated Malay version 30-items GHQ (Abdul & Hatta., 1996).

Each item is accompanied by four responses, typically being 'not at all', 'no more than usual', 'rather more than usual' and 'much more than usual'. The minimum GHQ-12 total score was 0 and the maximum GHQ-12 total score was 12. The General Health Questionnaire of 12 questions (GHQ-12) score equal to or more than 4 was considered as significant distress. The forms are shown in Appendix 4.

3.6 Instrumentation

3.6.1 Questionnaires

A self- administered questionnaire will be used in the survey: It was a close response questionnaire and it was translated into Indonesian translation. Divided into 5 sections which were:

Section A: personal information

Section B: working information

Section C: lifestyles

Section D: GHQ-12

Section E: Nordic Questionnaire (Appendix 3: the example of questionnaire)

The Nordic questionnaire (Kuorinka *et al.*, 1987) is used in the survey to measure: Musculoskeletal symptoms (low back pain, neck and shoulder pain, arm pain, knee and legs pain, hand pain, ankle and foot pain). In Appendix 1 is the Nordic questionnaire form.

3.6.2 Rapid Upper Limb Assessment (RULA)

The RULA method was used in the observational study to evaluate ergonomics risk of work related WMSD due to work posture, muscle use, forces exerted on the upper arms, lower arms, neck, trunk and legs. (McAtamney & Corlett, 1993; Pourmahabadian & Azam, 2006)

Ergonomic risk factors parts involved in this study such as static postures, forceful exertion, contact stress, repetitive body movement & manual handling.

3.6.3 Measuring tape and weighing scale

3.6.3.1 SECA Body Meter

This instrument was used to measure the height of the respondents. Heights of respondents were used to determine Body Mass index (BMI) which were included as cofounder in this study.

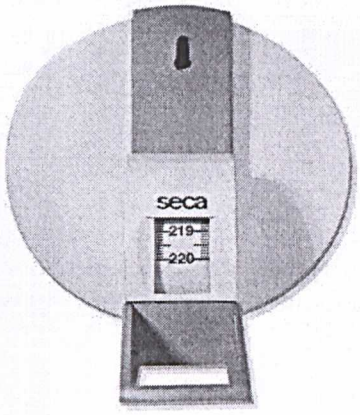


Figure 3.8 SECA Body Meter

3.6.3.2 SECA Weighing Scale

This instrument was used to measure the weight of the respondents. Weights of respondents were used to determine Body Mass index (BMI) which were included as cofounder in this study.

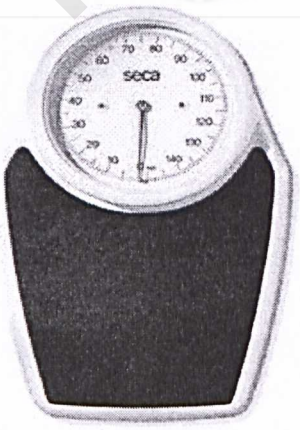


Figure 3.9 SECA Weighing Scale

3.6.4 HIRARC form

Hazard Identification, Risk Assessment and Risk Control (HIRARC) form was used to identify hazard, analyze and assess its associated risk and then apply the suitable control measures.

3.7 Quality Assurance

The purpose of pre-test was to test whether respondents would be able to understand the questions and answer them in the questionnaire as well as it is also to test if the questionnaire was able to meet the objectives of the study or not. Sets questionnaire were given to the selected harvesters and then the respondents were explaining about the objectives of the study and how to answer the questionnaire. After that, the respondents can give comments to improve the questionnaire.

Inter reliability test was done by had twice measurement by two assessor in same condition, place and into same respondents' characteristics at Felda Sungai Tengi, Kuala kubu Bharu. After that, the data given were analyzing using SPSS. Alpa Cronbach value more than 0.7 or 70%, so that the questionnaire can be preceded. The result of reliability test for self –administrated was 0.920. The reliability of RULA also was determined and the result was 0.836.

For the weight and height measurement, assessor was following Standard Operating Procedure (SOP) to avoid any mistaken steps. The measurement was repeated for three times.

3.8 Statistical Analysis

All of the data were computed and analyzed using SPSS (Statistical Package for Social Science) version 18.0.

3.8.1 Univariate Analysis

3.8.1.1 Socio Demographic

The univariate analysis was used to obtain percentage, median, interquartile range, mean, standard deviation. Besides, it is also used to determine the socio demography such as ethnics, marital status, education level, monthly income, duration of employment and working information such as duration of working per day, overtime per week, duration of rest, previous employment history, part time job, leisure activities and previous injuries history.

3.8.1.2 Prevalence of MSDs symptoms

The prevalence of MSDs symptoms was analyzed using univariate analysis in frequency and percentage.

3.8.1.3 RULA scores

RULA scores were analyzed in term of frequency, percentage, mean and standard deviation (SD). From RULA grand score a low risks (1-2 scores), medium risks (3-4 scores) and high risks of getting MSDs (5-7 scores) were determined.

3.8.2 Bivariate Analysis

Chi- square test was used to determine the association between MSDs symptoms with RULA score factors among harvesters in oil palm plantation and also association between MSDs symptoms with All data were analyzed with the significant values of $p<0.05$

3.8.3 Multivariate Analysis

Binary logistic regression analysis was used to determine the association between selected risks factors such BMI, years of employment, age. All data were analyzed with the significant values of $p<0.05$

3.9 Ethic clearance

This study was approved by UPM Faculty of Medicine and Health Sciences Ethics committee (UPM/FPSK/PADS/T7-MJKEtikaPer/F01(JKK(U)_Dis(11)26) as shown in Appendix 1. Consent letter (Appendix 3) was shown to each of the respondent before questionnaire session was in session. Any measurement and interview were carried with consent of respondents.

CHAPTER 4

RESULT

4.1 Demographic data

Results for first objective, a total of 129 harvesters participated in the study. Harvesters selected from two the plantations which were 86 harvesters from FELDA Lok Heng (representing 3 years old oil palm tree) and 43 respondents were selected from FELDA Waha (representing 5 years old oil palm tree). The mean age of the workers is 27.77±7.131 years old and the average BMI is in normal category was 21.19 ± 2.12. Majority was smokers (85.6%) and only 0.7% (1) of respondents consumed alcohol. One–fourths of the respondents had low levels of education. About 58.1% of the respondents had income in the range of RM 500 until RM 999 in a month and almost half of them (42.6%) had household for 1 to 3 people. (Table 4.1)

Table 4.1 Demographic data (N=129)

Characteristics	N (%)
Age (mean ± SD)	27.77±7.131
10-19 years	5 (3.9)
20-29 years	82 (63.6)
30-39 years	30 (23.3)
40-49 years	10 (7.8)
50-59 years	2 (1.6)
BMI	
<18.5	7 (5.4)
18.5-24.9	110 (85.3)
25-29.9	12 (9.3)
>30	0 (0)
Education level	
None	15 (11.6)
Primary	39 (30.2)
Secondary	38 (29.5)
Higher	37 (28.7)
Current smoker	
Yes	112 (86.8)
No	17 (13.2)
Alcohol consumption	
Yes	1(0.8)
No	128 (99.2)
Income	
<RM500	7 (4.7)
RM500-999	75 (58.1)
RM1000-1499	39 (30.3)
RM1500-1999	6 (4.7)
RM2000-2500	2 (1.6)
>RM2500	0 (0)
Household	
<1 person	9 (7.0)
1-3 persons	55 (42.6)
4-6 persons	51 (39.5)
7-9 persons	11 (8.5)
10-13 persons	2 (1.6)
14-16 persons	0 (0)
>17 persons	1 (0.8)

4.1.1 Psycho-Social Health

In regards to psycho-social health, 28 % of respondent lack of sleep because of they always thinking of their family and village where they cannot meet them until they are finished the contract with FELDA. Twenty six percent of the respondent always felt sad without any reason while doing their jobs and about 22.5% (29) not able to overcome their problems (financial, health and family). In term of stress, a few distress conditions for respondents during the period of work such as stress 7.0%, loss of believe 6.2% and felt useless 3.9%, however they were still satisfied with their current job (Table 4.2).

Table 4.2 General health characteristics (N= 129)

Characteristics	N (%)
Lack sleep	36 (27.9)
Stress	9 (7.0)
Concentration	3 (2.3)
Useful	1 (0.8)
Overcome problems	6 (4.7)
Able to make decisions	7 (5.4)
Cannot overcome problems	29 (22.5)
Feel happy	8 (6.2)
Enjoy the day	9 (7.0)
Feel sad	33 (25.6)
Lost of believe	8 (6.2)
Feel useless	5 (3.9)

The result of GHQ-12 total score, 10.3% of the respondents had significant psychological stress compared to others as shown in Table 4.3.

Table 4.3 Total score of GHQ

Score	N	%
0	56	43.4
1	32	24.8
2	19	14.7
3	8	6.2
4	12	9.3
5	0	0
6	2	1.6

(Significant distress ≥ 4)

4.1.2 Working Information

At the time of this study, 121 (93.8%) of the respondents were working on weekends, in which 7.0% of them working once in a month on weekend. Twenty six percent were working twice in a month on weekend, 30 (23.3%) of respondents working thrice in a month and 37.2% of the respondent worked every weekend.

For the working duration as a harvester had mean of 1.64± 0.49 years and for resting duration, they spend less than an hour a day during working (mean= 42.03 ± 26.0 minutes) (Table 4.4).

Table 4.4 Physical work characteristics (N=129)

Characteristics	N (%)
Working on weekend	121 (93.8)
Frequency working on weekend	
None	8 (6.2)
1 in a month	9 (7.0)
2 in a month	34 (26.4)
3 in a month	30 (23.3)
4 in a month	48 (37.2)
Duration of working as harvester (years)	
<1 years	53 (41.1)
1-5 years	76 (58.9)
>5 years	0 (0)
Working duration in a day (minutes)	
<360 minutes	28 (21.7)
360-419 minutes	34 (26.4)
420- 450 minutes	53 (41.1)
>450 minutes	14 (10.9)
Duration of resting in a day (minutes)	
<30 minutes	19 (14.7)
30-50 minutes	52 (40.3)
>50 minutes	58 (45.0)

From 129 respondents, only 63.6% of respondents had work experienced and about 29.5% had previous injuries which were feet 11.64%, hand 10.87%, finger 9.32%, head 5.43%, knee 3.88%, upper back 3.11%, lower back and thigh 2.33%, neck and elbows 1.55% (2) and shoulder 0.78% (1) .from 29.5% of the respondent who had previous injuries only 49.6% seek for treatment for the injury. (Table 4.5)

Table 4.5 Working history (N= 129)

	Yes	No
Variables	**N (%)**	**N (%)**
Working history	82 (63.6)	47 (36.4)
Had previous injuries	38 (29.5)	44 (34.1)
Head	7 (5.43)	31 (24.07)
Neck	2 (1.55)	36 (27.95)
Shoulder	1 (0.78)	37 (28.72)
Hand	14 (10.87)	24 (18.63)
Finger	12 (9.32)	26 (20.18)
Elbow	2 (1.55)	36 (27.95)
Upper back	4 (3.11)	34 (26.39)
lower back	3 (2.33)	35 (27.17)
Thigh	3 (2.33)	35 (27.17)
Knee	5 (3.88)	33 (25.62)
Feet	15 (11.64)	23 (17.86)
Seek Treatment	18 (49.6)	23 (14.0)

For leisure activities, 93.0% of the respondents prefer cooking, 82.9% for house chores such as washing clothes and swept inside the house, half of them 51.2% were doing sport activities, 26.4% enjoyed fishing, 14% gardening, 4.7% karaoke and 0.8% (1) were hunting in the jungle. From the activities during leisure time, only 19.4% (25) had injuries related to the activities they were doing. (Table 4.6)

Table 4.6 Leisure activities (N=129)

	Yes	No
Variables	**N (%)**	**N (%)**
Leisure activities		
Hunting	1 (0.8)	128 (99.2)
Gardening	18 (14.0)	111 (86.0)
Cooking	120 (93.0)	9 (7.0)
House core	107 (82.9)	22 (17.1)
Fishing	34 (26.4)	95 (73.6)
Karaoke	6 (4.7)	123 (95.3)
Sports	66 (51.2)	63 (48.8)
Injuries related to leisure activities	25 (19.4)	104 (80.6)

4.2 Prevalence of MSDs symptoms

4.2.1 Prevalence for total respondents

Result for second objective, Table 4.7 shows prevalence of MSDs symptoms among 129 of the respondent. From the result, lower back is the highest part that experienced MSDs symptom which was consisted of 60.5% (78 respondents), followed by knee part 43.4% (56 respondents), shoulder 38.8% (50 respondents), neck 34.1% (44 respondents), upper back 28.7% (37 respondents), arms 25.6% (33 respondents), feet 20.2% (26 respondents), and elbows 17.8% (23 respondents).

Lower back had a highest prevalence of respondents which is 32.58% (42 respondents) who had experienced problems that prevent them working in a normal condition, followed by knee 20.93% (27 respondents), neck and upper back 14.73% (19 respondents), shoulder 13.19% (17 respondents), arms and thigh 10.86% (14 respondents), feet 7.77% (10 respondents), and elbows 6.97% (9 respondents).

Besides, it found that lower back was the highest complained for the prevalence of MSDs problems experienced within 7 days which is 23.27% (30 respondents), followed by knee 12.99% (20 respondents), neck 11.1% (17 respondents), neck 11.63% (15 respondents, shoulder and knee 10.86% (14 respondents), thigh and elbows 4.66% (6 respondents), arms 3.88% (5 respondents) and feet 3.11% (4 respondents). Most of respondents agreed that MSDs problem experienced by them were came from their job tasks where the highest agreement in lower back which is 53.52% (69 respondents).

From 44 respondents which had problems in neck part, only 3.88% (5 respondents) have suffered injuries caused by accident, only 1.55% (2 respondents) gets treatment and 0.78% (1 participant) take medical leave for the injury and none of them have to replace working hour that they leave. For shoulder, from 50 respondents which had problems in this part, only 3.88% (5 respondents) have suffered injuries caused by accident, only 0.78% (1 respondents) gets treatment and non of them take medical leave for the injury and replace working hour that they leave.

About 23 respondents complaints experienced pain in elbows part where only 4.64% (6 respondents) have suffered injuries caused by accident, only 0.78% (1 respondent) seek treatment and none of them take medical leave for the injury replace working hour that they leave. Within 33 respondents which had problems in arms part, only 4.65% (6 respondents) have suffered injuries caused by accident, only 0.78% (1 participant) gets treatment and 0.78% (1 participant) take medical leave for the injury and 1.55% (2 respondents) have to replace working hour that they leave.

A total of 37 participants experienced pain at upper back part and only 2.33% (3 respondents) have suffered injuries caused by accident and none of them seek for treatment or take medical leave for the injury and replace working hour that they leave. Result shows that 78 respondents had problems in lower back part and within respondents only 4.65% (6 respondents) have suffered injuries caused by accident, only 1.55% (2 respondents) gets treatment, 2.33% (3 respondents) take medical leave for the injury and 0.78% (1 respondent) have to replace working hour that they leave.

The study showed that, 25 respondents which had problems in thigh part, only 2.33% (3 respondents) have suffered injuries caused by accident, less than 1% (1 respondents) gets treatment and none of them take medical leave for the injury and replace working hour that they leave. In term of problems in knee part, only 7% (9 respondents) have suffered injuries caused by accident, less than 1% (1 participant) gets treatment and 0.78% (1 participant) take medical leave for the injury and none of them have to replace

working hour that they leave. From 26 respondents which had problems in feet part, only 6.22% (8 respondents) have suffered injuries caused by accident, 2.33% (3 respondents) gets treatment and 3.11% (4 respondents) take medical leave for the injury and 1.56% (2 respondents) have to replace working hour that they leave.

4.2.2 Prevalence of MSDs for 3 years palm oil tree

For objective 2(a), Table 4.8 shows prevalence of MSDs symptoms among 43 of respondents who harvesting FFB. From the result, lower back is the highest part that experienced MSDs symptom which was consisted of 19.38% (25 respondents), followed by the knee (17.83%), neck 12.4% (16 respondents), shoulder 10.08% (13 respondents), upper back 8.53% (11 respondents), elbows 7.75% (10 respondents), arms 6.2% (8 respondents), feet 5.43% (7 respondents), and thigh 3.88% (5 respondents).

Table 4.7 Prevalence of MSDs symptoms (N=129)

Variables	Neck Yes N (%)	Shoulder Yes N (%)	elbows Yes N (%)	arms Yes N (%)	upper back Yes N (%)	lower back Yes N (%)	Thigh Yes N (%)	knee Yes N (%)	Feet Yes N (%)
Life time MSDs symptoms (in the next 12 months)	44 (34.1)	50 (38.8)	23 (17.8)	33 (25.6)	37 (28.7)	78 (60.5)	25 (19.4)	56 (43.4)	26 (20.2)
MSDs prevent normal work	19 (14.73)	17 (13.19)	9 (6.97)	14 (10.86)	19 (14.74)	42 (32.58)	14 (10.86)	27 (20.93)	10 (7.77)
Have problems in past 7 days	15 (11.63)	14 (10.86)	6 (4.64)	5 (3.88)	12 (9.31)	30 (23.27)	6 (4.66)	14 (10.85)	4 (3.11)
Job cause MSDs problem	39 (30.23)	45 (34.92)	22 (17.03)	29 (22.5)	33 (25.6)	69 (53.52)	23 (17.85)	53 (41.08)	26 (20.2)
Injuries cause by accident	5 (3.88)	5 (3.88)	6 (3.92)	6 (4.65)	3 (2.33)	6 (4.65)	3 (2.33)	9 (6.98)	8 (6.22)
treatment	2 (1.55)	1 (0.78)	2 (1.31)	1 (0.78)	0 (0)	2 (1.55)	1 (0.78)	1 (0.78)	3 (2.33)
medical leave	1 (0.78)	0 (0)	0 (0)	1 (0.78)	0 (0)	3 (2.33)	0 (0)	1 (0.78)	4 (3.11)
replace work duration	0 (0)	0 (0)	0 (0)	2 (1.55)	0 (0)	1 (0.78)	0 (0)	0 (0)	2 (1.56)

Table 4.8 Prevalence of MSDs symptoms for FFB's harvesters for 3 years palm oil tree (N=43)

Variables	Neck	shoulder	elbows	arms	upper back	lower back	thigh	knee	Feet
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Life time MSDs symptoms (in the next 12 months)	16 (12.40)	13 (10.08)	10 (7.75)	8 (6.20)	11 (8.53)	25 (19.38)	5 (3.88)	23 (17.83)	7 (5.43)
MSDs prevent normal work	9 (6.98)	2 (1.55)	5 (3.88)	1 (0.78)	3 (2.33)	14 (10.85)	2 (1.55)	9 (6.98)	2 (1.55)
Have problems in past 7 days	7 (5.43)	4 (3.10)	2 (1.55)	0 (0)	4 (3.10)	9 (6.98)	0 (0)	2 (1.55)	1 (0.78)
Job cause MSDs problem	14 (10.83)	12 (9.30)	10 (7.75)	6 (4.65)	9 (6.98)	23 (17.83)	5 (3.88)	21 (16.28)	7 (5.43)
Injuries cause by accident	1 (0.78)	0 (0)	2 (1.55)	1 (0.78)	2 (1.55)	2 (1.55)	1 (0.78)	4 (3.10)	3 (2.33)
treatment	1 (0.78)	0 (0)	0 (0)	1 (0.78)	0 (0)	1 (0.78)	0 (0)	1 (0.78)	3 (2.33)
medical leave	1 (0.78)	0 (0)	0 (0)	1 (0.78)	0 (0)	1 (0.78)	0 (0)	1 (0.78)	3 (2.33)
replace work duration	0 (0)	0 (0)	0 (0)	1 (0.78)	0 (0)	1 (0.78)	0 (0)	0 (0)	1 (0.78)

Table 4.9 shows the results for objective 2 (b), the prevalence of MSDs symptoms among 43 FFB's collector. From the result, lower back is the highest part experienced which consisted of 24% (31 respondents), followed by shoulder pain (19.38%), neck pain (15.50%), knee 13.95% (18 respondents), upper back and thigh 13.18% (17 respondents), arms 10.8% (13 respondents), arms 6.2% (8 respondents), feet 9.30% (12 respondents), and elbows 7.75% (10 respondents).

Table 4.9 Prevalence of MSDs symptoms for FFB's collectors for 3 years oil palm tree (N=43)

Variables	Neck	shoulder	elbows	arms	upper back	lower back	thigh	knee	Feet
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Life time MSDs symptoms (in the next 12 months)	20 (15.50)	25 (19.38)	10 (7.75)	13 (10.08)	17 (13.18)	31 (24.03)	17 (13.18)	18 (13.95)	12 (9.30)
MSDs prevent normal work	10 (7.75)	12 (9.30)	4 (3.10)	8 (6.20)	11 (8.53)	21 (16.28)	11 (8.53)	14 (10.85)	6 (4.65)
Have problems in past 7 days	5 (3.88)	8 (6.20)	3 (2.33)	2 (1.55)	5 (3.88)	17 (13.18)	5 (3.88)	9 (6.98)	2 (1.55)
Job cause MSDs problem	19 (14.73)	23 (17.83)	9 (6.98)	13 (10.08)	15 (11.63)	28 (21.70)	16 (12.40)	18 (13.95)	12 (9.30)
Injuries cause by accident	3 (2.33)	4 (3.10)	3 (2.33)	3 (2.33)	1 (0.78)	4 (3.10)	2 (1.55)	5 (3.88)	4 (3.10)
treatment	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.78)	1 (0.78)	1 (0.78)	2 (1.55)
medical leave	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (1.55)	0 (0)	0 (0)	1 (0.78)
replace work duration	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.78)

4.2.3 Prevalence of MSDs for 5 years oil palm tree (N=43)

Table 4.10 shows prevalence of MSDs symptoms among 43 FFB's harvesters for objective 2(c). In terms of experiencing pain, lower back is the highest part (8.53%), followed by shoulder pain (6.98%), arms and knee pain (3.88%), neck pain (2.33%), shoulder pain (10.1%), followed by upper back pain (1.55%), feet and elbows 0.78% (1 participant), and none reported having thigh pain.

The result from Table 4.11 answered objective 2 (d), the prevalence of MSDs symptoms among 43 FFB's collector shows that lower back is the highest part that experienced MSDs symptom which was consisted of 8.53% (11 respondents), followed by knee part 7.75% (10 respondents), arms and upper back 5.43% (7 respondents), feet 4.65% (6 respondents), neck 3.88% (5 respondents), thigh and shoulder 2.33% (3 respondents) and elbows 1.55% (2 respondents).

Table 4.10 Prevalence of MSDs symptoms for FFB's harvesters for 5 years oil palm tree (N=23)

Variables	Neck	shoulder	elbows	arms	upper back	lower back	thigh	knee	Feet
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Life time MSDs symptoms (in the next 12 months)	3 (2.33)	9 (6.98)	1 (0.78)	5 (3.88)	2 (1.55)	11 (8.53)	0 (0)	5 (3.88)	1 (0.78)
MSDs prevent normal work	0 (0)	3 (2.33)	0 (0)	2 (1.55)	2 (1.55)	3 (2.33)	0 (0)	1 (0.78)	0 (0)
Have problems in past 7 days	1 (0.78)	1 (0.78)	0 (0)	1 (0.78)	0 (0)	1 (0.78)	0 (0)	0 (0)	0 (0)
Job cause MSDs problem	1 (0.78)	8 (6.20)	1 (0.78)	4 (3.10)	2 (1.55)	8 (6.20)	0 (0)	4 (3.10)	1 (0.78)
Injuries cause by accident	0 (0)	0 (0)	0 (0)	1 (0.78)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.78)
treatment	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
medical leave	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
replace work duration	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Table 11 Prevalence of MSDs symptoms for FFB's collectors for 5 years oil palm tree (N=20)

Variables	Neck	shoulder	elbows	arms	upper back	lower back	thigh	knee	Feet
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Life time MSDs symptoms (in the next 12 months)	5 (3.88)	3 (2.33)	2 (1.55)	7 (5.43)	7 (5.43)	11 (8.53)	3 (2.33)	10 (7.75)	6 (4.65)
MSDs prevent normal work	0 (0)	0 (0)	0 (0)	3 (2.33)	3 (2.33)	4 (3.10)	1 (0.78)	3 (2.33)	2 (1.55)
Have problems in past 7 days	2 (1.55)	1 (0.78)	1 (0.78)	2 (1.55)	3 (2.33)	3 (2.33)	1 (0.78)	3 (2.33)	1 (0.78)
Job cause MSDs problem	5 (3.88)	2 (1.55)	2 (1.55)	6 (4.65)	7 (5.43)	10 (7.75)	2 (1.55)	10 (7.75)	6 (4.65)
Injuries cause by accident	1 (0.78)	1 (0.78)	1 (0.78)	1 (0.78)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
treatment	1 (0.78)	1 (0.78)	1 (0.78)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
medical leave	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
replace work duration	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

4.2.4 Lifetime Prevalence of MSD

The study showed that, the life time prevalence of MSD shows that a very high prevalence of MSD 93.8% (121 respondents). Out of 129 respondents, majority of the harvesters had one or more complain of pain at any body parts as shown in Table 4.12.

Table 4.12 Total MSDs

Total MSDs symptoms	N	%
Having MSDs symptom		
Yes	121	93.8
No	8	6.2

4.3 Postural Analysis

Table 4.13 shows the distribution of RULA scoring that answered objective 3. The mean upper arms score of the harvesters was 3.88 indicating an average degree of shoulder flexion more than 90°, while the average lower arms score was 2.47, indicating elbow flexion between 60° to 100°. The average wrist score was 2.07, which meant that the wrists were placed in an extension position with an angle less than 15°. The mean neck score was 1.86 and the mean of trunk score was 3.03, which meant that the neck and trunk of the respondents were either in flexion, rotation, side bending or in combination.

The final RULA grand score of total harvesters ranged from a minimum of 4 to a maximum of 7 with an average score of 6.26 indicating that the average harvesters action level of 3. Twenty percent, of respondents had a total score of 6 who needed prompt investigation and changes to avoid serious harm (action level 3). Furthermore, 58.1% of the respondents had a score of 7 who required immediate changes to avoid serious physical damage (action level 4).

Table 4.13 The RULA scoring (N=129)

	Body part N (%)								
RULA score	Upper arms	Lower arms	Wrists	Final wrists &arms	Neck	Trunk	Legs	Final neck, trunk& legs	Grand score
1	-	5 (3.9)	19 (14.7)	-	59 (45.7)	7 (5.4)	128 (99.2)	-	-
2	8 (6.2)	59 (45.7)	82 (63.3)	-	53 (41.1)	23 (17.8)	1 (0.8)	-	-
3	42 (32.6)	65 (50.43)	28 (21.7)	2 (1.6)	1 (0.8)	58 (45.0)	-	2 (1.6)	-
4	50 (38.8)	-	-	24 (18.6)	8 96.2)	41 (31.8)	-	30 (23.3)	13 (10.1)
5	15 (11.6)	-	-	34 (26.4)	8 (6.2)	-	-	21 (16.3)	15 (11.6)
6	14 (10.9)	-	-	32 (24.8)	-	-	-	46 (35.7)	26 (20.2)
7	-	-	-	14 (10.9)	-	-	-	19 (14.7)	75 (58.1)
>7	-	-	-	23 (17.9)	- -	-	-	11 (8.5)	-
Mean (SD)	**3.88 (1.06)**	**2.47 (0.57)**	**2.07 (0.6)**	**6.16 (2.12)**	**1.86 (1.12)**	**3.03 (0.85)**	**1.01 (0.09)**	**5.71 (1.4)**	**6.26 (1.02)**

For the characterization of risks based on RULA grand score for total number of respondents, about 10.1% (13 respondents) had a medium score (3-4 scores) while the rest of respondents which was 89.9% (116 respondents) had a high risks of getting MSDs (5-7 scores). (Table 4.14)

Table 4.14 Risk of MSD Based on RULA Score

Risks	N	%
Low (1-2 score)	0	0
Medium (3-4 score)	13	10.1
High (5-7 score)	116	89.9

For objective 3 (a), the mean upper arms score of FFB's harvesters in 3 years old plantation was 3.37 indicating an average degree of shoulder flexion more than 90°, while the average lower arms score was 2.44 indicating elbow flexion between 60° to 100°. The average wrist score was 1.63, which meant that the wrists were placed in an extension position with an angle less than 15°. The mean neck score was 1.81 and the mean of trunk score was 3.02, which meant that the neck and trunk of the respondents were either in flexion, rotation, side bending or in combination while cutting the fruit bunch from the oil palm tree.

The final RULA grand score of FFB's harvesters in 3 years old plantation ranged from a minimum of 6 to a maximum of 7 with an average score of 6.81 indicating that the average FFB's harvesters needed action level 3. 6.02% of respondents had a total score of 6 who needed prompt investigation and changes to avoid serious harm (action level 3). Furthermore, 27.13% of the respondents had a score of 7 who required immediate changes to avoid serious physical damage (action level 4). (Table 4.15)

Table 4.15: RULA score for FFB's harvesters for 3 years oil palm tree

Body part N (%)									
RULA score	Upper arms	Lower arms	Wrists	Final wrists &arms	Neck	Trunk	Legs	Final neck, trunk& legs	Grand score
1	-	2 (1.55)	18 (13.95)	-	8 (6.20)	-	43 (33.3)	-	-
2	5 (3.88)	20 (15.50)	23 (17.83)	-	35 (27.13)	4 (3.10)	-	-	-
3	19 (14.71)	21 (16.28)	2 (1.55)	-	-	34 (26.35)	-	-	-
4	17 (13.18)	-	-	1 (0.77)	-	5 (3.88)	-	2 (1.55)	-
5	2 (1.55)	-	-	11 (8.52)	-	-	-	6 (4.65)	-
6	-	-	-	22 (17.05)	-	-	-	25 (19.38)	8 (6.20)
7	-	-	-	7 95.43)	-	-	-	7 (5.43)	35 (27.13)
>7	-		-	2 (1.55)	-	-	-	3 (2.33)	-
Mean (SD)	**3.37 (0.76)**	**2.44 (0.59)**	**1.63 (0.58)**	**6.0 (0.98)**	**1.81 (0.39)**	**3.02 (0.46)**	**1 (0)**	**6.07 (0.88)**	**6.81 (0.39)**

For the characterization of risks based on RULA grand score, none of them had a low or medium risks of getting MSDs and all of FFB's harvesters which was 33.33% (43 respondents) had a high risks of getting MSDs (5-7 scores). (Table 4.16)

Table 4.16 Risk of MSDs

Risks	N	%
Low (1-2 score)	0	0
Medium (3-4 score)	0	0
High (5-7 score)	43	33.33

While, for objective 3 (b), table 4.17 shows the mean upper arms score of FFB's collectors in 3 years old plantation was 3.58 indicating an average degree of shoulder flexion more than 90^{o}, while the average lower arms score was 2.26 indicating elbow flexion between 60^{o} to 100^{o}. The average wrist score was 2.09, which meant that the wrists were placed in an extension position with an angle between 0^{o} until 15^{o}. The mean neck score was 1.16 and the mean of trunk score was 3.40, which meant that the neck and trunk of the respondents were either in flexion, rotation, side bending or in combination while carrying the fruit bunch from the oil palm tree.

The final RULA grand score of FFB's collectors in 3 years old plantation as shown in table 4.17 was ranged from a minimum of 4 to a maximum of 7 with an average score of 5.6 indicating that the average FFB's collectors needed action level 3. 9.30% of respondents had a total score of 6 who needed prompt investigation and changes to

avoid serious harm (action level 3). Furthermore, 9.30% of the respondents had a score of 7 who required immediate changes to avoid serious physical damage (action level 4). (Table 4.17)

Table 4.17: RULA score for FFB's collector for 3 years oil palm tree

	Body part N (%)								
RULA score	Upper arms	Lower arms	Wrists	Final wrists &arms	Neck	Trunk	Legs	Final neck, trunk& legs	Grand score
1	-	2 (1.55)	1 (0.77)	-	37 (28.68)	-	42 (32.56)	-	-
2	3 (2.33)	28 (21.70)	37 (28.68)	-	5 (3.88)	2 (1.55)	1 (0.77)	-	-
3	17 (13.18)	13 (10.08)	5 (3.88)	-	1 (0.77)	22 (17.05)	-	2 (1.55)	-
4	18 (13.95)	-	-	16 (12.4)	-	19 (14.71)	-	19 (14.71)	10 (7.75)
5	5 (3.88)	-	-	18 (13.95)	-	-	-	4 (3.10)	9 (6.98)
6	-	-	-	4 (3.10)	-	-	-	14 (10.85)	12 (9.30)
7	-	-	-	4 (3.10)	-	-	-	4 (3.10)	12 (9.30)
>7	-	-	-	1 (0.77)	-	-	-	-	-
Mean (SD)	**3.58 (0.79)**	**2.26 (0.54)**	**2.09 (0.37)**	**4.98 (1.04)**	**1.16 (0.43)**	**3.40 (0.58)**	**1.02 (0.15)**	**4.98 (1.17)**	**5.6 (1.14)**

In terms of characterizing risks based on RULA grand score about 7.75% (10 respondents) had a medium score (3-4 scores) while the rest of respondents which was 25.58% (116 respondents) had a high risks of getting MSDs (5-7 scores). (Table 4.18)

Table 4.18 Risk of MSDs

Risks	N	%
Low (1-2 score)	0	0
Medium (3-4 score)	10	7.75
High (5-7 score)	33	25.58

Objective 3 (c) was answered by the results obtained in table 4.19 where the mean upper arms score of FFB's harvesters in 5 years old plantation was 5.48 indicating an average degree of shoulder flexion more than 90°, while the average lower arms score was 2.74 indicating elbow flexion between 60° to 100°. The average wrist score was 2.57, which meant that the wrists were placed in an extension position with an angle between 0° until 15°. The mean neck score was 3.65 indicating that the neck extend and were either in twisted, side bending or in combination while cutting the fruit bunch from the oil palm tree. The trunk scores 1.7 indicating that the trunk was erected while working and sometimes twisted or side bending.

Besides, the final RULA grand score of FFB's harvesters in 5 years old plantation shows a range from a minimum of 6 to a maximum of 7 with an average score of 6.91 indicating that the average harvesters needed action level 3. 1.55% of respondents had a total score of 6 who needed prompt investigation and changes to avoid serious harm

(action level 3). Furthermore, 16.28% of the respondents had a score of 7 who required immediate changes to avoid serious physical damage (action level 4). (Table 4.19)

Table 4.19 RULA score for FFB's harvesters for 5 years oil palm tree, (N=23)

	Body part N (%)								
RULA score	Upper arms	Lower arms	Wrists	Final wrists &arms	Neck	Trunk	Legs	Final neck, trunk& legs	Grand score
1	-	-	-	-	2 (1.55)	7 (5.43)	23 (17.83)	-	-
2	-	6 (4.65)	10 (7.75)	-	5 (3.88)	16 (12.40)	-	-	-
3	-	17 (13.18)	13 (10.08)	-	-	-	-	-	-
4	3 (2.33)	-	-	-	8 (6.20)	-	-	7 (5.43)	-
5	6 (4.65)	-	-	-	8 (6.20)	-	-	-	-
6	14 (10.85)	-	-	1 (0.78)	-	-	-	-	2 (1.55)
7	-	-	-	2 (1.55)	-	-	-	8 (6.20)	21 (16.28)
>7	-	-	-	20 (15.51)	-	-	-	8 (6.20)	-
Mean (SD)	**5.48 (0.73)**	**2.74 (0.45)**	**2.57 (0.51)**	**9.87 (1.55)**	**3.65 (1.40)**	**1.7 (0.47)**	**1 (0)**	**6.78 (2.07)**	**6.91 (0.29)**

Based on RULA grand score, characterization of hazards had be made as shown in table 4.20 where none of them had a low or medium risks of getting MSDs and all of respondents who had a jobs to cut the fruit bunch which was 17.83% (23 respondents) had a high risks of getting MSDs (5-7 scores).

Table 4.20 Risk of MSDs

Risks	N	%
Low (1-2 score)	0	0
Medium (3-4 score)	0	0
High (5-7 score)	23	17.83

Table 4.21 shows results of RULA score that answered objective 3 (d). The mean upper arms score of FFB's collector in 5 years oil palm plantation was 3.8 indicating an average degree of shoulder flexion more than $90^{o,}$ while the average lower arms score was 2.65 indicating elbow flexion between 60^{o} to 100^{o} .The average wrist score was 2.40, which meant that the wrists were placed in an extension position with an angle between 0^{o} until 15^{o}. The mean neck score was 1.4 and the mean of trunk score was 3.8, which meant that the neck and trunk of the respondents were either in flexion, rotation, side bending or in combination while carrying the fruit bunch from the oil palm tree.

The range from a minimum of 4 to a maximum of 7 with an average score of 5.75 of final RULA grand score for FFB's collectors indicating that the average FFB's collectors needed action level 3. 3.10% of respondents had a total score of 6 who needed prompt investigation and changes to avoid serious harm (action level 3). Furthermore, 5.43% of the respondents had a score of 7 who required immediate changes to avoid serious physical damage (action level 4). (Table 4.21)

Table 4.21 RULA score for FFB's collectors for 5 years oil palm tree (N=43)

	Body part N (%)								
RULA score	Upper arms	Lower arms	Wrists	Final wrists &arms	Neck	Trunk	Legs	Final neck, trunk& legs	Grand score
1	-	1 (0.78)	-	-	12 (9.3)	-	20 (15.50)	-	-
2	-	5 (3.88)	12 (9.30)	-	8 (6.20)	1 (0.78)	-	-	-
3	6 (4.65)	14 (10.85)	8 (6.20)	2 (1.55)	-	2 (1.55)	-	-	-
4	12 (9.3)	-	-	7 (5.43)	-	17 (13.18)	-	2 (1.55)	3 (2.33)
5	2 (1.55)	-	-	5 (3.88)	-	-	-	11 (8.53)	6 (4.65)
6	-	-	-	5 (3.88)	-	-	-	7 (5.43)	4 (3.10)
7	-	-	-	1 (0.78)	-	-	-	-	7 (5.43)
>7	-	-	-	-	-	-	-	-	-
Mean (SD)	**3.8 (0.62)**	**2.65 (0.59)**	**2.40 (0.5)**	**4.8 (1.11)**	**1.4 (0.5)**	**3.8 (0.52)**	**1 (0)**	**5.25 (0.64)**	**5.75 (1.12)**

For the characterization of risks based on RULA grand score about 2.33% (3 respondents) had a medium score (3-4 scores) while the rest of respondents which was 13.18% (17 respondents) had a high risks of getting MSDs (5-7 scores). (Table 4.22)

Table 4.22 Risk of MSDs

Risks	N	%
Low (1-2 score)	0	0
Medium (3-4 score)	3	2.33
High (5-7 score)	17	13.18

4.4 Ergonomics risk factors

Table 4.23 answered objective 4 to identify ergonomics risk factors that contributed to MSDs symptoms among harvesters. Regarding risk level among harvesters, two main activities in oil palm plantation are harvesting fresh fruit bunch and collecting fruit bunch exposed to medium and high levels of ergonomics risk factors. Activities in harvesting FFB that exposed to high level of ergonomic risk are prolonged standing and repetitiveness while medium level activities are awkward posture and excessive loading whereas fresh fruit bunch's collector exposed to awkward postures, prolonged standing and repetitiveness as high risk factor and excessive loading as medium risk.

Table 4.23 Risk Level Associated among Harvesters

Hazard(s)	Activity/ location	L*	S **	Risk	Level	Remarks
Awkward posture	• Harvest FFB	4	3	12	M	• Flexion of body and extension of neck during work
	• Collect FFB	5	3	15	H	• Flexion of body more than 60^0 during collect fruit bunch
Prolonged standing	• Harvest FFB	5	3	15	H	Involve :
	• Collect FFB	5	3	15	H	• Static posture to the knee and feet
Excessive loading	• Harvest FFB	4	2	8	M	• Excessive load during carrying chisel (chisel weight ≥ 3 kg) and cut fruit bunch
	• Collect FFB	5	2	10	M	• Excessive load during carrying fruit bunch (weight most of time ≥ 10 kg)
Repetitiveness	• Harvest FFB	5	3	15	H	• Repetitiveness while working for a day
	• Collect FFB	5	3	15	H	

*likelihood, **severity
H= high risk, M=medium risk, L=low risk
Note: only for ergonomic hazards

4.5 Factor associated with MSDs symptoms

For possible confounders of age, BMI, years of employments, working in weekend, frequencies working in weekend, duration of work, resting duration, working experiences and household, were analyzed to know the association of these cofounders with total MSDs symptoms of harvesters.

From results showed that there is a significance association between body mass index (BMI) and total MSDs symptoms among FFB's harvesters in 3 years old oil palm tree plantation. (Table 4.24)

From results showed that there is a significance association between years of employment and total MSDs symptoms among FFB's harvesters in 5 years old oil palm tree plantation. (Table 4.25)

Table 4.24 Factor associated with Total MSDs symptoms palm oil tree ≤ 3 years (FFB's harvesters)

Variables	No	Yes	X^2	P value
	N (%)	N (%)		
Age				
<30	1(2.33)	24(55.81)	0.737	0.391
≥30	0 (0)	18(41.86)		
BMI				
Normal	0 (0)	34(79.07)	4.354	**0.037***
Not normal	1(2.33)	7(16.28)		
No of household	0(0)	23(53.49)	0.271	0.603
0-2	1 (2.33)	13(30.23)		
>2				
Resting hour	0(0)	1(2.33)	0.024	0.876
≤15 min	1 (2.33)	41(95.35)		
>15 min				
Working hour	0 (0)	15(34.88)	0.548	0.459
≤360 min	1(2.33)	27(62.79)		
>360 min				
Total GHQ score	1(2.33)	39(90.7)	0.077	0.782
≤3	0 (0)	3(6.9)		
>3				
Years of employment	0 (0)	26(60.47)	2.645	0.450
1-3 years	1(2.33)	16(37.21)		
>3 years				

*significance $p<0.05$

Table 4.25 Factor associated with Total MSDs symptoms palm oil tree ≤ 5 years (FFB's harvesters)

Variables	No	Yes	X^2	P value
	N (%)	N (%)		
Age				
<30	1(4.35)	11(47.83)	0.491	0.484
≥30	2(8.7)	9(39.13)		
BMI				
Normal	2(8.7)	14(60.87)	0.014	0.907
Not normal	1(4.35)	6(26.09)		
No of household				
0-2	1(4.35)	9(39.13)	0.144	0.704
>2	2(8.7)	11(47.83)		
Resting hour				
≤15 min	0(0)	6(26.09)	1.303	0.254
>15 min	3(13.04)	13(56.52)		
Working hour				
≤360 min	0 (0)	11(47.83)	3.163	0.075
>360 min	3(13.04)	9(39.13)		
Total GHQ score				
≤3	3(13.04)	17(73.91)	0.518	0.472
>3	0 (0)	3(13.04)		
Years of employment				
1-3 years	0 (0)	6(26.07)	8.306	**0.040***
>3 years	2(8.7)	14(60.87)		

*significance p<0.05

CHAPTER 5

DISCUSSION, RECOMMENDATION & CONCLUSION

5.1 Socio-demographic data

In this study, 129 harvesters were selected where they from two plantations which were 86 harvesters of 3 years old oil palm tree and 43 harvesters of 5 years old oil palm tree and then divided into two tasks; cut fruit bunches and carried the fruit bunches. The mean age was 28 years and all of them are male which were selected from Tenaga Kerja Indonesia (TKI) and most respondents had a BMI in the normal range which had a mean 21.18 and not having any diseases. It is in line with the information given by FELDA management in which only young and healthy workers were selected to work in plantation. Harvesters or workers who had chronic illnesses would be sent back to their country.

About 27.9 % (36) of respondents lack of sleep because of they always thinking of their family and village where they cannot meet them until they are finished the contract with FELDA. Few of them which are 25.6% (33) of respondents were always felt sad without any reason while doing their jobs and about 22.5% (29) not able to overcome their problems such as financial problems, health problems and family problems. Otherwise, there were only a few distress conditions for respondents during the period of work such as stress 7.0% (9), lost of believe 6.2% (8) and felt useless 3.9% (5) but they were still satisfied with their jobs (Table 2) because they thought of working here to improve their family's life and collected the money.

The General Health Questionnaire of 12 questions (GHQ-12) score equal to or more than 4 was considered as significant distress (Muhammad., 2009) and from result of total score of GHQ-12, 14 (10.9%) of respondents which is 12 (9.3%) of respondents got 4 marks and 2 (1.6%) of respondents got 6 marks. The total score of GHQ-12 shows that 16 of respondents were considered as had significant distress (table 3).

5.2 Prevalence of MSDs symptoms

The result of this study showed a high prevalence of work related LBP (60.5%) among oil palm plantation workers throughout their working experience in the plantation. This study confirmed the earlier report that LBP had a high prevalence of work related pain in oil palm plantation workers. A study among 103 oil palm plantation workers in Selangor

showed a prevalence rate of back pain at 76.7% throughout their working experience in the plantation and 67% in the last 12 months duration. (Nizam & Rampal, 2005). Moreover, other study showed back pain prevalence of 83.8% among harvesters in oil palm plantation (Hendra & Suwandi, 2009). The result showed similarity due to the study was conducted on a same set of population where the respondents were Indonesian workers in a younger age group (mean age was 27.77±7.131 years old). Low back was found to be main part affected in this study as a result from harvesting and collecting FFB work process that involved flexion of workers' body more than 60^{0} that occurred repeatedly throughout working duration. Movement of lower back repeatedly and continuously throughout working duration will cause overuse on muscle, tendon and joint and then its lead to muscle cramps and pressure to the nerve (Hendra & Suwandi, 2009). Awkward postures also occurred to the workers while they were harvesting and collecting FFB. This situation was lead to mechanical stress on muscle, ligament and joint and caused pain on musculoskeletal.

Based to an assessment of ergonomic risk using the RULA method, 89.9% of the harvesters were found to have an extreme posture (action level 4) that required a need for an immediate investigation and also change immediately which can be categorized as having high risk of MSDs symptom, while only 10.1% of them, at level 3, needed an investigation and a change in work habits soon (medium risk). In addition to the high RULA scores, the main part that was affected in this study was low back (high prevalence). This representation of symptoms may related to the harvesting of oil palm

fruit in plantation with 3 years old tree and collecting of oil palm fruit either in plantation with 3 years old tree or 5 years old tree, which in these activities they performed the tasks by flexed the trunk between or more than 60o due to the height of the tree and also repetitive trunk movement (based on Final RULA score of neck, trunk& legs with mean 5.71 considered as high risk of MSDs symptom). A study found that fruit harvesters had high stresses in the low back due to awkward postures with severe flexion when trees are below 3.4 m and severe extension when trees are above 5.8 m (Fulmer et al., 2002). Working in lower areas where the job requiring severe trunk flexion, such as picking and deleafing activities, has been found to produce significant low back pain (45%) (Palmer., 1996). The patterns of the trunk movement in high frequency of repetitive trunk flexion extension combined with twisting during working may affect the lower back especially when they working at low level from the ground (Meksawi et al., 2011). The effects of the trunk movement on the lower back was described on study from Guo (2002) which indicated that 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.

Shoulder pain also was showed a high prevalence rate which is 38.8% throughout their working experience in the plantation especially for FFB's collectors in oil palm fruit in 3 years old tree (19.38%) and also FFB's harvesters in 5 years old tree (6.98%). In United States, upper extremity injuries account for about 22% of all lost time injuries that

occurred on farms in 1995 (Meyer et al., 2000). The other study by Palmer (2002) was showed that shoulder pain was found to be greater in agriculture (14%) than either other manual labor (9.7%) or non-manual labor (7.1%) jobs.

Findings from RULA scores were showed the mean upper arms score of the harvesters who had tasks to carry the bunch fruit for 3 years old tree was 3.58 and 5.48 for harvesting fruit bunch in 5 years old tree were indicating an average degree of shoulder flexion more than 90o, while the average lower arms score was 2.26 for harvesters who had tasks to carry the bunch fruit for 3 years old tree and 2.74 for harvesting fruit bunch in 5 years old tree indicating elbow flexion between 60^{o} to 100^{o}.

A study from Bjelle et al., (1981) has shown that workers with shoulder disorders (to a large extent supraspinatus tendinitis) had flexed their upper arm above 60o for about twice as long (about 1 hour/working day) than those workers who did not have shoulder disorders. The intramuscular pressure in the supraspinatus muscle is so high when abduction of upper arms above 30o and this condition restricted the flow of blood to this muscle and when it combine with mechanical load on the tendon lead to cell death in the tendon (Hagberg et al., 1995), which in its turn may trigger an inflammation. Increased risk for shoulder problems have been found for workers who are required to work at or above shoulder height between 10,000 and 16,000 times/week (Palmer., 1996).

5.3 Factor associated with MSDs symptoms

Prevalence of MSDs symptoms was higher among younger workers compared to older workers where workers aged less than 30 years old had higher prevalence of MSDs symptom (workers who had harvesting fruit bunch) which was 55.8% for 3 years old trees and 47.83% for 5 years old trees although statistically it is not significant for both plantation. Studies showed that it would be expected that farm youth would suffer MSDs at rates equivalent or greater than those for older age (Davis & Kotowski., 2007) and muscle strains in upper extremities, shoulders, back, and neck have been reported to be a daily occurrence for many farm youth (Bartels et al., 2000).

The potential factor of MSDs symptom in farm youth may by the changing musculoskeletal system. Between the ages of youth, height still increases 15- 20%, which result in stimulation and lengthening of the muscles in the musculoskeletal system (Marks & Cohen., 1978). As a result of the body growth, a potential imbalance resulted in the musculoskeletal system that causes tightening of the muscles and tendons. This tightening of muscles and tendons may be one source of pain due to overuse or damage to the tendon- bone attachment (Kidd et al., 2000).

Body Mass Index (BMI) is a statistically significant positive association between the level of overweight (BMI) and the likelihood that an individual has a MSDs (Michael & Jonathan., 2002). It is in line with finding that showed a statistically significant

association ($p < 0.05$) between BMI and total MSDs symptoms in FFB's harvesters in 3 years old palm tree plantation. A study showed that adult overweight and obesity has been associated with a higher prevalence of musculoskeletal disorders, primarily affecting the lower limbs (Marjolein et al., 2009).

Knee and foot problems are significantly more common in overweight and obese people compared with normal weight people It therefore seems reasonable to assume that these structural problems in the feet of the overweight and obese people are correlated with the reported knee and foot problems (Marjolein et al., 2009).

Above statement is in line with findings of prevalence rate of knee pain which was 17.83% (second higher prevalence rate) and also RULA score for final score of neck, trunk, legs with mean 6.07 and where 31.79% of workers had classified as high risk for getting MSDs symptoms in lower extremities.

In this study, FFB's harvesters in 5 years old palm plantation and working for more than 3 years have higher prevalence of having MSDs symptoms (63.64%) compared to FFB's collector. The association is statistically significant ($p = 0.04$) between years of employment and MSDs symptoms. In general, musculoskeletal disorders outcome for farmers were resulted from cumulative trauma (Davis and Kotowski., 2007). Cumulative trauma occurred in nature, developing from repeated exposures to a stressor, one may

assume that trauma would increased with increased of duration or year of employment and then caused MSDs related to work.

No significant relationship was found between prevalence rate of musculoskeletal symptoms and psychosocial factors. It is in line with the results of study by Choobineh et al. (2006) conducted in which no association was found between psychosocial factor and musculoskeletal problems. Regarding this, Kerr at al. (2001) pointed out that when physical demands were included in a model of musculoskeletal problems, the significance of psychosocial demands disappeared. It also might be because the questions on psychosocial factors were too general and needed to be refined (Nizam & Rampal., 2005). But in another research work, Choobineh et al. (2009) noted that some psychosocial factors including conflicts at work, waiting on work from others, interruption others make and time pressure were significantly associated with musculoskeletal symptoms in different body regions.

From logistic regression analysis, adjusted for possible cofounders of age, BMI, total GHQ score, years of employment, number of household, duration of working time and duration of resting time related to musculoskeletal symptoms were analysis and no of these confounders were statistically significant. De Jonge and Kompier (1997) declared that the size of research population could have important implications for the results of a study.

Although this research was unable to conclude significant result to several factors, other research has concluded association between those factors with musculoskeletal symptoms such as age, awkward postures, number of children etc. The reason has been stated as above due to small sample size and this study was also homogenous in term of gender. Furthermore, workers that were participated in this study is a foreign workers that may tend to under report their injuries since they may be lack insurance, or are paid based on incentives, as well as worry about repercussions for reporting (Earle-Richardson et al., 2003).

5.4 Recommendations

Although most agricultural workplaces especially oil palm plantation not regulated with respect to ergonomic hazards but efforts to improve better workplaces should be done to reduce health hazards due to ergonomic risk factors.

The occupational health and safety hierarchy uses a three-tier approach for implementing workplace safety interventions listed in descending order prioritization which were engineering controls to reduce hazards, work practice changes to reduce exposure, and the use of personal protective equipment. However, in the context of agriculture ergonomics, we propose recommendations and interventions based from materials and also practices, shown in Table 5.1

Table 5.1 Recommendations agriculture ergonomic problems

Materials	Individual level changes, tools and small equipment. • Modified wheelbarrows for harvesters who carrying fruit bunches (adjustable handles, added push-bar and three wheels) • Modified chisel (lighter material used, small and adjustable handle) • Loose seeds collectors (with adjustable height handle and lighter material)
Practices	Work processes and procedures • A mandated 5-minutes rest break every hour of stoop harvesters • Warm-up before starting work every morning (compulsory)
	Individual working behavior • Body mechanics training (especially lifting) for harvesters who carrying fruit bunches.

The most effective ways to prevent agriculture ergonomics is to design out the hazard by physically modifying materials, methods, tools or machinery such as Table 5.1 box 1. In oil palm tree plantation, to alleviate either postures or repetitiveness of a task with least cost involved, modifying standard rest breaks can improve workers' symptoms reports and will be impact on productivity. Some evidence indicates that limiting risk factors through administrative controls of training, stretching programs (warm-up), and job rotation tend to have short-term gains (Daltroy et al., 1997). To ensure these efforts are success requires a shift in safety culture and positive attitude by manager plantation and also other leaders.

In the prevention of back injuries, proper lift training has always been the first choice of defense because it is quick, inexpensive and can be conducted in any environment. More training is required to increase harvesters' awareness about back injury risk factors and to provide some ergonomic analysis and solution generation skills.

5.5 Conclusion

The results of this study showed a high prevalence of work related low back pain among oil palm plantation workers which could have been contributed by individual factors such as Body Mass Index (BMI) and also years of employment. Ergonomics risk factors such as awkward postures, prolonged standing, repetitiveness and excessive load were

the predictor of back pain and others MSDs symptoms. The interventions through materials that were used and practices during working is the best approach in managing work related musculoskeletal symptoms

REFERENCES

Ahonen E, Venalainen J, Kononen U, Klen T.(1990).*The physical strain of dairy farming*. Ergonomics 33:1549-1555.

Armstrong, T.J., Buckle, P., Fine, L.J., Hagberg, M., Jonsson, B., Kilbom, A., Kuorinka, I.A.A., Silverstein, B.A., Sjogaard, G., & Juntura, E.R.V.(1993). *A conceptual model for work related neck and upper limb musculoskeletal disorders.* Scand Journal Work Environment Health 1993 ; 19 : 73 -84.

Bartel S.,Niederman B.,Waters T.R. (2000). *Job Hazards for Musculoskeletals.* Journal Agricultural Safety Health 6:191-201.

Best TM, McElhaney JH, Garrett WE, Myers BS.(1995). *Axial strain measurements in skeletal muscle at various strain rates.* Journal of Biomechanical Engineering 117:262-265.

Bjelle, A., Hagberg, M., & Michaelson , G. (1981). Occupational and individual factors in acute shoulder neck disorders among industrial workers. *British Journal of Industrial Medicine 38* , 356-363.

BP Bernard, ed. (1997a) . *Musculoskeletal Disorders and Workplace Factors*. National Institute for Occupational Safety and Health. ; Cincinnati OH .

Bobick TG and Meyers JR.(1994). *Agriculture-related sprain and strain injuries, 1985-1987*. International Journal of Industrial Ergonomics 14:223-232.

Bone, K. W., & Palmer, K.T. (2002). *Musculoskeletal disorders in farmers and farm workers*. Occupational Medicine Vol. 52 (8); 441- 450, 2002.

Brulin, C.,Gerdle, B.,Hoog, J.,Knutson, A.,& Sundelin, G. (1998). Physical & psychosocial work related risk factors associated with musculoskeletal symptoms among homecare personnel. *Scandinavian Journal of Caring Sciences 12(2)* , 104-110.

Bureau of Labor Statistics (1999). *Occupational Injuries and Illnesses: Counts, Rates and Characteristics, 1997.* Washington DC: US Department of Labor, BLS.

Chapman, L.J., Karsh, B.,Meyers, J., Newenhouse, A., Meyer, B.,Miles, J.,& Janowitz, I.(2001).Ergonomics and musculoskeletal injuries in agriculture.Cooperative agriculture safety and health : An identification of problems areas in the

agricultural environment. *American Conference of Governmental Industrial Hygienists.* Cincinnati OH.

Chapman, L.J., Newenhouse, A.C., Pereira, K.M., Karsh, B.T., Meyer, R.M., Brunette, C. M., & Ehlers, J.J. (2008). *Evaluation of a Four Year Intervention to Reduce Musculoskeletal Hazards Among Berry Growers*. Journal of Safety Research 39 (2008) 215- 224.

Choobineh, A., Motamedzade, M., Kazemi, M., Moghimbeigi, A., & Pahlavian, A.H. (2011). *The impact of ergonomics intervention on psychosocial factors and musculoskeletal symptoms among office workers*. International Journal of Industrial Ergonomics 41 (2011) 671- 676.

Cohen A, Gjessing C, Fine L, Bernard B, McGlothlin J. eds. (1997b). *Elements of Ergonomics Programs*.National Institute for Occupational Safety and Health. ; Cincinnati OH.

Daltroy, L.H., Iverson,M.D., Larson,M.G.,Lew, R., Wright, E., Ryan, J.,Zwerling, C.,Fossel, A.H., & Liang, M.H. (1997). A controlled trial of an educational program to prevent back injuries. *New England Journal Medicine (337)* , 322-328.

Davis K.G and Kotowski S.E. (2007). Understanding the ergonomics risk for musculoskeletal disorders in the United States Agricultural Sector. *American Journal of Industrial Medicine 50* , 501-511.

De Jonge, J., & Kompier, M.A.J. (1997). A critical examination of the demand- control support model from a work psychological perspective. *International Journal Stress Management 4* , 235-258.

Department of Occupational Safety and Health (2008). Hazards Identification, Risk Assessment and Risk Controls (HIRARC)..

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

Fulmer S, Punnett L, Slingerland D, Tucker A & Earlerichardson G. (2002). Ergonomics exposures in apple harvesting: Preliminary observation. *American Journal Industrial Medicine 2*, 3-9.

Guo H.R, Tanaka S, Halperin W.E & Cameron L.L. (1999). Back pain prevalence in US industry and estimates of lost-weekdays. *American Journal Public Health 89*, 1029-1035.

Gustafsson, B., Lundqvist, P.,& Pinzke, S. (1992). Ergonomic factors in the work situation for AI- technicians on animal farms. *Advances in Industrial Ergonomics and Safety (IV)* , 129-134.

Hagberg, M., Silverstein , B., Wells, R., et al. (1995). *Work related musculoskeletal disorders (WMSDs): A reference book for prevention.* London: Taylor & Francis.

Hartman, E.,Oude Vrielink, H.H.E.,Metz, J.H.M.,& Huirne, R.B.M. (2005). Exposure to physical risk factors in Dutch agriculture:effect on sick leave due to musculoskeletal disorders. *International Journal Industrial Ergonomics 35 (11)* , 1031-1045.

Hendra & Suwandi R. (2009). Risiko ergonomik dan keluhan musculoskeletal disorder pada pekerja panen kelapa sawit. *Prosiding Seminar Nasional Ergonomik IX.* Semarang.

Innes, E., & Walsh, C. (2010). *Musculoskeletal disorders in Australian dairy farming. Work*, 36(2), 141-155.

International Labor Organization (ILO). (2003). *Facts on Agriculture*. Retrieved August 25, 2011, from http://www.ilo.org

James Watkins (2010). *Structure and Function of the Musculoskeletal System.2nd.* Human Kinetics: Champaign, ILL. 399pp. ISBN-13: 978-0-7360-7890-0. Retrieved May 2012 from: http://www.humankinetics.com/products/all-products/structure-and-function-of-the-musculoskeletal-system---2e

Kamaluddin B, Hashami B, Norr Hassim I, Jamal Hisham H & Rampal K.G. (2001). Back pain among oil palm plantation workers in Bintulu, Sarawak. *The 8th Public Health Colloqium.* Kuala Lumpur.

Karhu,O.,Kansi,P.,& Kuorinka, I. (1977). Correcting working postures in industry: a practical method for analysis. *Applied ergonomics 8(4)* , 199-201.

Kerr M.S, Frank J.W, Shannon H.S, Norman R.W, Wells R.P, Neumann W.P, Bombardier C. (2001). Biomechanical and psychological risk factors for low back pain at work. *American Journal Public Health 91(7)*, 1069-1075.

Keyserling, W.,Punnett, L., & Fine, L. (1999). Trunk posture and back pain: identification and control of occupational risk factors. *Applied Industrial Hygiene 3(3)* , 87-92.

Kermit, G.D., & Susan, E.K. (2007). *Understanding the Ergonomic Risk for*

Musculoskeletal Disorders in the United States Agricultural Sector. American journal of industrial medicine 50:501–511.

Kirkhorn, S., Earle-Richardson, G., & Banks, R. (2010). *Ergonomic risks and musculoskeletal disorders in production agriculture: recommendations for effective research to practice.* Journal of Agromedicine, 15(3), 281-299.

Kirkhorn, S.R., & Schenker, M.B. (2002). Current health effects of agricultural work:respiratory disease,cancer, reproductive effects, musculoskeletal injuries and pesticide-related illnesses. *Journal Agricultural Safety and Health 8(2)* , 199-214.

Kuorinka I, Jonsson B, Kilbom A,Vinterberg H, Biering-Sorensen F, Andersson G & Jorgensen K. (1987). Standardized nordic questionnaires for the analysis of musculoskeletal symptoms . *Applied Ergonomic 18(3)*, 233-237.

Leigh,J.,& Fries, J. (1992). Disability in a national sample. *American Journal of Public Health (82)* , 1517-1524.

Lim, Y. (2008). Physical discomfort and psychosocial job stress among male and female operators at telecommunication call centers in Taiwan. *Applied Ergonomic 40* , 561-568.

Malaysia, P. O. (1999). Oil Palm Industry. Kuala Lumpur: Ministry of Prime Industry.

Marjolein, M.J.P.,Enserink, B.,& Klijn,F. (2009). How policy makers and researchers in the Netherlands deal with uncertainties in flood management. *Paper at 12th International Riversymposium.* Brisbane, Australia.

Marks, A., & Cohen, M.I. (1978). Developmental processes of adolescence. *Volta Rev 80* , 275-285.

Merchant ,J.A, Kross,B.C,Donham, K.J, & Pratt, D.S. (1989). *Agriculture at risk, a report to the nation.*Iowa City, IA: National Coalition for agricultural Safety and Health.

McAtamney L & Nigel Corlett E. (1993). RULA: a survey method for the investigation of work related upper limb disorders. *Applied ergonomic 24(2)*, 91-99.

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 xxx (2011) 1-7.

Merja Perkio Makela (2001). *Exercise and ergonomics –focused group counseling among female farmers*. Occupational Ergonomics 2 (2001) 239- 250.

Ministry of Human Resources, Malaysia. (2008). Retrieved April 12, 2011, from Department of Occupational Safety and Health: http://www.dosh.my

Mohd Arif, S.,Azman, I.,& Mohd Noor, N. (2001). The production cost of oil palm fresh fruit bunches: The case of independent smallholders in Johor. Malaysian Palm Oil Board (MPOB).

Mohd Nizam J & Rampal K.G. . (2005). Study of back pain and factors associated with it among oil palm plantation workers in Selangor. *Journal Occupational Safety Health 2*, 36-41.

Muhammad Saiful B.Y, Ahmad Fuad A.R & Mohd Jamil Y. (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)*.

National Research Council and Institute of Medicine (2001). *Musculoskeletal disorders and the work place: low back and upper extremities*. National Academy Press: Washington, D.C. 2001.

Palmer K., (1996). *Musculoskeletal problems in the tomato growing industry: tomato trainer's shoulder*. Occupational Medicine 1996;46:528-431.

Punnett,L.,Wegman,D.H.,(2004).Work-Related Musculoskeletal Disorders: *The Epidemiologic Evidence and The Debate*, Journal of Electromyography and Kinesiology,13-23

Radwin, R.G, & Meyer, R.H. (2001). Comparison of stoop versus prone postures for a simulated agricultural harvesting task. *Applied ergonomic 38 (5)* , 549-555

Rainbird, G., & O'Neil, D. (1995). *Occupational disorders affecting agricultural workers in tropical developing countries.* Applied Ergonomic Volume 26, No 3, 187- 193, 1995.

Rosecrance, J., Rodgers,G.,& Merlino, L. (2006). Low back pain and musculoskeletal symptoms among Kansas farmers. *American Journal Industrial medicine 49* , 547-556.

Sesto. (2001). The impact on musculoskeletal disorders of changing physical and psychosocial work environment conditions in the automobile industry. *International Journal Industrial Ergonomic 28* , 31-45.

Shengli, N. *Ergonomics and occupational safety and health: An ILO perspective.* Applied Ergonomics 41 (2010) 744e753.

Van Poppel, M.N., Hoogendoorn, W.E., Bongers, P.M., Koes, B.W.,& Bouter, L.M. (1999). Physical load during work and leisure time as risk factors for back pain. *Scand. Journal Work Environment Health 25(5)* , 387-403.

Van Tulder, M.W., Koes,B.W., & Bouter,L.M. (1995). A cost of illness study of back pain in the Netherlands. *Pain 62* , 233-240.

World Health Organization (WHO). (2008). Facts on Body Mass Index (BMI).Retrieved August 26, 2011, from http://www.who.org

Xiang, H.,Stallones, L.,& Keefe, T.J. (1999). Back pain and agricultural work among farmers:an analysis of the Colorado farm family health and hazard surveillance survey. *American Journal Industrial Medicine 35* , 310-316

APPENDICES

FAKULTI PERUBATAN DAN SAINS KESIHATAN
FACULTY OF MEDICINE AND HEALTH SCIENCES
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG,
SELANGOR, MALAYSIA

PENERANGAN KEPADA PESERTA

TAJUK KAJIAN:

Kajian Kelaziman Dan Faktor Risiko Gejala Otot Skeletal Dalam Kalangan Penuai Di Ladang Kelapa Sawit Di Kota Tinggi

Terima kasih kerana membantu kami di dalam kajian ini.

1. **Apakah kajian ini?**

   Kajian ini adalah berkaitan dengan gejala otot skeletal yang dikenali memberi kesan kesihatan yang ketara kepada pekerja-pekerja yang bekerja di sektor pertanian. Faktor risiko ergonomik seperti postur janggal dan faktor-faktor individu seperti umur, jantina, tabiat merokok dan faktor psikologi diketahui memainkan peranan yang penting dalam kejadian MSD di kalangan pekerja.

2. **Apakah tujuan kajian ini?**

   Kajian ini dijalankan bertujuan untuk menentukan kelaziman gejala otot skeletal dan kaitannya dengan faktor-faktor risiko di kalangan penuai di ladang kelapa sawit.

3. **Berapa ramai responden yang terpilih?**

   Responden akan dipilih dari kalangan Tenaga Kerja Indonesia Felda Lok Heng dan juga Felda Waha, Kota Tinggi, Johor. Seramai 200 orang responden akan dipilih untuk kajian ini.

4. **Apakah jenis ujian yang akan dijalankan?**

   Semua responden akan ditemubual untuk mengisi borang soal selidik. Selain daripada itu, berat badan serta tinggi responden akan diambil utnutk menentukan BMI. Cara kerja responden juga akan dirakam bagi menilai faktor risiko ergonomik seperti postur janggal, beban berlebihan dan sebagainya.

5. **Adakah bayaran dikenakan?**

   Pengkaji akan menanggung segala pembiayaan ujian yang akan dijalankan dan tiada sebarang bayaran dikenakan terhadap setiap responden.

6. **Adakah maklumat dijamin sulit?**

   Semua maklumat yang diberikan oleh responden di dalam borang kaji selidik adalah dijamin sulit. Tiada huraian individu akan dibuat pada mana-mana bahagian di dalam kajian atau penerbitan.

7. **Adakah hak anda?**

   Kajian ini melibatkan anda secara sukarela. Oleh itu, peserta mempunyai hak

FAKULTI PERUBATAN DAN SAINS KESIHATAN
FACULTY OF MEDICINE AND HEALTH SCIENCES
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG,
SELANGOR, MALAYSIA

untuk menarik diri dari penyertaan dalam kajian ini pada bila-bila masa sekiranya peserta merasa tidak selesa untuk memberikan maklumat kepada pengkaji.

8. Apakah yang harus anda lakukan?

Anda dikehendaki menandatangani borang penyertaan responden yang menyatakan minat anda untuk menyertai kajian ini. lanya boleh dilakukan setelah anda membaca dan memahami isi kandungan penerangan ini. Borang penyertaan responden haruslah dikembalikan kepada penyelidik sebelum ujian dijalankan. Sekiranya anda mempunyai sebarang kemusykilan, penyelidik akan membantu untuk memberi maklumat yang selanjutnya.

Terima kasih atas kerjasama dan bantuan anda.

NOR HADIBAH BINTI TOKESNO

Penyelidik

B. Sc. Kesihatan Persekitaran dan Pekerjaan

Jabatan Kesihatan Persekitaran dan Pekerjaan

Fakulti Perubatan dan Sains Kesihatan

Universti Putra Malaysia.

0137542466

die_lya89@yahoo.com

FAKULTI PERUBATAN DAN SAINS KESIHATAN
FACULTY OF MEDICINE AND HEALTH SCIENCES
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG,
SELANGOR, MALAYSIA

BORANG PERSETUJUAN RESPONDEN

TAJUK KAJIAN : PERKAITAN ANTARA FAKTOR RISIKO ERGONOMIK DENGAN KELAZIMAN GEJALA OTOT SKELETAL DI KALANGAN PENUAI DI LADANG KELAPA SAWIT

PENYELIDIK : NOR HADIBAH BINTI TOKESNO

Saya.....No.K/P.....
.....
alamat.....
..... bersetuju untuk menyertai kajian bertajuk seperti di atas.

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 faham bahawa kajian ini dijalankan untuk mengkaji perkaitan antara faktor risiko ergonomik dengan kelaziman gejala otot skeletal di kalangan penuai di ladang kelapa sawit.

Saya juga faham bahawa segala maklumat yang diberikan dan segala keputusan yang saya peroleh 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

FAKULTI PERUBATAN DAN SAINS KESIHATAN
FACULTY OF MEDICINE AND HEALTH SCIENCES
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG,
SELANGOR, MALAYSIA

penyelidik semasa kajian dijalankan dan tiada sebarang tindakan boleh dikenakan ke atas saya atas tindakan tersebut.

Tandatangan ..... Tandatangan .....
(*Responden*) (*Saksi*)

Tarikh :..... Nama :.....

No. K/P :.....

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

Tarikh ..... Tandatangan .....
(Penyelidik)

APPENDIX 3

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN PENYELIDIK

RESPONDENT ID: ☐☐☐☐

BAHAGIAN A: BIODATA

1.2 No. tel. : A2 ☐

1.3 Umur : ☐☐ tahun A3 ☐

1.4 Warganegara : 1 ☐ Warganegara 2 ☐ Bukan warganegara A4 ☐

1.5 Suku : 1 ☐ Jawa 2 ☐ Banjar
3 ☐ Bugis 4 ☐ Lain-lain _____ A5 ☐

1.6 Status : 1 ☐ Tidak menikah 2 ☐ Menikah A6 ☐

1.7 Jumlah Tanggungan : _____ orang
(termasuk ayah, ibu, isteri, anak) A7 ☐

1.8 Pendidikan : 1 ☐ Tidak bersekolah 2 ☐ Sekolah Desa (6 – 11 tahun) A8 ☐
3 ☐ Sekolah Menengah Pertama (12 – 14 tahun) 4 ☐ Sekolah Menengah Atas (15- 17 tahun)
5 ☐ Universitas (≥ 18 tahun)

APPENDIX 3

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN PENYELIDIK

1.9 Pendapatan pokok :

1 ☐ < RM 500
2 ☐ RM 500 – RM 1000
3 ☐ RM 1000 – RM 2000
4 ☐ > RM 2000

A9 ☐

1.10 Pendapatan kerja selain kerja :

1 ☐ < RM 500
2 ☐ RM 500 – RM 1000
3 ☐ RM 1000 – RM 2000
4 ☐ > RM 2000

A1 ☐

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 kecelakaaan 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	Tengkuk/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? B16

1 ☐ Ya 0 ☐ Tidak

Jika ya, berapa lama anda bekerja pada hari libur? B17

1 ☐ Sekali sebulan 2 ☐ Dua kali sebulan

3 ☐ Tiga kali sebulan 4 ☐ Empat kali sebulan

2.2.4 Secara keseluruhan, berapa jam anda bekerja dalam sehari? B18

_____ jam

2.2.5 Adakah kerja anda sekarang mengikut syif? B19

1 ☐ Ya 0 ☐ Tidak

2.2.5 Berapa lamakah anda beristirihat dalam masa sehari anda bekerja? B20

_____ jam

2.2.6 Apakah anda membuat kerja sambilan? B21

1 ☐ Ya 0 ☐ Tidak

Jika ya, sila nyatakan data sebagai berikut:

Jenis pekerjaan	Lama bekerja (jam)	Tahun bekerja
Total		

B21a ☐
B21b ☐

APPENDIX 3

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN PENYELIDIK

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 ☐ Yan 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:

		Ya	Tidak	
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 aktivitas-aktivitas (3.3.1.1 – 3.3.1.7) di bahagian tersebut yang membataskan pekerjaan anda?

1 ☐ Ya 0 ☐ Tidak

APPENDIX 3

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN PENYELIDIK

BAHAGIAN D: MAKLUMAT PERUBATAN

4.1 Apakah anda menghidap penyakit sebagai berikut?

		Ya	Tidak	
4.1.1	Sakit jantung	1 ☐	0 ☐	D1 ☐
4.1.2	Darah Tinggi (Hypertension)	1 ☐	0 ☐	D2 ☐
4.1.3	Kencing Manis (Diabetes)	1 ☐	0 ☐	D3 ☐
4.1.4	Skitzophrenia (Mental)	1 ☐	0 ☐	D4 ☐
4.1.5	Insomnia (Sukar tidur)	1 ☐	0 ☐	D5 ☐
4.1.6	Asma (lelah/semput)	1 ☐	0 ☐	D6 ☐
4.1.7	Rheumatoid arthritis (sakit sendi)	1 ☐	0 ☐	D7 ☐

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

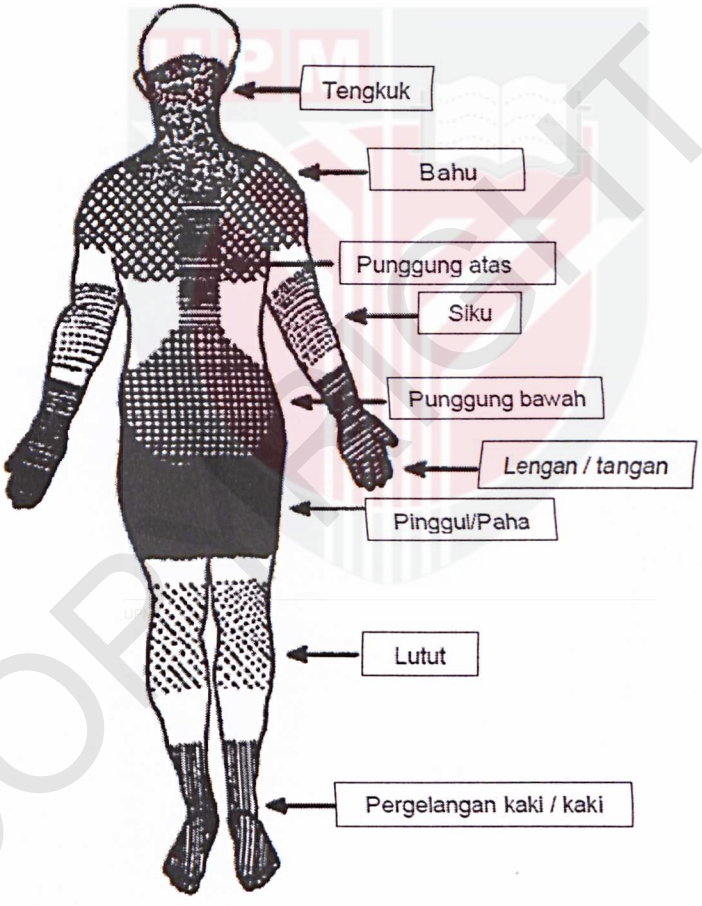
		Ya	Tidak	
4.1.1	Sakit jantung	1 ☐	0 ☐	D8 ☐
4.1.2	Darah Tinggi (Hypertension)	1 ☐	0 ☐	D9 ☐
4.1.3	Kencing Manis (Diabetes)	1 ☐	0 ☐	D10 ☐
4.1.4	Skitzophrenia (Mental)	1 ☐	0 ☐	D11 ☐
4.1.5	Insomnia (Sukar tidur)	1 ☐	0 ☐	D12 ☐
4.1.6	Asma (lelah/semput)	1 ☐	0 ☐	D13 ☐
4.1.7	Rheumatoid arthritis (sakit sendi)	1 ☐	0 ☐	D14 ☐

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN PENYELIDIK

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.



KEGUNAAN PENYELIDIK

APPENDIX 3

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?	
5.1.1 Tengkuk/leher ☐ Ya ☐ Tidak Tahap kesakitan: _____		1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	E1 ☐ E2 ☐ E3 ☐ E4 ☐
5.1.2 Bahu ☐ Ya ☐ Tidak Tahap kesakitan: _____		1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	E5 ☐ E6 ☐ E7 ☐ E8 ☐

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN PENYELIDIK

APPENDIX 3

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 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	E9 ☐ E10 ☐ F11 ☐ E12 ☐
5.1.4 Lengan/Tangan ☐ Ya ☐ Tidak Tahap kesakitan:		1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	E13 ☐ E14 ☐ E15 ☐ E16 ☐

KEGUNAAN PENYELIDIK

APPENDIX 3

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 dikempat kerja ataupun di rumah?)	Apakah anda mengalami masalah dalam jangka waktu 7 hari belakangan ini?	Apakah anda merasakan masalah itu berawal dari pekerjaan anda?	
_____					
5.1.5 Punggung atas ☐ Ya ☐ Tidak Tahap kesakitan: _____		1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	E17 ☐ E18 ☐ E19 ☐ E20 ☐
5.1.6 Punggung bawah ☐ Ya ☐ Tidak		1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	E21 ☐ E22 ☐ E23 ☐ E24 ☐

KEGUNAAN PENYELIDIK

APPENDIX 3

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?	
Tahap kesakitan: _____					
5.1.7 Satu atau kedua-duanya bagian paha ☐ Ya ☐ Tidak Tahap kesakitan: _____		1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	E25 ☐ E26 ☐ E27 ☐ E28 ☐
5.1.8 Satu atau kedua-duanya bagian lutut ☐ Ya ☐ Tidak		1 ☐ Ya ☐	1 ☐ Ya ☐	1 ☐ Ya ☐	E29 ☐ E30 ☐ E31 ☐ E32 ☐

125

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN PENYELIDIK

APPENDIX 3

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 (redih, 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?	
Tahap kesakitan: _____		2 Tidak	2 Tidak	2 Tidak	
5.1.9 Satu atau kedua-duanya pergelangan kaki ☐ Ya ☐ Tidak Tahap kesakitan: _____		1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	E33 ☐ E34 ☐ E35 ☐ E36 ☐

KEGUNAAN PENYELIDIK

APPENDIX 3

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 istirihat sakit bagi penyakit yang anda alami di bagian badan tersebut?	Pernahkah anda terpaksa mengganti kerja atau tugas karena sakit pada bagian badan tersebut?
5.2.1 Tengkuk/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

TENGKUK
E37
E38
E39
E40

BAHU
E41
E42
E43
E44

SIKU
E45
E46
E47
E48

LENGAN
E49
E50
E51
E52

127

KEGUNAAN PENYELIDIK

APPENDIX 3

52.4 Lengan/tangan	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak
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 istirihat sakit bagi penyakit yang anda alami di bagian badan tersebut?	Pernahkah anda terpaksa mengganti kerja atau tugas karena sakit pada bagian badan tersebut?
52.5 Punggung bawah/pinggang	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak
52.7 Satu atau kedua duanya bagian paha	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak
52.8 Satu atau kedua-duanya bagian lutut	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak
52.9 Satu atau kedua-duanya bagian kaki	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak	1 ☐ Ya 2 ☐ Tidak

B.ATAS
E53
E54
E55
E56

B.BAWAH
E57
E58
E59
E60

PAHA
E61
E62
E63
E64

KAKI
E65
E66
E67
E68

APPENDIX 4

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN PENYELIDIK

SOAL KESEHATAN UMUM (GENERAL HEALTH QUESTIONNAIRE; GHQ-12)

1.2 Pernahkah anda kekurangan tidur kerana risau? A2 ☐
(contoh: hati tidak tenteram, tidak aman , berasa geliisah dan cemas)

0 ☐ tiada langsung 0 ☐ tidak lebih dari biasa
1 ☐ lebih dari biasa 1 ☐ sangat lebih dari biasa

1.3 Adakah anda sentiasa berasa tertekan/tegang? A3 ☐
(contoh: menyabarkan diri supaya tidak marah)

0 ☐ tiada langsung 0 ☐ tidak lebih dari biasa
1 ☐ lebih dari biasa 1 ☐ sangat lebih dari biasa

1.4 Adakah anda boleh berkonsentrasi untuk apa yang anda lakukan? A4 ☐
(contoh: memusatkan fikiran untuk menghabiskan sesuatu tugas)

0 ☐ lebih dari biasa 0 ☐ tidak lebih dari biasa
1 ☐ kurang dari biasa 1 ☐ sangat kurang dari biasa

1.5 Adakah anda merasakan bermanfaat untuk sesuatu yang anda lakukan? A5 ☐
(contoh: ramai orang memerlukan/mengharapkan saya, saya adlah penting kepada seseorang)

0 ☐ lebih dari biasa 0 ☐ tidak lebih dari biasa
1 ☐ kurang dari biasa 1 ☐ sangat kurang dari biasa

1.6 Adakah anda dapat mengatasi masalah anda?
(contoh: berurusan dengan hal, orang dan materi yang payah)

0 ☐ lebih dari biasa 0 ☐ tidak lebih dari biasa
1 ☐ kurang dari biasa 1 ☐ sangat kurang dari biasa

1.7 Adakah anda merasa mampu membuat keputusan? A7 ☐
(contoh: membuat pilihan yang baik untuk bila nak makan, makan apa, pakai baju apa dan lain-lain keputusan harian dalam hidup)

0 ☐ lebih dari biasa 0 ☐ tidak lebih dari biasa
1 ☐ kurang dari biasa 1 ☐ sangat kurang dari biasa

1.8 Adakah anda merasa tidak dapat mengatasi kesukaran/masalah anda?
(contoh: masalah kesehatan, kewangan dan keluarga)

0 ☐ tiada langsung 0 ☐ tidak lebih dari biasa
1 ☐ lebih dari biasa 1 ☐ sangat lebih dari biasa

OCCUPATIONAL SAFETY AND HEALTH
IN AGRICULTURE:
PALM OIL INDUSTRY

KEGUNAAN PENYELIDIK

A1 ☐

1.9 Adakah anda merasa cukup gembira dalam segala hal yang difikirkan?
(contoh: tentang kehidupan, hal dan orang sekitar)

0 ☐ lebih dari biasa
0 ☐ tidak lebih dari biasa
1 ☐ kurang dari biasa
1 ☐ sangat kurang dari biasa

1.10 Adakah anda dapat menikmati kegiatan hari-hari anda?
(contoh: pergi berjalan-jalan,mendengar music, nonton sinetron)

0 ☐ lebih dari biasa
0 ☐ tidak lebih dari biasa
1 ☐ kurang dari biasa
1 ☐ sangat kurang dari biasa

1.11 Apakah anda berasa tidak gembira dan sedih?
(contoh: susah ahti tanpa sebab)

0 ☐ tiada langsung
0 ☐ tidak lebih dari biasa
1 ☐ lebih dari biasa
1 ☐ sangat lebih dari biasa

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

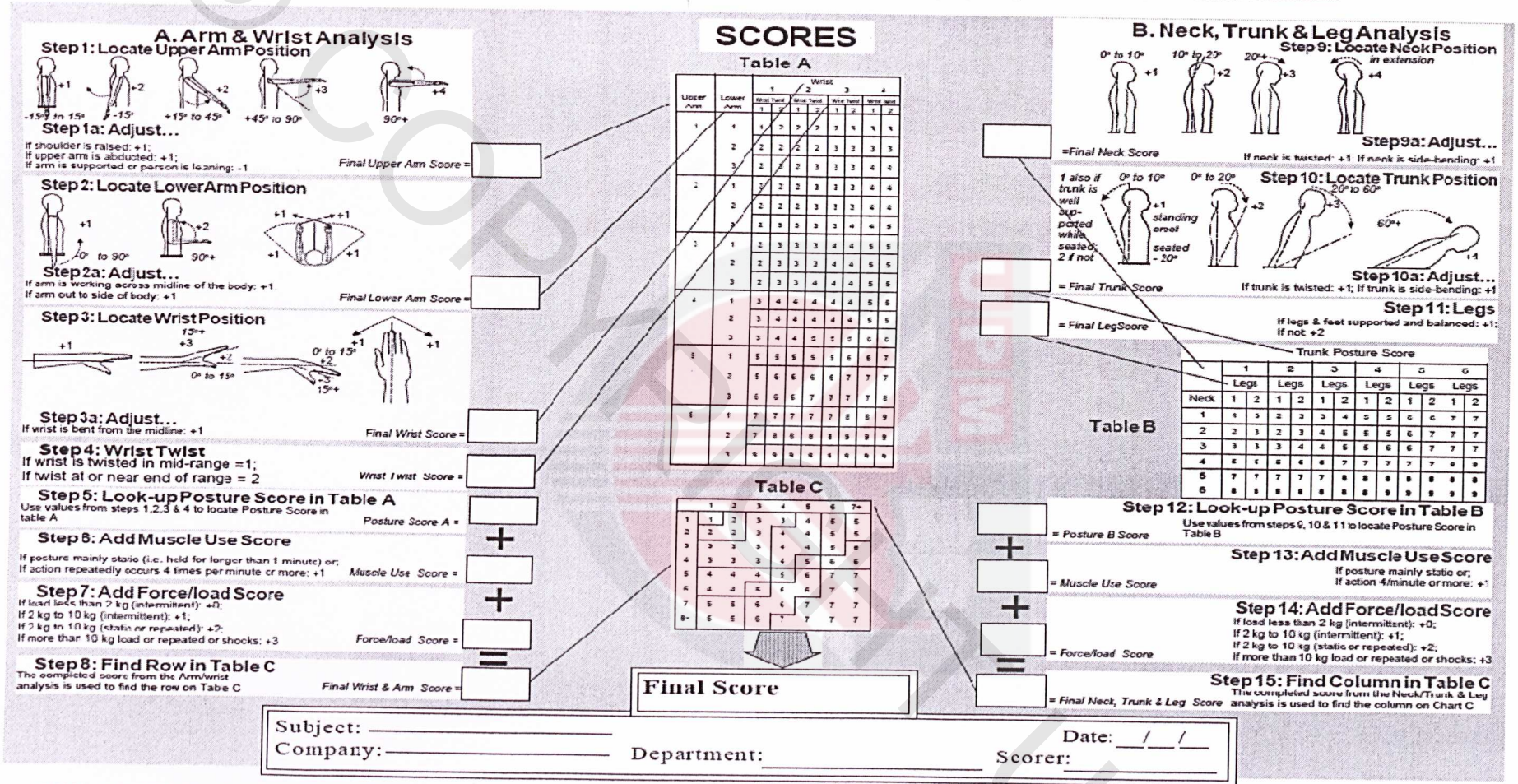
0 ☐ tiada langsung
0 ☐ tidak lebih dari biasa
1 ☐ lebih dari biasa
1 ☐ sangat lebih dari biasa

1.13 Apakah anda memikirkan diri anda seseorang yang tidak berguna?
(contoh: berfikir diri 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

RULA Employee Assessment Worksheet

Complete this worksheet following the step-by-step procedure below. Keep a copy in the employee's personnel folder for future reference.



FINAL SCORE: 1 or 2 = Acceptable; 3 or 4 investigate further; 5 or 6 investigate further and change soon; 7 investigate and change immediately

APPENDIX 5

Borang HIRARC

BORANG HIRARC			
Syarikat:		Dikendalikan oleh: (Nama, jawatan) Tarikh: (dari... hingga ...)	
Proses / Lokasi:			
Diluluskan oleh: (Nama, jawatan)			
Tarikh:		Tarikh Semakan:	Tarikh Semakan Berikutnya:

1. Pengenalpastian Hazard				2. Analisis Risiko				3. Kawalan Risiko	
Bil.	Aktiviti Kerja	Hazard	Yang Boleh Mengakibatkan	Kawalan Risiko (jika ada)	Kemungkinan	Keterukan	Risiko	Langkah Kawalan yang Disarankan	Pegawai Bertugas (Tarikh Tamat/ status)
1									
2									
3									
4									
5									