FACTORS ASSOCIATED WITH WORK-RELATED MUSCULOSKELETAL DISORDERS (WMSDs) AMONG COFFEE HARVESTERS IN DOI CHAANG COFFEE FACTORY, MAE SUAI DISTRICT, CHIANG RAI, THAILAND

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ปัจจัยที่มีความสัมพันธ์กับความผิดปกติของระบบกระดูก และกล้ามเนื้ออันเนื่องมาจากการทำงานในเกษตรกรชาวสวนกาแฟของโรงงานดอยช้าง อำเภอแม่สรวย จังหวัดเชียงราย ประเทศไทย

นางสาววิภาวี ส่องแสง

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสาธารณสุขศาสตรมหาบัณฑิต
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วิภาวี ส่องแสง : ปัจจัยที่มีความสัมพันธ์กับความผิดปกติของระบบกระดูก และกล้ามเนื้ออันเนื่องมาจากการทำงานในเกษตรกรชาวสวนกาแฟของโรงงานดอยช้าง อำเภอแม่สรวย จังหวัดเชียงราย ประเทศไทย (FACTORS ASSOCIATED WITH WORK-RELATED MUSCULOSKELETAL DISORDERS (WMSDs) AMONG COFFEE HARVESTERS IN DOI CHAANG COFFEE FACTORY, MAE SUAI DISTRICT, CHIANG RAI, THAILAND) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: รศ. ดร. วัฒน์สิทธิ์ ศิริวงศ์, 109 หน้า.

อาการความผิดปกติของระบบกระดูกและกล้ามเนื้ออันเนื่องมาจากการทำงาน ส่งผลกระทบต่อสุขภาพของกลุ่มประชากรวัยทำงาน โดยเฉพาะในกลุ่มเกษตรกร หรือแรงงานรับจ้าง ในประเทศไทยการศึกษาวิจัยในเรื่องนี้ยังพบได้น้อย ดังนั้นการศึกษาเชิงวิเคราะห์แบบภาคตัดขวางนี้จึงมีวัตถุประสงค์เพื่อศึกษาความชุก และความสัมพันธ์ของปัจจัยเสี่ยงและอาการปวดกระดูกและกล้ามเนื้อ ในชาวสวนกาแฟ 272 คน ในจังหวัดเชียงราย ประเทศไทย เครื่องมือที่ใช้ในการเก็บข้อมูลคือ Standard Nordic Questionnaire และวิธีการเก็บข้อมูลคือการสัมภาษณ์แบบตัวต่อตัว วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณา และเชิงอนุมาน วิเคราะห์หาความสัมพันธ์แบบตัวแปรเชิงทวิ ของปัจจัยโดยนำเสนอค่า Odd Ratio (OR) และช่วงความเชื่อมั่นร้อยละ 95 (95% CI)

ผลการศึกษาพบว่า ค่าความชุกของอาการปวดกล้ามเนื้อ ใน 7 วัน และ 12 เดือนที่ผ่านมา คือ 79.4% และ 81.6% โดยอาการปวดเกิดขึ้นมากที่สุดในบริเวณ คอ ไหล่ และข้อมือ ปัจจัยความเสี่ยงในระยะ 7 วัน ที่มีความสัมพันธ์กับอาการคือ อายุ (OR=2.47, 95% CI=1.01-1.08) การสูบบุหรี่ (OR=2.85, 95% CI=1.22-7.36) และอาการความเครียด (OR=2.84, 95% CI=1.44-6.00) ส่วนปัจจัยที่มีความเสี่ยงในระยะ 12 เดือนที่มีความสัมพันธ์กับอาการปวดคือ อายุ (OR=2.17, 95% CI=1.10-4.32) และอาการความเครียด (OR=2.49, 95% CI=1.26-4.95) ท่าทางการทำงานที่มีความสัมพันธ์กับอาการปวดใน 9 ส่วนของกล้ามเนื้อในร่างกายคือ การบิดเอี้ยวตัว การยกแขนเป็นเวลานาน และการยกของหนัก

จากผลการวิจัยนี้ ความชุกของอาการเจ็บปวดกระดูกและกล้ามเนื้อในชาวสวนกาแฟนั้นยังเกิดขึ้นค่อนข้างสูง และปัจจัยความเสี่ยงต่าง ๆ ก็มีหลายปัจจัยรวมทั้ง ปัจจัยส่วนตัว ปัจจัยด้านสุขภาพจิตใจ และปัจจัยด้านการทำงาน ทางโรงงานควรมีการให้คำแนะนำและสาธิตท่าทางการทำงานที่ถูกต้องให้แก่ชาวสวน และมีการเฝ้าระวังการทำงานของบุคคลในกลุ่มเสี่ยงเพื่อป้องกันการเกิดปัญหาสุขภาพ และในอนาคต ควรมีการศึกษาเพิ่มเติมเพื่อรณรงค์เพื่อป้องกันและลดปัญหานี้ต่อไป

สาขาวิชา สาธารณสุขศาสตร์ ลายมือชื่อนิสิต .....

ปีการศึกษา 2560 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

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WIPAWEE SONGSAENG: FACTORS ASSOCIATED WITH WORK-RELATED MUSCULOSKELETAL DISORDERS (WMSDs) AMONG COFFEE HARVESTERS IN DOI CHAANG COFFEE FACTORY, MAE SUAI DISTRICT, CHIANG RAI, THAILAND. ADVISOR: ASSOC. PROF. WATTASIT SIRIWONG, Ph.D., 109 pp.

Work-related musculoskeletal disorders (WMSDs) cause great impact on health of the working population especially the unskilled labor such as farmers and low-income workers. However, in Thailand, only a few epidemiological studies investigated the risk factors related to WMSDs in farmers. This cross-sectional study aims to assess the prevalence and risk factors associated with WMSDs among 272 coffee harvesters in Chiang Rai, Thailand. The questionnaire was adapted from Standard Nordic Questionnaire and face to face interview was done with the eligible participants. Descriptive statistic was used to find the prevalence and binary logistic regression was use to find the association between risk factors and WMSDs. The results were given that the prevalence of 7 days and 12 months WMSDs were 79.4% and 81.6% respectively with the most prevalence pain in the regions of neck, shoulder and wrist. The risk factors that significantly associated with 7 days WMSDs were age (OR=2.47, 95% CI=1.01-1.08), smoking (OR=2.85, 95% CI=1.22-7.36) and stress (OR=2.84, 95% CI=1.44-6.00), while the risk factors that associated with 12 months WMSDs were only age (OR=2.17, 95% CI=1.10-4.32) and stress (OR=2.49, 95% CI=1.26-4.95). The postures which significantly associated with the pain in nine body regions were twisting body, lifting arms above shoulder for long time, and carrying heavy object. The outcome of this study indicated that there was high prevalence of WMSDs among coffee harvesters and the individual, psychosocial and work-related factors were all associated with the disorders. The factory and health care providers in the village should demonstrate the correct working postures for harvesters and should pay more attentions to the group of people who were at risk. More studies should be done to help us understand the cause and impact of WMSDs, so that successful prevention program could be done in the future to protect WMSDs.

Field of Study: Public Health Student's Signature .....

Academic Year: 2017 Advisor's Signature .....

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Chapter I: Introduction

1.1 Background information and rationale

Thailand is an agricultural country with a population of 65.9 million people (National Statistical Office, 2016). One of the main occupations in Thailand is agriculture. The national statistical office (NSO) conducted a series of agricultural census (2013) and found out that as of May 2013, Thailand had a total of 5.9 million agricultural holdings which accounts for 25.2% of the total households in the country. Most of the people in the agricultural field (96.3%) operate by cultivating crops; the others operate in activities such as livestock, fresh water culture or sea salt farms. The total area of agriculture holdings is 116.5 million rai^2 (186.4 million km^2). The northern region is the second largest area of agriculture holdings with 1.3 million members (22%) and 27.1 million rais (23.3%) respectively (National Statistical Office, 2013). Most of the people in the country pay close attention to agriculture as it is the main source of income for many households. According to the national statistical office's labor force survey, as of the end of 2016, there were 12.57 million people working in the agricultural field.

Approximately 22% of the agriculture holdings members are in the northern region. Chiang Rai is a small province in the northern part of Thailand, border to Burma and Laos, with a population of about 1.2 million people (National Statistical Office, 2016). The total land for agriculture and living is 11,678 km^2. Since the area has many

mountains with cool weather throughout the year, it is good for many agriculture plantations such as coffee, tea, corn, macadamia nuts, beans, and many other plants. Coffee and Tea plantations account for one of the main types of cultivation in Chiang Rai. Regarding the coffee plantations, Doi Chaang village, in Wawee sub-district, is the main location to grow coffee. Since the village is sitting at an altitude of 1,000 to 1,700 meters above sea level and has so many rich natural resources, it is suitable to grow Arabica coffee ("Doi Chaang coffee, single origin world class specialty coffee," 2018).

Doi Chaang is a mountainous area which is home to Thai people and many ethnic groups such as Akha, Lisu, and Chinese ("Doi Chaang coffee, single origin world class specialty coffee," 2018). In the past, Doi Chaang was characterized by shifting cultivation through slash and burn practices which brought adverse effects to the forest and natural vegetation. Fully aware of these practices, His Majesty the King Rama the 9th introduced a project to plant varieties of winter crops. These crops later become industrial crops and created job opportunities and income for many households in the village. With His Majesty the King Rama the 9th's initiatives, farmers in the area have turned to grow Arabica coffee and other industrial winter crops such as macadamia nuts, tea, beans and many other crops ("Doi Chaang coffee, single origin world class specialty coffee," 2018). Currently, those in the total population of more than 1,000 households are working in the agriculture field, mainly in coffee plantations.

People in Doi Chaang rely on coffee plantations as their main source of income. They have worked hard to plant, harvest, and process raw coffee beans into various

products. The exposure related to hard work has caused them to have many occupational health risk factors including ergonomic problems such as musculoskeletal disorders, muscle fatigue, and muscle pain. The risk factors related to the work for farmers and low-income people have increased and the awareness among occupational health professionals has been growing in the past 10 years because of the large burden of illnesses related to musculoskeletal disorders (Luangwilai, Norkaew, & Siriwong, 2014).

The data from the department of disease control (2012), indicated that there is an increasing number of patients who reported having musculoskeletal symptoms every year from 2010 to 2012. Most of the provinces reported with the cases of musculoskeletal disorders (MSDs) are located in the northern and eastern part of Thailand. In the year 2012, the data shows that 2,938 patients were reported with musculoskeletal symptoms in Chiang Rai, and Chiang Rai has been listed as one of the top ten provinces with the highest number of patients in musculoskeletal disorders (*Disease related to bone and muscle*, 2012). One of the reasons that the northern and eastern part of Thailand reported the highest cases of MSDs is due to the high number of workers who work in the agricultural field. Furthermore, the data from the ministry of public health office in Chiang Rai province further indicated that the number of musculoskeletal diseases among farmers and low-income workers in Wawee sub-district has increased from 74 cases reported in 2015 to 242 cases reported in 2016 (Kantawee, 2017). This result shows the rapid increase within one year. This may due

to the exposure to hard work among the farmers and other workers in Wawee sub-district.

The World Health Organization has stated that a major occupational problem globally is associated with work-related musculoskeletal disorders (WMSDs) (Thetkathuek, Meepradit, & Sa-ngiamsak, 2017). WMSDs refer to musculoskeletal disorders that cause or intensify by hard work such as lifting heavy items, bending, reaching overhead, pushing and pulling heavy loads, working in awkward body postures, performing the same or similar tasks repeatedly etc. (Herry et al., 2015). The European Agency for Safety and Health at Work indicated that in 2008 there were millions of cases of work-related musculoskeletal disorders, the types being muscle discomfort with pain, tingling, cramps, numbness, tightness, weakness, feeling cold or hot, heaviness and swelling (Pintakham & Siriwong, 2016). The 2015 annual report of the department of disease control in Thailand indicated that about 50.5% of their cases for all workers were incidents for work-related musculoskeletal disorders, and the women are at higher risk than men, 52.3% and 48.8% respectively (Pangate, Kongprasert, Tengtrisorn, & Manosoontorn, 2016). The report also showed that the prevalence of disease is higher among the elderly, and that the parts of the body that were affected were pain in the lower back (6.3%), knee (4.8%), and shoulder (3.3%) (Pangate et al., 2016).

Besides socio-demographic factors, the risk factors of musculoskeletal disorders also relate to work conditions. Work-related musculoskeletal disorders are caused by

physical strains forced on the body at work, such as rapid work pace, forceful exertion, extreme repetitive motions, vibration and working for long hours with unnatural body postures (Herry et al., 2015). The previous studies from the center of disease control Thailand designated that the causes of WMSDs are due to working in awkward position (50.3%), working in the same position for long time (78.1%), carrying heavy object of more than 25 kg by oneself (49.2%), working in not suitable environment (13.0%) and working in rapid movements (19.7%) (Pangate et al., 2015). Farming and harvesting require a high physical demand that imposes strain on the body as well as effects from the environment such as outdoor exposure in limited spaces (Osborne et al., 2013). Moreover, farming is also requiring a heavy work load and work tasks that can cause musculoskeletal disorders (Kolstrup, 2012). These are the reasons why farmers are at increasing potential risks of developing WMSDs compared with other workers in different jobs (Osborne et al., 2013).

The other factor that may associated with WMSDs is related to psychosocial risk factors. The psychological demands and social work factors are often attributed to combination of different factors. The most widely known attributed factors are physical factors at work with related stress symptoms (Bugajska et al., 2013). One possible way that psychosocial factors at work may influence WMSDs is by exposing workers to unfavorable physical and emotional factors. The physical exposure at work may include high job demand, social support, family support, job satisfaction, and degree of satisfaction with leisure time activities (Meeksawi, Tangtrakulwanich, &

Chongsuivatwong, 2012). These factors are related to physical and emotional feelings which may lead to stress and cause problem of WMSDs.

The symptoms of Musculoskeletal Disorders are measured with Standard Nordic Questionnaires. This set of questionnaires is standardized and has been used worldwide. The set of questionnaires was constructed to divided human body into nine anatomical regions, the regions were selected based on the accumulation of muscle pain (where the symptom occur) and regions where symptoms are distinguishable from each other both by respondent and a health surveyor (Kuorinka et al., 1987). In each body part, two questions were asked to assess the measurement of the pain within two periods of times. First question is asking whether there is the pain in that body region within the past 7 days, which can also be called acute musculoskeletal disorders. Second question is asking whether there is the pain in that body region within previous 12 months, which can also be called chronic musculoskeletal disorders (Kuorinka et al., 1987). So, this Standard Nordic questionnaires will be used in this research study to analyze the musculoskeletal symptoms in different body parts within two different time periods. In addition, the stress symptom will be measured by the short form of questionnaire DASS-21, selected 7 questions related to stress issues.

The incidence of injuries of agriculture workers has resulted in serious health issues (Herry et al., 2015). For example, in coffee plantations, there are high risks for workers to develop musculoskeletal disorders because coffee harvesting requires a

high physical effort demand. The work in coffee plantations requires repetitive motions, awkward body bending, heavy manual lifting, working long hours, kneeling and vibration. The harvesters may also develop some psychological distress which may lead to the muscle pain as well. These are the risk factors that may cause musculoskeletal disorders. Coffee harvesters in Doi Chaang coffee plantation usually complain of body pain after work. While there are many research studies focusing on the work-related musculoskeletal disorders in many occupations, the studies about WMSDs among farmers, are still very few. In fact, in Thailand, there is rarely any study focusing on the risk factors associated with musculoskeletal disorders among coffee harvesters. Therefore, it would be worthwhile to further study about the prevalence of WMSDs, so this study can be used to develop health promotion and prevention programs for farmers, especially coffee harvesters, not only in the Doi Chaang area but also throughout Thailand.

1.2 **Problems leading to research**

There is an increasing number of work-related musculoskeletal disorders (WMSDs) among farmers including coffee harvesters because of their work conditions and environmental factors. Coffee harvesters complain about musculoskeletal pains.

1.3 Research Questions:

- What are the prevalence and risk factors of acute (7 days) and chronic (12 months) musculoskeletal disorders among coffee harvesters?
- Are there associations between individual factors (such as sociodemographic, health-related and lifestyle) and acute and chronic WMSDs?
- Are there associations between work-related factors and acute and chronic WMSDs?
- Are there associations between psychosocial risk factor related to stress and acute and chronic WMSDs?

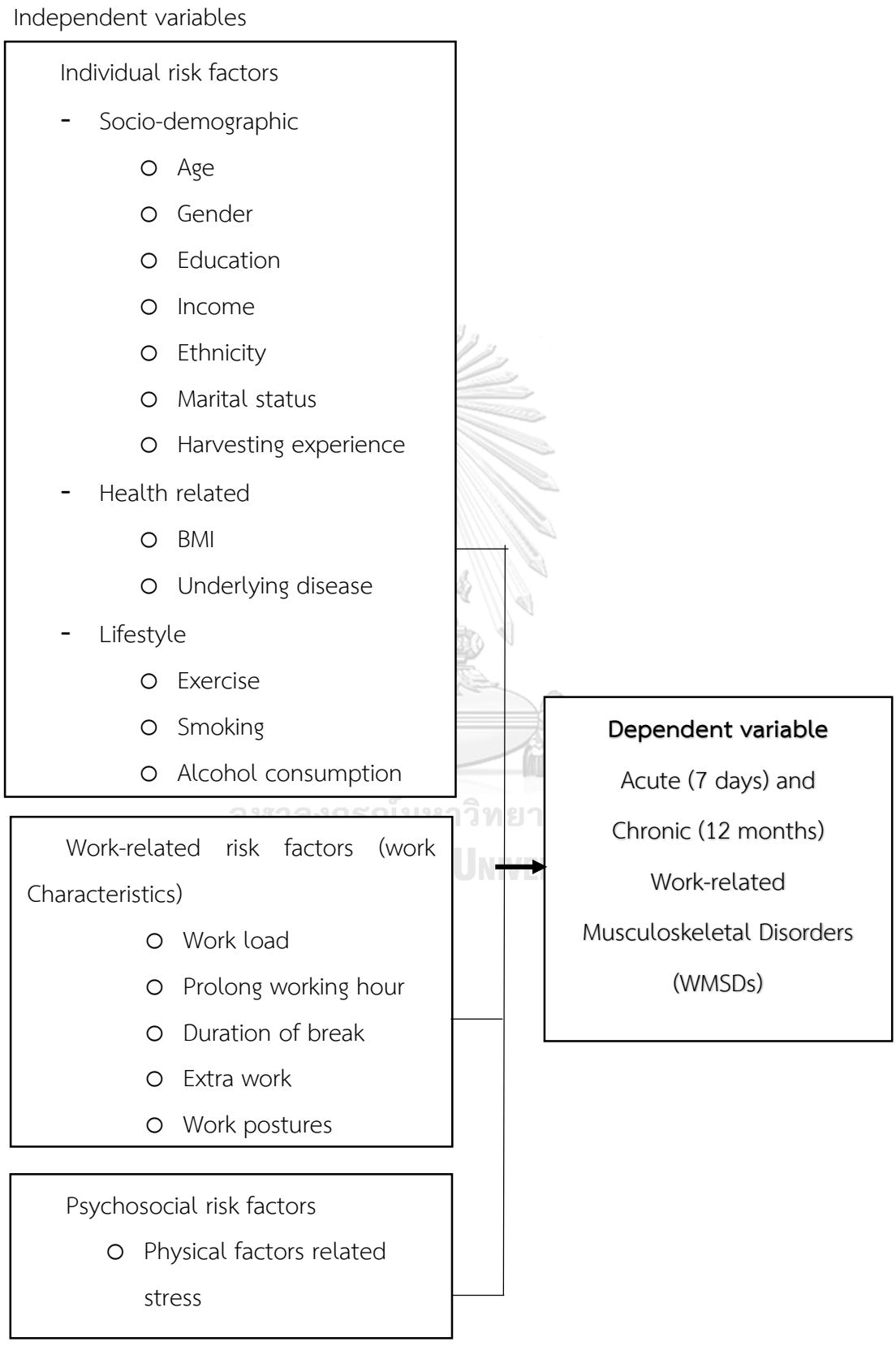
1.4 Hypotheses:

- There are associations between individual factors and acute and chronic WMSDs among coffee harvester in Doi Chaang.
- There are associations between work-related factors and acute and chronic WMSDs among coffee harvester in Doi Chaang.
- There are associations between psychosocial risk factor related to stress and acute and chronic WMSDs among coffee harvester in Doi Chaang.

1.5 Objectives:

- To find the prevalence of acute (7-days) and chronic (12-months) musculoskeletal disorders among coffee harvesters during the harvesting season.
- To identify risk factors associated with acute and chronic Work-related Musculoskeletal Disorders (WMSDs) among coffee harvesters in Doi Chaang coffee plantation, Wawee Sub-District, Chiang Rai, Thailand.

1.6 Conceptual Framework



1.7 Operational definitions

Harvesters— coffee harvesters (those who pick up the coffee cherries) who work in different coffee plantations in Doi Chaang village and registered their names to sell their coffee cherries to Doi Chaang factory for processing

Musculoskeletal disorders (MSDs) - refers to injuries and disorders that cause health problems of the locomotors apparatus of muscles, tendons, skeleton, cartilage, ligaments and nerves (WHO).

Work-related musculoskeletal disorders (WMSDs)- refers to musculoskeletal disorders that the individual has due to their work which exposes them to risk factors, such as lifting heavy items, bending, reaching overhead, pushing and pulling heavy loads, working in awkward body postures, and performing the same or similar tasks repeatedly (Henry et al., 2015).

Coffee Harvesting Processes:

a) **Selective harvesting** refers to when harvesters use both hands to pick the ripe coffee cherries (fruit) one by one. Then they will put those coffee cherries into a basket and dump them into a big sack and carry it out to the storing place. Almost all of the people in Doi Chaang village are using this method of harvesting.

b) **Strip harvesting** refers to when the harvesters manually or mechanically stripped the fruit from the coffee tree at once which means the coffee cherry could be ripe, unripe, or overripe.

Individual factors including sociodemographic, health related and life style:

a) **Age**- refer to the age of harvesters between 18 and 60 years old

b) **Gender**- refer to male or female

c) **Education level**- refer to the highest level of formal education that the harvesters obtained divided into no education, primary school, secondary school, and bachelor degree or higher

d) **Income**- refer to the amount of money that the harvester gets from working in coffee plantations (approximate amount per day or per month)

e) **Ethnicity**- refer to a social group that each individual harvester belongs to, either Thai or other ethnic minority group. Each ethnic minority group shares a common and distinctive culture, religion, language, or the likes within the group. In Wawee sub-district most of the ethnic groups are Akha, Lisu, and Chinese

f) **Harvesting experience**- the number of years that the harvesters worked in the coffee harvesting fields (how long have they been harvesting coffee)

g) **BMI**- refer to the proportion between weight and height to determine the degree of body mass index into 4 levels consisting of:

- Less than 18.5 = underweight
- Between 18.5-24.9 = normal weight
- Between 25.0-29.0 = overweight
- More than 29.9 = obesity

(Reference: World Health Organization, 2006)

h) **Underlying diseases**- the incurring diseases that the individual harvester might has such as diabetes, hypertension, Gout, etc.

i) **Exercise**- refer to any sport that the individual play or activities that involve bodily movement that the individual do which is done in order to become stronger and healthier. The sports or activities which considered as exercise should be done at least 30 minutes per one time and more than twice a week.

j) **Smoking** - refer to smoker or non-smoker persons including how long they have been smoking

k) **Alcohol consumption**- refer to alcohol drinker or non-drinker persons, including how long have they have been drinking alcohol

Work-related factors:

a) **Work load**- an area of the field (how big is the work field) and how much work (amount of work including how many kg of coffee does an individual harvest per day)

b) **Prolong working hour**- the working time (how long) that the harvesters work consecutively per day—how many hours a day approximately do the harvesters work in coffee field

c) **Working postures**- refer to the working positions that harvesters do during harvesting coffee such as standing for long time, walk up and down hill, lifting arm above the head for long time, hand/wrist twisting, trunk twisting, repetitive movement, poor working condition etc.

d) **Duration of break**- the time during the day that the harvesters is resting and not working (how long and how often do harvesters get a break from work)

e) **Extra work**- the other jobs or works during harvesting time that each harvester does besides harvesting coffee, such as working in farming for other crops (beans, rice, corn, macadamia and nuts), daily employed, side jobs, etc.

Psychosocial risk factors

a) **Physical factor related to stress**- refer to a state of mental or emotional strain or tension resulting from adverse or demanding circumstances. In this case the individual harvester may have underlying tension from work problems, family problems, financial problems, social problems, etc. which lead them to develop symptoms of stress. The level of stress was measured using DASS-21 scale

Chapter II: Literature Review

2.1 Coffee and coffee harvesters

Coffee accounts for one of the main cultivation products in Chiang Rai Province. Since Chiang Rai is a mountainous area with cool weather, it is suitable to grow winter plants such as coffee. Coffee is planted with coffee seeds and it will take three to four years to grow into a plant. Then the fruits, coffee cherries, will come out in a green color. Once the coffee cherry turns red, that means the bean is ready to be ripen. Normally, the coffee cherry can be harvested once a year (From November to February). Since coffee is an industrial crop in Chiang Rai, many people are working as coffee farmers or harvesters and make a lot of money from their own coffee plantation.

Coffee harvesters are those who work in the field to harvest coffee cherries during harvesting season. Sometimes we use the term coffee harvester interchangeable with coffee farmers. These people have experience in harvesting coffee and processing coffee cherries after harvesting. These people may have other responsibilities besides harvesting coffee as well since the harvesting season is only once a year. The harvesting season for coffee is only from October to February or March. During other times of the year these people may only watch over and take care of their coffee plantation, or they might produce and harvest other local crops such as corn, beans, macadamia nuts and other products. Moreover, some of the harvesters once they are finished with harvesting coffee may work as daily or part time employees in factories or elsewhere

in the city. In Doi Chaang, there are almost 1,000 households and mostly all of the families work or have worked in coffee plantations as harvesters ("Doi Chaang coffee, single origin world class specialty coffee," 2018). However, in this study, the harvesters that will be recruited for the study is the ones who currently work in coffee fields and have their names registered to Doi Chaang coffee factory (the biggest factory in the village).

2.2 Coffee harvesting process

Production of coffee is a time and labor-intensive process. After planting coffee seeds, it may take around three to four years before the planted coffee tree will begin bearing fruit. Once the fruit, called coffee cherries, turn their color into bright red, they will be ready to be harvested. This process of harvesting is performed by hand. There are two harvesting methods. The first is called selective harvesting and the second method is called strip harvesting.

Figure 1 Coffee Cherries: The red beans are the ripen coffee cherry, the brow are the bad one and cannot be used, the green are not ready to ripe yet.

The selective picking is only done by manual labor or picking by hand, where harvesters select only the cherries in the right state of ripening ("Coffee," 2009-2017). After every few weeks, the harvesters will go back again and again to pick up only ripe coffee cherries until the all the good ripened fruits have been harvested (Shuler, 2015).

Figure 2 Selective picking method

The pickers or harvesters will spend the day picking ripe fruit from the tree and filling their baskets. Then they will walk with their full baskets to empty the coffee cherries into a large sack or bag. At the end of the day, when the big sack is full, the harvesters will have to spread out the harvested fruits and take out the unripe or overripe fruit that may accidentally mix with the ripe coffee. Then they will put the good ripe coffee cherries into the sack again and carry the sack from the field into the main stocking place where the sack will be weighed and they will get paid according to the weight ("10 Steps from seed to cup,"). This harvesting method results in much

higher quality of coffee beans because only ripe fruit are picked. However, it is also time consuming and requires high labor-intensive efforts with minimal pay.

The second method is strip harvesting. In this method, all the coffee fruit are stripped from the coffee branch at once without distinction whether a cherry is fully ripe or not. This method can be performed both manually and mechanically. There are three common ways that coffee is strip harvested—manual stripping, mechanical stripping and mechanical harvesters.

Figure 3 Manual striping method

Manual stripping is when harvesters place a big piece of plastic on the ground. Then they grab the branch with their hands and pull outward, knocking all the fruits onto the ground. Then the harvesters will collect the coffee fruits and put into a big sack or bag then take it to be weighed (Shuler, 2015). Only this method of strip harvesting has done in Doi Chaang village. In mechanical stripping, the harvesters use derricadeiras, a mechanical stripper that looks like a hand attached to a weed whacker, to help in harvesting. The harvesters will first put down the plastic canvas and then use the mechanical strippers to knock down all the coffee onto the canvas. All of the coffee cherries are then put into bags which are taken to be weighed (Shuler, 2015). In the mechanical harvester method, the machines use vibrating and rotating mallets to knock the coffee fruit off the tree into collection units. This method required skilled harvesters with strong power to control the machine and collect the coffee cherries afterward. It is also requiring very flat and strong ground to hold the heavy machine (Shuler, 2015).

The strip harvesting process is easy and convenient as it will allow shorter times of harvesting and less manpower. However, strip harvesting will provide no distinction in quality between different stages of the ripening process. That will cause lower quality in the product when taking coffee cherries into processing the coffee beans. Plus, the machine is expensive and requires skilled users to run the machine which will require more money to be spent ("Coffee," 2009-2017). Most of the people in Doi Chaang are using the manual selective picking and manual strip harvesting method, as

they want to control the quality of coffee beans and the plantation is located in a mountainous area which make it difficult to use machines to assist.

2.3 Musculoskeletal disorders

Musculoskeletal disorders or MSDs are injuries and disorders that cause effect on bones and muscle systems (i.e. muscles, joints, ligaments, discs, tendons nerve, etc.) (Luangwilai et al., 2014). The muscular system is responsible for the movement of the human body. There are about 700 different muscles attached to the bones of skeletal system to make up roughly half of person's body weight (Taylor, 1999). There are three types of muscle tissue: visceral muscle, cardiac muscle and skeletal muscle. First, visceral muscle can be found in stomach, intestines and blood vessels. It has functions to make the organs contract to move substance through the organs. Second, cardiac muscle can be found only in the wall of heart and response for pumping blood and give blood supply by deliver oxygen nutrients to the blood and remove waste product from the blood. Finally, skeletal muscle is the only voluntary muscle tissue in the body which control every physical action that a person consciously performs (Luangwilai et al., 2014). The main function of muscle system is movement; muscles are the only tissue in the body that has ability to contract, so it helps move the other parts of body. The other functions of muscular system are to maintain the posture of body position, to move substances inside the body, and to generate the body heat (Taylor, 1999).

Musculoskeletal disorders happen when the functions of musculoskeletal system are disrupted. Musculoskeletal disorders involve a wide range of inflammatory and degenerative conditions affecting the muscles, tendons, ligaments, joints, peripheral nerves, and supporting blood vessels (Punnett & Wegman, 2004). It also includes all forms of ill-health that ranging from light, transitory disorders to irreversible, disabling injuries of musculoskeletal system. Musculoskeletal disorders (MSDs) are widespread in many countries with high substantial costs and impact on quality of life.

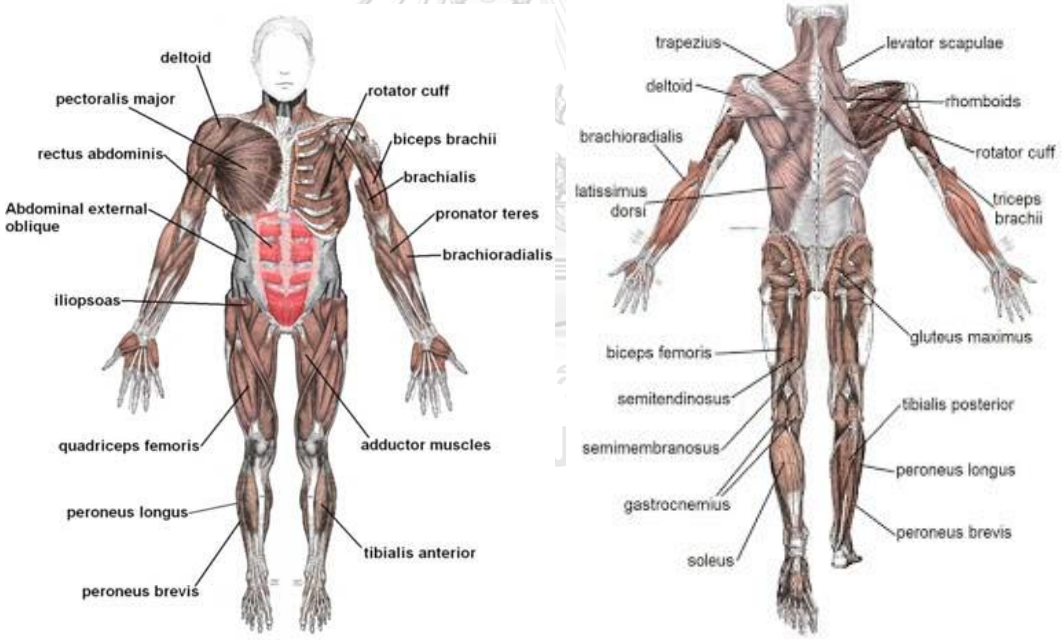


Figure 4 Muscle system

The Center of Disease Control (CDC) Thailand indicated that the musculoskeletal disorders considered as group of diseases that come from many associated factors such as repetitive movement, hard exercise, awkward posture,

activities at home, increasing of age and psychological problems (*Disease related to bone and muscle*, 2012). The CDC office also stated that there is no clear identification whether musculoskeletal disorders could rise from work related factors or not, so it is not clear in some countries whether it is suitable to call this group of diseases work-related musculoskeletal disorders. However, in Thailand since the year 2007, work-related musculoskeletal disorders (WMSDs) became known as the group of diseases arising from musculoskeletal symptoms causing by work-related factors. The Center of Disease Control further classify this group of diseases by the agent and occupations or activities which may have cause the disease. (Table 1)

Table 1 Group of diseases from musculoskeletal disorders (MSDs) classified by CDC Thailand in 2012

Code	Disease	Agent (cause of disease)	Occupation/Industry
M 54	Lower Back pain (Dorsalgia)	Lifting heavy objects Twisting body or bending the body	The works which require to lift and carry heavy objects, truck driver, rice farmers, nurse, and messenger
M 65.3	Synovitis and tenosynovitis (related to finger pain or numbness)	Working in the same motion for long time especially using hands' muscles	Any occupation which required to use a lot of hands and fingers motions

M 65.4	Inflammation on the radius bone	Work that required repetitive motions with twisting hand in the unnatural position	Job that require to use scissors to cut hard objects, using computer's mouse for long time, bakery, jewelry shop etc.
M 70.0	Soft tissue disorders related to use, overuse and pressure Inflammation of tendons and muscles in hand's area	Work that required repetitive motions with twisting hand in the unnatural position	Job that require to use scissors to cut hard objects, using computer's mouse for long time, bakery, jewelry shop etc.
M 70.2	Inflammation of elbows' muscles	Use of elbow to lean against something for long time	Painter, pipe repairer who has to crawl into the pipe by using elbows
M 70.4	Inflammation of knees' muscles	Crawl for long time, stay on the knees for long hours	People who work with the floor cleaning and laying down tile on the floor, cleaner who mob the floor
M 77	Other enteropathies	Jobs that require repetitive movements	Technician working with nail and hammer, cooker, sport players like tennis players, golf players or volleyball players.

2.4 Work-Related Musculoskeletal Disorders

The cause of musculoskeletal disorders is mostly work-related. So, we called it work-related musculoskeletal disorders (WMSDs). In the United States, WMSDs are the single largest category of work-related illness which represent more than third of occupational disease (Punnett & Wegman, 2004). From a weekly epidemiological surveillance report in 2011, the first group of diseases from occupational sources were musculoskeletal diseases 45.0% (1,898 cases), followed by toxic effects from contacts with venomous animals 24.5%, skin disease 20.3%, toxic effect of contact with plants 4.2%, respiratory and lung disease 2.7%, pesticides 1.6%, and finally the toxic effect of gas and vapor poisoning 0.9% (Luangwilai et al., 2014). The prevalence of musculoskeletal disorders is high among all occupations, and it is considered to be the major occupational health problem of workers around the world. Moreover, the provincial reports indicated that musculoskeletal discomfort in Thailand is increasing from 79% from Hatyai municipal area, Songkhla province, 79.12% from Bangkok, and 88% from a screening survey in Chiang Rai Municipality, Chiang Rai province (Pintakham & Siriwong, 2016). So, this problem of WMSDs is increasing everywhere around the world including Thailand.

According to the World Health Organization, WMSDs are health problems that include symptoms like pain, swelling or sensation of heaviness and fatigue that affect locomotion apparatuses such as nerves, ligaments, cartilage, bony skeleton, tendon, and muscles. These included all complaints from discomfort to irreversible and

incapacitating injuries (Lopez-Aragon, Lopez-Liria, Callejon-Ferre, & Gomez-Galan, 2017). MSDs are often work-related and become a major cause of public health concern. The prevalence of MSDs varies from 15% to 42% among unskilled laborers such as farmers, forest workers, and construction workers (Meeksawi et al., 2012). So, right now the work-related musculoskeletal disorders (WMSDs) are common among the working population (Phajan, Nilvarangkul, Settheetham, & Laohasiriwong, 2014). The prevalence of WMSDs is increasing worldwide with substantial costs and impact on quality of life. For example, in the Great Britain, WMSDs is accounts for 41% of all work-related ill-health, becoming a significant burden to many employers and employees (Buckley, 2016). In many countries such as Canada, United States, Sweden, England and Finland, WMSDs cause disability and absent from work more than any other diseases (Punnett & Wegman, 2004). The report in Thailand for the year 2012, shows that there are 274,832 cases of WMSDs per year and the cost to treat this disease among the population is highly expensive (Phajan et al., 2014). So, the WMSDs generally affects the quality of life of the working population and it results in costly treatment.

2.5 Risk factors of WMSDs

2.5.1 Work related factors

There are several work-related factors that cause WMSDs among workers. Many studies investigated the prevalence of WMSDs among agricultural occupations and it

has been found that there is a high prevalence of the disease among this population (Thetkathuek et al., 2017). The major causes of WMSDs are physical ergonomic factors such as a combination of load and posture, postural activities, heavy weight lifting, awkward working postures, manual materials handling, long working hours per shift, long time standing or walking, trunk twisting, repetitive movements or monotonous work and poor working conditions (Meeksawi et al., 2012). We can see almost all of these postures and working position in the process of harvesting coffee. All of the activities from work are considered to increase the prevalence of WMSDs.

Lifting arms above shoulders for long time

Twisting hands and fingers

Lifting and carrying heavy object

Squatting for long time

Bending

Stand on un even ground (work on hill)

Figure 5 Working postures that harvester do regularly

According to a study from Tanaka et al. (2001), 40% of all upper extremity musculoskeletal disorders in the total US employed population were attributable to occupational exposures. And this percentage represents more than 500,000 employers who are affected by WMSDs per year (Tanaka, Petersen, & Cameron, 2001). Many

studies in the US also give results that an estimated proportion of WMSDs morbidity is related to individual workplace factors among people exposed at work (Punnett & Wegman, 2004). So, it has been said that those exposures at work should be prevented in order to reduce the cases of MSDs among employed workers. When looking specifically at farm workers, for those who work in different crops plantations, it was found that they performed their tasks in settings where the temperature is too hot, the working hours are too long, the work load is too heavy and that they were affected by vibration of the machines and tools that they use. All of these exposures at work have caused them to have musculoskeletal pain (Thetkathuek et al., 2017).

2.5.2 Individual factors

Beside work-related factors, the personal factors such as age, gender, education, ethnicity, BMI, exercise, smoking, alcohol consumption and underlying diseases can also be considered as factors associated with the disease.

Age is one of the important factors associated with WMSDs because the symptom is also increased with age. The study of the National Institute of Arthritis and Musculoskeletal and Skin Disease has stated that the musculoskeletal symptoms will start affecting adults with an age around 30-40 years old; as the age increases, the disease becomes more common (Luangwilai et al., 2014). One study on the prevalence of musculoskeletal disorders in the US population conducted an annual National Health Interview Survey finding self-reports of WMSDs, especially in cases of arthritis.

The survey indicated that the prevalence of the disease was estimated at 49.4% for persons with an age of more than 65 years old and only 0.5% for persons aged less than 16 years old (Lawrence et al., 1998). This study also shows the increase in prevalence of WMSDs with increases in age. It presents that an increase in the prevalence of WMSDs is largely due to aging of the population.

The next factor is gender, many studies found that the prevalence of WMSDs among male and females is different. A study related to WMSDs among Cambodian migrant workers in the fruit plantations in the eastern part of Thailand indicated that 44.7% of women workers developed MSDs while only 38.9% of male workers had the symptoms (Thetkathuek et al., 2017). Similarly, another study focusing on rice farmers in the eastern part of Thailand found that there was about 61% of lower back pain in female farmers while there was only about 51% in male (Taechasubamorn, Nopkesorn, & Pannarunothai, 2011). The National Institute for Occupational Safety and Health (NIOSH) conducted several studies related to musculoskeletal disorders in the work place, and most of the statistical results showed that the prevalence of work-related musculoskeletal disorders in females appears to exceed the prevalence of disorders in males (Tanaka et al., 2001)

Some studies gave results that one's educational level is associated with WMSDs. A study of lower back pain injury among farmers in Iowa shows that there is an association between higher education and lower back pain (Luangwilai et al., 2014). Another similar study, conducted by Meeksawi et al. (2012) in the rubber farmers in

the southern part of Thailand, also agree that the lower level of education is significantly associated with lower back pain and musculoskeletal symptoms.

The Body Mass Index (BMI) is a simple index of weight- for-height that is usually used to classify obesity, overweight and underweight in adults (World Health Organization, 2006). BMI was defined as the measurement of the relationship of muscle mass and fat in the human body and it is calculated by mass in kilograms divided by height in square meters (World Health Organization, 2006). A study in Australia about the association between BMI and musculoskeletal pains in factory workers shows the result that the overweight or obese participants when compared with normal weight participants reported more frequent occurrences of musculoskeletal pain and related symptoms in the shoulder (p=0.007) and wrist/hand (p= 0.040) (Moreira-Silva, Santos, Abreu, & Mota, 2013). Although there are some studies indicated that BMI associated with muscle pain, there is no clear explanation on this given subject.

Beside BMI, exercise sometimes played role in helping reduce pain of muscle system as well. Exercise to a certain extend could help build the muscle up, but too much exercise or too much physical exertion on the body could also cause muscle injury and muscle pains (Nunes & Bush, 2012). In some studies exercise was given as a protective factor, meaning the more regularly you exercise, the more protected you are from WMSDs (Luangwilai et al., 2014). On the other hand, some studies indicated that exercise could be risk factor, meaning the more intensive exercise you perform, the higher chance of getting WMSDs and muscle injury (Chaikleang & Nithithamtara,

2016). So, exercise could be considered as risk factor or protective factor depending on the intensity and frequency of exercise each individual person does.

Finally, there are some studies which found that there is an association between smoking and WMSDs. A study from Leino-Arjas in 1998, showed that there is a relationship between smoking and back pain only in those occupations that required high physical exertion. Many other studies also indicated that the longer period you smoke, the higher chance of developing back pain (Leino-Arjas, 1998). Another study from Skillgate et al. (2009) also stated that smoking is a risk factor which contribute to long term sick leave resulting from back or neck pain (Skillgate, Vingård, Josephson, Holm, & Alfredsson, 2009).

2.5.3 Psychosocial risk factors

The other risk factor that is believed to be associated with WMSDs is the psychosocial factor. Psychosocial variables have just recently become more prominent among epidemiologic risk factors for work-related musculoskeletal disorders (Feuerstein, Shaw, Nicholas, & Huang, 2004). Psychosocial factors are mostly attributed to a combination of different factors. In this study, the psychosocial factors will include those that related to the physical environment at work related to stress symptoms.

The exposure of workers to unfavorable physical factors may influence the WMSDs. The work-related psychosocial factors are included the high job demand, decision latitude, social support, job insecurity, and external environmental concerns

(Lee, Wilbur, Kim, & Miller, 2007). The strategy that workers may employ for completing, responding to or coping with job demands may affect the musculoskeletal health (Feuerstein et al., 2004). High job demands, in particular, have some effects to harmful physical working conditions in some occupations. The high job demands may lead to prolong working hours and less favorable work style to accomplish the demands at work (Feuerstein et al., 2004). Besides high job demands, family and social support are also very important because they are psychosocial related factors. A study in Korea about the psychosocial factors at work indicated that flight attendants with WMSDs compared with those without WMSDs had a higher perceived physical load, psychological job demands, and job insecurity (Lee et al., 2007). So, the jobs that require the high physical demands with prolong working hours and with less satisfaction of the workers may cause the workers to the development WMSDs more often than the jobs with less physical demands.

All unfavorable physical factors at work could lead to emotional strain and cause stress. Many studies have been found that the relationship between psychosocial factors and MSDs could be mediated by stress symptoms. A study about psychological factors related to WMSDs in sugarcane farmers showed that stress provoked an increase in muscle co-activation leading to increased loading of the musculoskeletal system (Phajan et al., 2014). The other study by Gary Raine (1999) also demonstrated that stress from financial and individual problems were related to WMSDs (Raine, 1999). According to the study about lower back pain of rubber farmers

in the southern part of Thailand, the lower back pain is associated with emotional stress such as anger, fear, depression and social distress (Meeksawi et al., 2012). Most of the farmers are stressed with work problems, family problems, or financial problems. So, these emotional stresses may lead to the case of WMSDs in farmers and those in other similar occupations. Stress of any cause is considered as psychological factors and could increase the risk of WMSDs.

2.6 Questionnaires

First questionnaire that was used in this study was a Standardized Nordic Questionnaires which are the questionnaires that are used to analyze and record musculoskeletal symptoms. Since there are many studies related to factors associated with musculoskeletal disorders, the Nordic groups decided to develop questionnaires to analyze musculoskeletal symptoms to compare the results from different studies (Kuorinka et al., 1987). The questions consist of two types: the general questionnaire which is only for surveying and a specific questionnaire focusing on lower back and neck/shoulders which is used for the analysis (Kuorinka et al., 1987). The purpose of questionnaire is for screening musculoskeletal disorders and it provides the means to measure the outcome of epidemiological studies on musculoskeletal disorders (Lopez-Aragon et al., 2017). It is used as a tool for analyzing the work environment or work station that may cause MSDs and its validity and reliability has been tested with many populations at different times until formulated into a final version which is used widely

for studies related to MSDs. The questionnaires provide useful and reliable information on musculoskeletal symptoms which would help further in-depth investigation on decision making on the prevention of MSDs (Kuorinka et al., 1987).

The other standard question that was used in this research study is the DASS-21 items. DASS-21 is the shorter version of DASS 42-items, which is a self-administered questionnaire designed used world-wide to measure the magnitude of three negative emotional states: depression, anxiety and stress (Parkitny & McAuley, 2010). A respondent indicates on a 4-point scale that extent to which each of 21 statements applied over the past week. A printed connection is used to obtain total scores for each subscale and the higher scores on each subscale indicate increasing severity of depression, anxiety or stress (Parkitny & McAuley, 2010). The DASS-21 can be used to calculate depression, anxiety and stress separately with a different total set of scores in each category. More than 25 translations of DASS questionnaire has been use to assess the scores in many different countries, including Thailand. Since this research study will deal mainly to measure stress (tension and irritability) of the participants, only 7 questions about stress out of the total 21 questions were selected and the scores of stresses were calculated accordingly. The calculated total scores of these 7 questions of stress were done before doing data analysis. The total stress scores on DASS-21 needed to be multiply by two before calculating the final scores. The final scores were categorized into 5 categories: 0-14 is normal or no stress, 15-18 is mild level of stress, 19-25 is moderate level of stress, 26-33 is severe level of stress and

34+ is extremely severe level of stress. Then it served as categorical variables when doing data analysis (Oei, Sawang, Goh, & Mukhtar, 2013).

Final score for DASS-21

	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Extremely Severe	28+	20+	34+

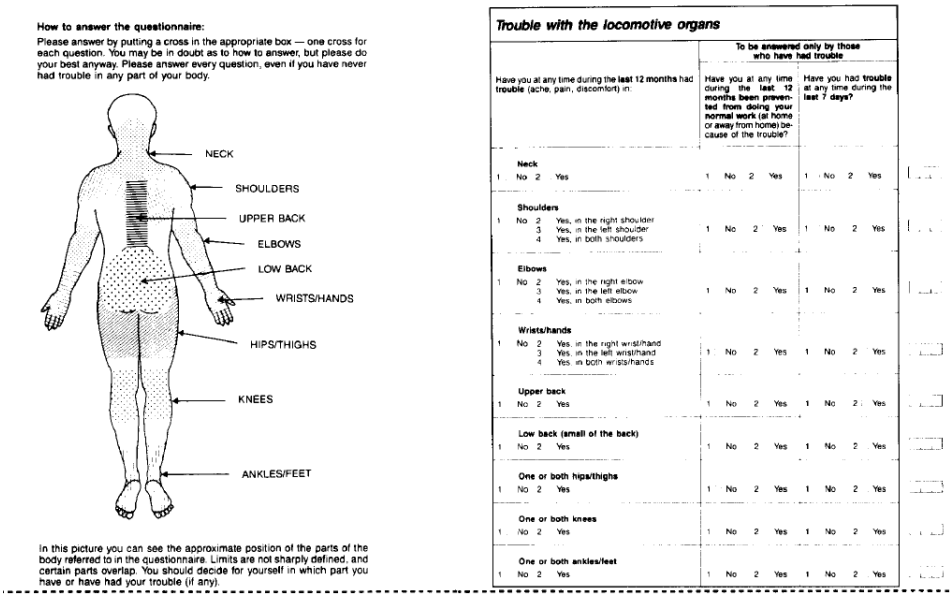


Figure 6 Example of Standard Nordic Questionnaire

Chapter III: Methodology

The study design of this research was cross-sectional design. The purpose of this research was to find the prevalence and risk factors of work-related musculoskeletal disorders (WMSDs) among coffee harvesters in Doi Chaang coffee factory, Wawee Sub-District, Mae Suai District, Chiang Rai, Thailand. The study took place during coffee harvesting season which was around January to March of 2018.

3.1 Study Population

Doi Chaang coffee factory was selected as the study site because it was the biggest coffee factory in Wawee Sub-District and well known for growing and processing coffee. As mentioned in the introduction, most of the people in Wawee sub-district worked in coffee plantations, but the exact number of households or persons who work as coffee harvesters was not known. So, the factory was purposively selected as the study site because it had the name lists of harvesters who registered to sell their products to the factory during the harvesting season. The study population of this study were harvesters who work in different coffee plantations (owned by themselves or their friends and family) and had registered their names with Doi Chaang coffee factory to sell their products to the factory during this harvesting season. The name list came from those harvesters who registered their names at the beginning of

harvesting season, October 2017 (N=689) (Doi Chaang factory agriculturalists registered name lists, 2017).

3.2 Sample size

The eligible target sample population of coffee harvesters who registered their names with the Doi Chaang coffee factory was 689 people (N). The sample size was calculated from the Taro Yamane formula (Yamane, 1967). Total population was 689.

Yamane formula:

$$n = \frac{N}{1 + N(e)^2}$$

n = sample size

N = Total population (689 coffee harvesters)

e = acceptable sampling error (at 95% confidence level, so p=0.05 is assumed)

$$n = \frac{689}{1 + 689(0.05)^2}$$

$$n = \frac{689}{2.72}$$

= 253. 076

n = 253

Give a 5% dropout rate, allowance was made to add to the sampling figures, namely to add to its sample size.

Therefore, the sample size of this study was 266 coffee harvesters.

3.3 Sampling Technique

The convenient sampling technique was used in this study. Doi Chaang coffee factory was the biggest factory in the village and most of coffee harvesters in the village who did not own coffee processing machines will sell their raw coffee cherries to this factory. So, Doi Chaang coffee factory was purposively selected as the study site. During harvesting season, coffee harvesters would regularly come to the factory in the evenings to sell the coffee bean that they harvested each day. We could not be predicted the specific day of the week that each harvester would come to sell their crops and we did not know exactly how many harvesters would come in one day. So, the convenient sampling technique was chosen to access the sample population. According to the number of harvesters that came each day, it took several evenings to reach the sample size population target. The ID number of harvesters from the registered lists that the factory has was recorded each time of the interview to avoid interviewing the same person on different days.

The researcher along with trained interviewers conducted a face to face interview with the participants who met the criteria. The samples needed to meet these inclusion criteria in order to participate in this study

Inclusion criteria:

- They must be both male and female harvesters aged between 18-60 years old.

- They must only harvest coffee during this time and come from different plantations to sell their coffee cherries to Doi Chaang factory
- They must be Thai citizens and/or ethnic minorities who mostly understand Thai language.
- They must have at least one year of experience in harvesting coffee.
- They must have to harvest coffee in the plantation at least one day in the past week (past 7 days).
- They must be willing to participate in the study.

Exclusion criteria:

- Those who have history of operations on their musculoskeletal system.
- Those who are regularly taking muscle relaxant drugs to reduce muscle pain (taking drugs to reduce pain more than 7 days in a role within the past one-month time, and muscle relaxant drugs are included Thai herbal drugs to reduce pain and western drugs such as Paracetamol, Tylenol, or any drugs for muscle pains.) (cut point reference from thailandhealth.or.th)
- Those who are disables.

In case that the participant understands Thai, but might not be able to communicate in the Thai language very well, a local translator helped to translate the correct information.

3.4 Measurement tools

There were two sections of questionnaires. One section was related to background and demographic data of the individual and the other section was used to measure musculoskeletal symptoms. The questionnaire was developed based on selected standardized questionnaire and literature review.

The section about background demographic questionnaires was developed by researcher from the literatures review. The questionnaires included information about each individual socio-demographic (age, sex, education, income, ethnicity), health factors, work-related factors, life-style factors, and psychosocial factors. The psychosocial part included the standardize DASS-21, which is the standard questionnaire that was used to measure stress level of harvesters. This stress symptoms may come from work and physical environment.

The reason that DASS-21 was chosen because it has been used worldwide for measuring distress from depression, anxiety and stress with a shorter number of questions and shorter amount of time. Each of the three scales in DASS-21, (anxiety, depression and stress) contains 7 items and each scale can be calculated for total score separately. Marrianna Szabo, 2010, stated that the scale of stress emerged empirically during the development of the depression and anxiety scales through an aggregation of items such as difficulty in relaxing, tension, impatience, irritability and agitation. The measurement of stress scale is correlated with anxiety and depression and it can be used to emphasize the specific associations with general distress factor

(Szabo, 2010). So, in this study, only the items on questionnaire which related to stress were chosen to represent the distress that harvesters may have.

The second section of questionnaire that relate to musculoskeletal disorders was acquired from the Standardized Nordic Questionnaires (Kuornika et al., 1987). This questionnaire was used to measure the respondents' subjective perceptions of disability and pain. It was also used alongside the purpose-designed questionnaire on risk factors to examine the relationship between risk exposure and work-related musculoskeletal disorders (Phajan et al., 2013). This Nordic questionnaire was chosen because it could be used to identify the 9 body regions that may develop the disorders (shoulder, neck, elbow, upper back, lower back, wrist/hand, hip/thighs, knee, and ankle/feet) that each individual may experience within 7 days or the last 12 months. The questionnaires were asking whether the participants have feel the pain related to muscle or bone in each body region within the past 7 days or 12 months period or not. If they have pain in any part of body within the given period of time that would indicate that they have symptoms associated with WMSDs. This tool was used worldwide and it had been translated into Thai language. This standard set of questionnaire was adapted from the research of Luangwilai, 2013.

This questionnaire was sent to three experts in this field to test its validity prior to the research study. The experts were evaluating the questions and give each question score of 1 if it is in line with objective, 0 if not sure about decision and -1 if it is not in line with objective. Then the average score was calculated in each question.

Once the average score was calculated, the questions with score of 0.5-1.0 is valid and was uses, but the questions that had score of less than 0.5 need revision. Once the revision is done, all of the average scores from each question were added up and divided by the total number of the questions. The validity score for this section of questionnaires was 0.88. In addition, this section of questionnaires was also sent to pretest its reliability (for pilot study) with 30 coffee harvesters in Huai San village (the village next to Doi Chaang). The reliability was then assessed by using Cronbach's α, yielding score of 0.72, which was just acceptable.

3.5 Data collection

First, Doi Chaang coffee plantations, Wawee Sub-district in Chiang Rai was chosen as the study area. The researcher first went to Doi Chaang coffee factory to contact the owner of the factory for interviewing the harvesters who come to this factory to sell their coffee cherries. Then, the permission letters to publicize the research was sent to the owner of the coffee factory. The owner then put advertisement announcement from researcher at the factory, so the harvesters who come to sell their coffee beans during harvesting season would know about this research. The harvesters who met the criteria and volunteer to participate in the research was recruited.

Prior to conduct the research, researcher trained 5 assistances to help with the interview of participants in this research. The assistances were trained to understand

the questions thoroughly and trained how to ask questions properly and correctly without bias or leading to answers.

The researcher explained the research detail to the participants as a whole clearly and informed the participants about the consent form. Then face to face interviews took place with all of those participants who gave consent to the researcher. All the data collections were kept by the researcher. The interview with the same set of questionnaires was conducted with every individual harvester. The researcher also asked to take picture during an interview and to visit the coffee plantation of the harvesters for taking pictures while they worked in the field.

3.6 Data Analysis

After data collection, the data was analyzed by using license SPSS statistics for windows version 22. The descriptive statistics were used to examine the independent variable characteristics of coffee harvesters and prevalence of WMSDs (frequencies, percentage, and means).

The dependent variables were 7 days (acute) and 12 months (chronic) work-related musculoskeletal disorders (WMSDs). The dependent variables were categorized with Yes and No (dichotomous), so the binary logistic regression was use to find the association between dependent and independent variables with the indicated odd ratio and 95% confidence interval. The association between each risk factor (Independent variables) and WMSDs were analyzed first by binary logistic regression,

using univariate analysis to find Odds Ratio (OR) with 95% confidence interval (CI). Then the risk factors that had significant value less than 0.200 ($p<0.200$) were chosen to put in final model for multivariate binary logistic regression analysis to explore the independent predictors of WMSDs with adjusted Odd Ratio. The analysis was done with the 7 days WMSDs and 12 months WMSDs separately.

Chapter IV: Results

A cross sectional study was used to find the prevalence of work-related musculoskeletal disorders and revealed the associations between WMSDs and the indicated risk factors among coffee harvester in Doi Chaang village, Chiang Rai Province. The data collection was done in between February and March 2018. There were total of 272 coffee harvesters agreed to participate in this study. The harvesters are from ethnic minority groups (hill tribes) who live in the northern part of Thailand.

4.1 The prevalence of WMSDs

In the questionnaire, musculoskeletal symptom of pain was categorized into nine parts (neck, shoulder, elbows, wrist/hand, upper back, lower back, hip, knee and ankle). For overall category, 'Yes' meant there was any pain in one or more of the body parts, and 'No' meant there was no pain at any part. The prevalence of WMSDs observed was higher in the 12 months period than in 7 days period with 81.6% and 79.4% respectively. In 7 days period, neck and shoulder pain were the most reported cases (59.2%), followed by wrist, lower back, ankle, upper back and so on. The past 12 months period gave similar results with shoulder pain with the most reported case (62.5%), followed by neck, wrist, lower back, ankle, upper back and so on. The prevalence of pain in each body part was presented in Table 2.

Table 2 Prevalence of WMSDs in the past 7 days and 12 months in coffee harvesters

	WMSDs in past 7 days		**WMSDs in past 12 months**	
Body Parts	No n (%)	Yes n (%)	No n (%)	Yes n (%)
Over all	56 (20.6)	216 (79.4)	50 (18.4)	222 (81.6)
Neck	111 (40.8)	161 (59.2)	107 (39.3)	165 (60.7)
Shoulder	111 (40.8)	161 (59.2)	102 (37.5)	170 (62.5)
Elbows	217 (79.8)	55 (20.2)	217 (79.8)	55 (20.2)
Wrist	128 (47.1)	144 (52.9)	126 (46.3)	146 (53.7)
Upper back	164 (60.3)	108 (39.7)	154 (56.6)	118 (43.4)
Lower back	155 (57.0)	117 (43.0)	148 (54.4)	124 (45.6)
Hip	177 (65.1)	95 (34.9)	167 (61.4)	105 (38.6)
Knee	184 (67.6)	88 (32.4)	178 (65.4)	94 (34.6)
Ankle	158 (58.1)	114 (41.9)	152 (55.9)	120 (44.1)

Since the harvesting job require a lot of hand motions in picking coffee cherry from the tree, it was also important to note that there could be some pain in different parts of the hand. So, one part of questionnaire was asking about the prevalence of the pain in different parts of hand. The results revealed that the prevalence of pain was high in thumb and index fingers (60.3%) compared to the other parts of hand. There was rarely any pain in the palm areas and the pain was mostly accumulated in the fingers areas. (Figure 7)

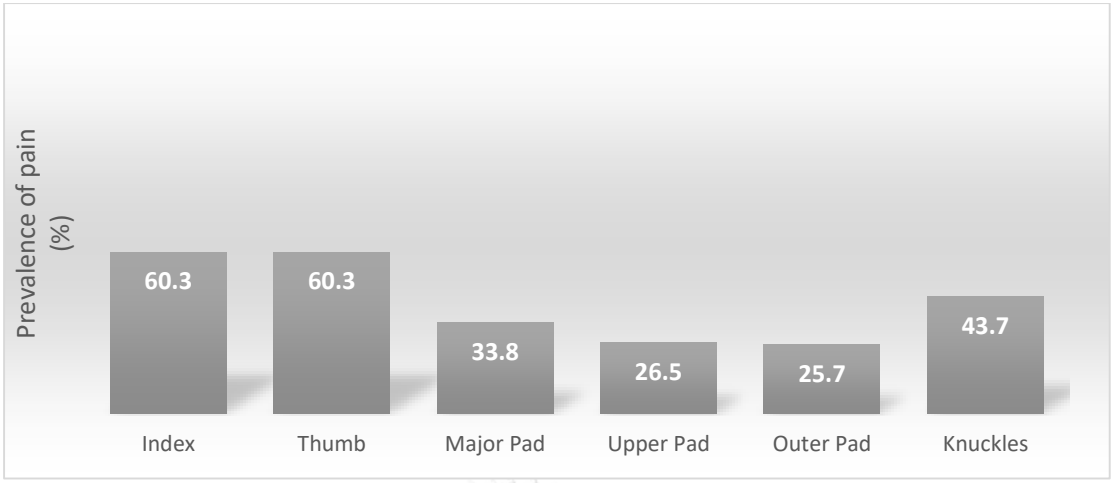


Figure 7 Prevalence of pain in the different parts of hand in coffee harvesters

4.2 General Characteristics (Individual factors)

The total population of 272 were included in this study. The age was between 18 and 60 years old with the mean of 42.3 years old (SD=12.2). A little more than half of the participants were male (53.7%) and about 46.3% were female. The majority of the participants did not have any formal education (63.2%), and about one third were obtaining primary and secondary education. Only about 8.5% of the participants had completed a bachelor degree or higher. The income ranged from 1000 to 20000 Baht with the mean of almost six thousand baht. Almost all of the participants were from Akha ethnic minority group (90.4%) while the rest (Lisu, Chinese and others) made up only 9.6%. Most of the participants were married or have been married; only about 10.7% remained single. The BMI ranged from 15.7 to 33.8 and it was classified into four groups, underweight (11.8%), normal weight (64.3%), overweight (17.6%) and obese (6.3%). Most of the participants were healthy and did not presented with any disease

(86.4%). The other 13.6% were presented with the diseases such as diabetes, rheumatoid, polymyositis and others personal sickness. Only a quarter of the participants were classified as doing exercise meaning they were doing any physical activities (sports or physical fitness) more than 30 minutes per one time and doing it more than twice a week. About one third of the participants were alcohol drinkers (33.1%) and only 28.6% were smokers. (Table 3)

Table 3 General Characteristic of Harvesters

Individual factors		**Person (n)**	**Percent (%)**
Age	Mean=42.3, SD=12.2, Median=45, Min=18, Max=60		
Gender			
	Male	146	53.7
	Female	126	46.3
Education			
	Never	172	63.2
	Primary	30	11.0
	Secondary	47	17.3
	Bachelor degree or higher	23	8.5
Income	Mean=5957.7, SD=3971.5, Median=5,000, Min=1,000, Max=20,000		
Ethnicity			
	Akha	246	90.4
	Others	26	9.6
Status			
	Single	29	10.7
	Married	217	79.8
	Divorced	8	2.9
	Widow	18	6.6

Individual factors		Person (n)	Percent (%)
BMI	Mean= 22.6, SD=3.6, Median=22.2, Min=15.7, Max=33.8		
	underweight	32	11.8
	normal weight	175	64.3
	over weight	48	17.6
	obesity	17	6.3
Disease			
	No	235	86.4
	Diabetes	28	10.3
	Rhumatoid	2	0.7
	Polymysitis	1	0.4
	Others	6	2.2
Exercise			
	No	204	75.0
	Yes (more than once a week)	68	25.0
Cigarette smoking			
	No	199	73.2
	Yes	73	26.8
Alcohol Consumption			
	No	182	66.9
	Yes	90	33.1

4.3 Work Characteristics

Most of the participants were experienced coffee harvesters, they worked in the field between 1 to 45 years with the average mean of 12.3 (SD=8.9). All of them are using gloves and wearing boots as supported equipment during harvesting time. A few of the participants did not own the farm while the biggest farm size that the

participants own was 80 rai (1 rai=1,600 m^2). Most participants work 5- 7 days a week and the work hours for each day was in between 5 to 12 hours. The participants usually got break one or two times during the day (90.8%) only 1.1% got no break and 8.1% got to break more than 2 times per day. The break time range between 0 to 60 minutes. Most of the participants had no other work beside harvesting during this time (81.6%), they are only focusing on harvesting coffee and work in the plantation. The average weight of coffee that the participants harvested was 71.6 kilogram (SD=35.1) with the maximum of 200 kg and minimum of 20 kg per day. During work, harvesters wearing supporter such as gloves (100%), boots (93.4%) and knee supporters (34.2%). Almost all of the participants were right handed, only 5.5% were right handed. The work postures were varying. In their tasks, the participants required to stand for long hours (95.2%), twisting body (86.4%), walk up and down hill (61.4%), bending (57.7%) and lift up arm and hand (55.9%). The rest of working postures were indicated in table 4.

Table 4 Work characteristics of harvesters

Work-related factors		**Person (n)**	**Percent (%)**
Work Experience	Mean= 12.3, SD=8.9, Median=10, Min=1, Max=45		
Farm Size	Mean= 11.5, SD=11.4, Median= 10, Min=0, Max=80		
Work Hour per day	Mean=8.7, SD=1.1, Median=8, Min=5, Max=12		
Break amount			
	No break	3	1.1
	1-2 times	247	90.8
	more than2 times	22	8.1
Break time (minute)	Mean=31.7, SD=16.8, Median=30, Min=0, Max=60		

Work-related factors		Person (n)	Percent (%)
Extra work			
	No	222	81.6
	Yes	50	18.4
Amount of harvested coffee (kg)	Mean= 71.6, SD=35.1, Median=62.5, Min=20, Max=200		
Wear supporters at work	Out of total numbers		
	Gloves	272	100
	Boots	254	93.4
	Knees support	93	34.2
Hand dominant			
	Right handed	257	94.5
	Left handed	15	5.5
Stand long time			
	No	13	4.8
	Yes	259	95.2
Walk up/down on hill			
	No	105	38.6
	Yes	167	61.4
Twisting body			
	No	37	13.6
	Yes	235	86.4
Lift arm			
	No	120	44.1
	Yes	152	55.9
Bending			
	No	115	42.3
	Yes	157	57.7
Hand/wrist twist			
	No	197	72.4
	Yes	75	27.6

Work-related factors		Person (n)	Percent (%)
Carry heavy object of >25 kg			
	No	144	52.9
	Yes	128	47.1
Repeat movement			
	No	185	68.0
	Yes	87	32.0

4.4 Psychosocial related to stress

The psychosocial factors were mainly related to stress. More than half of the participants (69.5%) had normal level of stress and about one third were classified as having mild, moderate and severe level of stress (16.9%, 7.4% and 6.3% respectively). Most of the people had strong family and social support. A little more than half (59.2%) had moderate fatigue from work, meaning they felt tire and weak from their job. Most of the participants got just right amount of leisure and relaxing time (62.1%). This meant most people got enough sleep and had good rest after work. More than three fourth of the participants felt that their job is insecure sometimes and very often (73.5% and 4.8% respectively). The feeling of job insecure was the feeling that they might lose the job or that they would not earn enough money from their job. Lastly, a little more than half (64.4%) of participants felt that their income was too little to cover their daily expenses. The participants have different feelings about the job. About 61.8% of the participants like this job of harvesting coffee, 5.5% feel that this job is easy and is better than the other jobs, 20.2% do this job because they have no choice (they family force

them to do the job), 1.8% finds that this job is boring, and 10.3% wants to change the job if they can find a better job with better pay. (Table 5)

Table 5 Psychosocial characteristics of harvesters

Psychosocial factors		**Person (n)**	**Percent (%)**
Stress			
	Normal (0-14)	189	69.5
	Mild stress (15-18)	46	16.9
	Moderate stress (19-25)	20	7.4
	Severe to extreme stress (>26)	17	6.3
Family support			
	weak	6	2.2
	moderate	38	14
	strong	228	83.8
Social support			
	weak	5	1.8
	moderate	53	19.5
	strong	214	78.7
Fatigue from work			
	mild	21	7.7
	moderate	161	59.2
	high	90	33.1
Leisure			
	too little	83	30.5
	just right	169	62.1
	very adequate	20	7.4
Job insecurity			
	never	58	21.3
	sometimes	200	73.5
	very often	13	4.8

Psychosocial factors	Person (n)	Percent (%)
Feeling about income		
too little	175	64.4
just right	86	31.6
very adequate	11	4.0
Feeling about job		
Like the job	168	61.8
Better than other	15	5.5
No choice	55	20.2
Boring	5	1.8
Want to change	28	10.3
Others	1	0.4

4.5 The association of risk factors and WMSDs

Each of the continuous variables were grouped into two categories with the median as separated point between two groups within each variable before analyze in univariate binary logistic regression analysis. The individual factors were included socio-demographic factors, health related factors, life style factors and psychosocial factors. The univariate analysis of binary logistic regression was used to identify the association between 7 days WMSDs and the risk factors. The results were given that risk factors related to the individual participants, such as age, smoking and stress were presented to have statistical significant association with WMSDs. The older age group participants, (>45 years old) are more likely to develop WMSDs. (OR=2.47, 95% CI [1.32-

4.63], p-value <0.05). People who smoke tended to have a higher chance of developing problems with musculoskeletal pains (OR=2.20, 95% CI [1.02-4.75], p-value<0.05). Finally, people who had some symptoms of stress at any level were having more chance of getting WMSDs than those who did not have any stress or in a normal stress level (OR=3.05, 95% CI [1.54-6.07], p-value <0.05). The other variables that did not presented with significant value but can be included in multivariate analysis model (p-value <0.2) were education, and disease. (Table 6)

Table 6 Crude association by univariate analysis of 7 days WMSDs and individual risk factors in coffee harvesters

Risk factors		**7 days WMSDs**				
	Total	**Yes n (%)**	**No n (%)**	**OR**	**95% CI**	**p-value**
Age						
≤ 45 years old	143	104 (72.7)	39 (27.3)			
> 45 years old	129	112 (86.8)	17 (13.2)	2.47	1.32-4.63	0.005
Gender						
Male	146	114 (78.1)	32 (21.9)			
Female	126	102 (81.0)	24 (19.0)	1.19	0.66-2.16	0.560
Education						
No education	172	142 (82.6)	30 (17.4)			
Educated	100	74 (74.0)	26 (26.0)	0.60	0.33-1.09	0.094
Income						
≤ 5,000 Baht	180	144 (80.0)	36 (20.0)			
>5,000 Baht	92	72 (78.3)	20 (21.7)	0.90	0.49-1.67	0.737
Ethnicity						
Akha	246	195 (79.3)	51 (20.7)			
Others	26	21 (80.8)	5 (19.2)	1.10	0.40-3.06	0.857

Risk factors		7 days WMSDs				
	Total	Yes n (%)	No n (%)	OR	95% CI	p-value
Status						
Single	29	21 (72.4)	8 (27.6)			
Married/has been married	243	195 (80.2)	48 (19.8)	1.55	0.65-3.71	0.327
BMI						
≤ 24.9 (normal)	207	168 (80.4)	39 (19.6)			
> 24.9 (Obese)	65	48 (73.8)	17 (26.2)	0.66	0.34-1.26	0.205
Disease						
No	235	183 (77.9)	52 (22.1)			
Yes	37	33 (89.2)	4 (10.8)	2.34	0.79-6.92	0.123
Exercise						
No	204	165 (80.9)	39 (19.1)			
Yes	68	51 (75.0)	17 (25.0)	0.58	0.37-1.36	0.300
Smoking						
No	199	152 (76.4)	47 (23.6)			
Yes	73	64 (87.7)	9 (8.2)	2.20	1.02-4.75	0.045
Drink Alcohol						
No	182	141 (77.5)	41 (22.5)			
Yes	90	75 (83.3)	15 (16.7)	1.45	0.76-2.79	0.262
Stress						
Normal	189	137 (72.5)	52 (27.5)			
Stress	83	79 (95.2)	4 (4.8)	3.05	1.54-6.07	0.001

The univariate analysis of work-related factors associated with 7 days WMSDs showed that none of the work-related factors gave statistically significant association except for the amount of kilogram of coffee that harvesters harvested each day. The

only factors that could be included in the multivariate analysis was weight of coffee harvested (OR=0.52, 95% CI [0.28-0.95], p-value <0.05). (Table 7)

Table 7 Crude association by univariate analysis of 7 days WMSDs and work-related risk factors in coffee harvesters

Risk factor		**7 days WMSDs**				
	Total	**Yes n (%)**	**No n (%)**	**OR**	**95% CI**	**p-value**
Work Experience (years)						
≤ 10 years	159	127 (79.9)	32 (20.1)			
> 10 years	113	89 (78.8)	24 (21.2)	0.93	0.52-1.69	0.823
Farm Size (rai)						
≤ 10 rai	163	132 (81.0)	31 (19.0)			
> 10 rai	109	84 (77.1)	25 (22.9)	0.79	0.44-1.43	0.434
Work Hours per day						
≤ 8 hours	152	122 (80.3)	30 (19.7)			
> 8 hours	120	94 (78.3)	26 (21.7)	1.13	0.62-2.03	0.696
Break time						
≤ 2 times	250	200 (80.0)	50 (20.0)			
> 2 times	22	16 (72.7)	6 (27.3)	0.72	0.25-1.79	0.421
Extra works						
No	222	175 (78.8)	47 (21.2)			
Yes	50	41 (82.0)	9 (18.0)	1.23	0.56-2.70	0.617
Amount of coffee harvest per day						
≤ 60 Kg	137	116 (84.7)	21 (15.3)			
> 60 Kg	135	100 (74.1)	35 (25.9)	0.52	0.28-0.95	0.032

After analyzing by univariate binary logistic regression, the variables which have P-value less than 0.2 from both individual table and work-related table along with the variables which found to be associated with WMSDs in the literatures review were selected to include in the adjusted model of multivariate analysis. The variables which were included in adjusted model were age, gender, education, disease, smoke, stress, and the amount of coffee harvested.

The multivariate analysis model presented that individual factors such as age (OR_{Adj}=2.47, 95% CI [1.01-1.08]), smoking (OR_{Adj}=2.85, 95% CI [1.22-7.36]), and stress (OR_{Adj}=2.84, 95% CI [1.44-6.00]) were associated with 7 days WMSDs with p-value <0.05. (Table 8)

Table 8 Adjusted association of risk factors and 7 days WMSDs in coffee harvesters by multivariate analysis

Risk factors	OR	95% CI	OR_{Adj}	95% CI	p-value
Age	2.47	1.32-4.63	2.47	1.01-1.08	0.008*
Gender	1.19	0.66-2.16	1.28	0.62-2.64	0.497
Education	0.60	0.33-1.09	1.00	0.45-1.84	0.998
Disease	2.34	0.79-6.92	1.67	0.46-4.89	0.381
Smoking	2.20	1.02-4.75	2.85	1.22-7.36	0.021*
Stress	3.05	1.54-6.07	2.84	1.44-6.00	0.003*
Amount of harvested coffee (kg)	0.52	0.28-0.95	0.62	0.32-1.22	0.170

Note: p-value is for the adjusted OR

* Significant level at p<0.05

The analysis of 12 months WMSDs gave similar result to 7 days WMSDs analysis. The univariate analysis was done to find the association between independent risk factors of the individual and 12 months WMSDs. Factors that presented with significant association were age (OR=2.20, 95% CI [1.15-4.22], p-value<0.05), and stress (OR=2.72, 95% CI [1.39-5.35], p-value<0.05). (Table 9).

Beside those significantly associated factors, the other factors which could be included in the multivariate model (p-value <0.2) were disease, smoking and drinking alcohol.

Table 9 Crude association by univariate analysis of 12 months WMSDs and individual risk factors in coffee harvesters

Risk factors		**12 months WMSDs**				
	Total	**Yes n (%)**	**No n (%)**	**OR**	**95% CI**	**p-value**
Age						
≤ 45 years old	143	109 (76.2)	31 (23.8)			
> 45 years old	129	113 (87.6)	16 (12.4)	2.20	1.15-4.22	0.017
Gender						
Male	146	118 (80.2)	28 (19.2)			
Female	126	104 (82.5)	22 (17.5)	1.12	0.61-2.08	0.715
Education						
No education	172	144 (83.7)	28 (16.3)			
Educated	100	78 (78.0)	22 (22.0)	0.69	0.37-1.29	0.242
Income						
≤ 5,000 Baht	180	146 (81.1)	34 (18.9)			
>5,000 Baht	92	76 (82.6)	16 (17.4)	1.11	0.57-2.13	0.763

Risk factors		12 months WMSDs				
	Total	Yes n (%)	No n (%)	OR	95% CI	p-value
Ethnicity						
Akha	246	199 (80.1)	47 (19.1)			
Others	26	23 (88.5)	3 (11.5)	1.81	0.52-6.29	0.350
Status						
Single	29	22 (75.9)	7 (24.1)			
Married/has been married	243	200 (82.3)	43 (17.7)	1.48	0.59-3.68	0.400
BMI						
≤ 24.9 (normal)	207	172 (83.1)	35 (16.9)			
>24.9 (Obese)	65	50 (76.9)	15 (23.1)	0.68	0.57-1.93	0.888
Disease						
No	235	188 (80.0)	47 (20.0)			
Yes	37	34 (91.9)	3 (8.1)	2.83	0.83-9.63	0.095
Exercise						
No	204	167 (81.9)	37 (18.1)			
Yes	68	55 (80.9)	13 (19.1)	0.75	0.47-1.89	0.857
Smoking						
No	199	157 (78.9)	42 (21.1)			
Yes	73	65 (89.0)	8 (11.0)	2.17	0.97-4.88	0.060
Drink alcohol						
No	182	144 (79.1)	38 (20.9)			
Yes	90	78 (86.7)	12 (13.3)	1.72	0.85-3.47	0.134
Stress						
Normal	189	143 (75.7)	46 (24.3)			
Stress at any level	83	79 (95.2)	4 (4.8)	2.72	1.39-5.35	0.004

The univariate analysis for work-related factors presented that there were no work-related factors associated with the symptoms of 12 months WMSDs (Table 10). However, factor such as kilogram of coffee harvested each day (p-value <0.2) could be put in the final multivariate analysis.

Table 10 Crude association by univariate analysis of 12 months WMSDs and work-related risk factors in coffee harvesters

Risk factors		**12 months WMSDs**				
	Total	**Yes n (%)**	**No n (%)**	**OR**	**95% CI**	**p-value**
Work Experience (years)						
≤ 10 years	159	130 (81.8)	29 (18.2)			
> 10 years	113	92 (81.4)	21 (18.6)	0.98	0.53-1.82	0.942
Farm Size (rai)						
≤ 10 rai	163	135 (82.8)	28 (17.2)			
> 10 rai	109	87 (79.8)	22 (20.2)	0.82	0.44-1.53	0.531
Work Hours per day						
≤ 8 hours	152	126 (82.9)	26 (17.1)			
> 8 hours	120	96 (80.0)	24 (20.0)	1.21	0.66-2.41	0.541
Break time						
≤ 2 times	250	204 (81.6)	46 (18.4)			
> 2 times	22	18 (81.8)	4 (18.2)	1.0	0.32-3.14	0.980
Extra works						
No	222	179 (80.6)	43 (19.4)			
Yes	50	43 (86.0)	7 (14.0)	1.48	0.62-3.51	0.378
Amount of coffee harvest per day						
≤ 60 Kg	137	116 (84.7)	21 (15.3)			
> 60 Kg	135	106 (78.5)	29 (21.5)	0.66	0.36-1.23	0.192

The variables which had p-value less than 0.2 from the univariate analysis tables were chosen along with variables from the literature review to include in the multivariate analysis. The variables that met the criteria were age, gender, disease, smoking, alcohol consumption, stress and Kg of coffee harvested per day. The final adjusted model indicated that only age (OR=2.17, 95% CI [1.10-4.32], p-value<0.05) and stress (OR=2.49, 95% CI 1.26-4.95], p-value<0.05) presented with the significant value associated with 12 months WMSDs. (Table 11)

Table 11 Adjusted association of risk factors and 12 months WMSDs in coffee harvesters by multivariate analysis

Risk factors	**OR**	**95% CI**	**OR_{Adj}**	**95% CI**	**p-Value**
Age	2.20	1.15-4.22	2.17	1.10-4.32	0.027*
Gender	1.12	0.61-2.08	1.32	0.61-2.84	0.479
Disease	2.83	0.83-9.63	2.09	0.56-7.18	0.288
Smoke	2.17	0.97-4.88	2.44	0.90-6.61	0.080
Alcohol consumption	1.72	0.85-3.47	1.23	0.50-3.01	0.649
Stress	2.72	1.39-5.35	2.49	1.26-4.95	0.009*
Kg of coffee harvested	0.66	0.36-1.23	0.55	0.42-1.62	0.572

Note: p-value is for the adjusted OR

* Significant level at p<0.05

For the analysis of postures, it is interesting to look at the analysis one by one with each body part. So the association between each postures and each part of body

represented with the pain was analyzed separately one by one. The results of 7 days WMSDs and 12 months WMSDs were similar. This was done to find which postures were related to which part of body and whether there is any significant association between any part with any specific posture.

Each body part and each posture were first analyzed one by one in the univariate analysis and only variables with p-value less than 0.2 were chosen to include in multivariate model. The univariate analysis of 7 days WMSDs gave results as showed in table 12. In the univariate table, the pain in elbows/arms is significantly associated with twisting body and lifting arms above shoulders. The pain in wrist is significantly associated with twisting hand/wrist. The pain in upper back is significantly associated with twisting body and lifting arms above shoulders. The pain in lower back is significantly associated with twisting body and lifting arms above shoulders. The other associations in the table could be included in the multivariate analysis model, but they did not give the significant associations value.

Table 12 Univariate analysis of association between working postures and 7 days WMSDs in coffee harvesters classified by each body part

Body parts/ postures	**Crude OR**	**95% CI**	**p-value**
Neck			
Twisting body	2.04	0.94-4.40	0.071
Shoulders			
Twisting body	2.04	0.94-4.39	0.071
Lifting arms above shoulders	1.54	0.95-2.51	0.180

Body parts/ postures	Crude OR	95% CI	p-value
Elbows/arms			
Twisting body	2.14	1.00-4.60	0.050
Lifting arms above shoulders	2.02	1.08-3.80	0.029
Carry heavy object (>25 kg)	1.75	0.96-3.12	0.066
Wrists			
Twisting wrist/hands	2.02	1.17-3.51	0.012
Upper back			
Twisting body	3.32	1.61-6.86	0.001
Lifting arms above shoulders	2.40	1.44-3.99	0.001
Lower back			
Twisting body	2.46	1.21-5.03	0.013
Lifting arms above shoulders	1.19	1.18-3.16	0.009
Hip and upper legs			
Twisting body	1.71	0.85-3.45	0.133
Bending	1.62	0.97-2.72	0.066
Knees			
Walk up and down hill	1.54	0.90-2.64	0.113
Twist body	1.96	0.97-3.97	0.060
Carry heavy object (>25 kg)	1.36	0.82-2.27	0.143
Ankle			
Twisting body	2.00	0.99-4.04	0.052

Note: Only postures with positive association to the pain in each part of body and have value <0.200 were chosen to include in the table.

Once the univariate analysis was done, the analysis was carry on for multivariate analysis. In multivariate, each body part was selected as dependent variable and the all postures from univariate table along with adjusted factors such as

age, gender, BMI and stress were included in the independent variables. The final model table for 7 days WMSDs gave result that only the postures of twisting body and lifting arms above shoulders for long time are statistically significant associated with upper back pain. (Table 13) The other associations of each body part and different postures did not give any statistically significant association.

Table 13 Multivariate analysis of association between working postures and 7 days WMSDs in coffee harvesters classified by parts of body

Body parts/ postures	Adjust OR	95% CI	p-value
Neck			
Twisting body	2.01	0.90-4.50	0.090
Shoulders			
Twisting body	1.76	0.75-4.12	0.191
Lifting arms above shoulders	1.41	0.83-2.39	0.208
Elbows/arms			
Twisting body	1.07	0.89-4.78	0.091
Lifting arms above shoulders	1.51	0.70-3.27	0.299
Carry heavy object (>25 kg)	1.32	0.64-2.71	0.448
Wrists			
Twisting wrist/hands	1.61	0.90-2.90	0.110
Upper back			
Twisting body	2.27	1.03-4.99	0.041*
Lifting arms above shoulders	2.36	1.35-4.11	0.002*
Lower back			
Twisting body	1.93	0.89-4.18	0.960
Lifting arms above shoulders	1.78	1.05-3.03	0.330

Body parts/ postures	Adjust OR	95% CI	p-value
Hip and upper legs			
Twisting body	1.40	0.65-3.02	0.384
Bending	1.65	0.94-2.89	0.084
Knees			
Walk up and down hill	1.11	0.58-2.12	0.748
Twist body	2.87	0.87-4.35	0.101
Carry heavy object (>25 kg)	1.88	0.66-2.21	0.533
Ankle			
Twisting body	1.80	0.85-3.73	0.124

Note: Adjusted with age, gender, BMI and stress

*significant value (p-value<0.050)

The univariate analysis of 12 months WMSDs gave the significant association between the pain in shoulders and twisting body (OR=2.41); pain in elbows/arms associated with twisting body, lifting arms above shoulders and carry heavy objects (OR=2.14, 2.50 and 1.93 respectively); pain in wrist associated with twisting hand/wrists (OR= 2.28); pain in upper back associated with twisting body and lifting arms above shoulders (OR=3.67 and 2.73); pain in lower back associated with twisting body and lifting arms above shoulders (OR=2.86 and 2.47); pain in knees associated with walk up and down the hill, twisting body, and carry heavy objects (OR=1.80, 2.91 and 2.03 respectively); pain in ankle is associated with twisting body (OR=2.34). (Table 14)

Table 14 Univariate analysis of association between working postures and 12 months WMSDs in coffee harvesters classified by parts of body

Body parts/ postures	Crude OR	95% CI	p-value
Neck			
Twisting body	1.90	0.88-4.10	0.103
Shoulders			
Twisting body	2.41	1.06-5.52	0.036
Lifting arms above shoulders	1.56	0.95-2.56	0.078
Elbows/arms			
Twisting body	2.14	1.00-4.60	0.050
Lifting arms above shoulders	2.50	1.31-4.79	0.006
Carry heavy object (>25 kg)	1.93	1.06-3.52	0.033
Wrists			
Twisting wrist/hands	2.28	1.30-3.99	0.004
Upper back			
Twisting body	3.67	1.73-7.79	0.001
Lifting arms above shoulders	2.73	1.65-4.53	<0.001
Lower back			
Twisting body	2.86	1.37-5.97	0.005
Lifting arms above shoulders	2.47	1.50-4.06	<0.001
Hip and upper legs			
Twisting body	1.83	0.91-3.67	0.090
Bending	1.51	0.91-2.49	0.108
Knees			
Walk up and down hill	1.80	1.06-2.06	0.031
Twist body	2.91	1.44-5.91	0.003
Carry heavy object (>25 kg)	2.03	1.22-3.37	0.006
Ankle			
Twisting body	2.34	1.15-4.77	0.020

Note: Only postures with positive association to the pain in each part of body and have value <0.200 were chosen to include in the table.

Once the univariate analysis had done, all of the variables from table 13 were put in the final model with adjust multivariate model. The adjusted factors that could be cofounding to the results were included age, gender, BMI, and stress.

The final adjusted value was given that twisting body was associated with upper back, knee and ankle pain (OR=2.53, 2.78 and 2.13 respectively). The postures of lifting arms above shoulder was statistically significant associated with upper back and lower back (OR=2.67 and 2.36 respectively). The posture of carrying heavy object of more than 25 kg was only significantly associated with knees with the odd ratio of 1.92. (Table 15)

Table 15 Multivariate analysis of association between working postures and 12 months WMSDs in coffee harvesters classified by parts of body

Body parts/ postures	Adjust OR	95% CI	p-value
Neck			
Twisting body	1.89	0.85-4.21	0.118
Shoulders			
Twisting body	2.04	0.84-4.96	0.116
Lifting arms above shoulders	1.41	0.83-2.40	0.205
Elbows/arms			
Twisting body	1.92	0.84-4.41	0.123
Lifting arms above shoulders	1.88	0.87-4.09	0.111
Carry heavy object (>25 kg)	1.32	0.65-2.69	0.438
Wrists			
Twisting wrist/hands	1.70	0.93-3.11	0.085

Body parts/ postures	Adjust OR	95% CI	p-value
Upper back			
Twisting body	2.53	1.12-5.74	0.026*
Lifting arms above shoulders	2.67	1.53-4.63	0.001*
Lower back			
Twisting body	2.03	0.92-4.51	0.080
Lifting arms above shoulders	2.36	1.38-4.03	0.002*
Hip and upper legs			
Twisting body	1.61	0.76-3.44	0.216
Bending	1.46	0.85-2.52	0.174
Knees			
Walk up and down hill	1.02	0.54-1.92	0.959
Twist body	2.78	1.26-6.14	0.011*
Carry heavy object (>25 kg)	1.92	1.06-3.48	0.031*
Ankle			
Twisting body	2.13	1.01-4.50	0.048*

Note: Adjusted with age, gender, BMI, and stress

*significant value (p-value<0.050)

Chapter V. Discussion

This cross-sectional research study intended to demonstrate the prevalence of work-related musculoskeletal disorders and identify the risk factors associated with the disorders among coffee harvesters in Doi Chaang village, Chiang Rai, Thailand. The data collection was done by using the questionnaire developed from literature review and adaptation of standardize questionnaires (Standardized Nordic Questionnaires and DASS-21) with the validity and reliability of 0.88 and 0.72 respectively. The face to face interviews were conducted with 272 coffee harvesters in the village on a voluntary basis. The binary logistic regression was used to find the associations, along with Odd Ratio [OR] and 95% confident interval [CI], between risk factors and WMSDs. The univariate analysis was done first and followed by multivariate analysis to identify the association.

5.1 Prevalence of WMSDs

Agricultural is a challenging occupation in which farmers have to suffer from work-related and health-related problems. The highest prevalence of WMSDs is among unskilled and low-income workers such as farmers because farming is a physically demanding occupation and farmers are facing with many physical challenges (Jain, Meena, Dangayach, & Bhardwaj, 2018; Kolstrup, 2012; Meeksawi et al., 2012). In this study, the prevalence of WMSDs for 7 days and 12 months' periods were 79.4% and

81.6% respectively. The results of the 12 months WMSDs was slightly higher, and this may be because of the works or activities that they have done in the past 7 days may not be as hard to put pressure or strain on the muscles, but in the past year there might be time when they work hard to cause injuries or pain in their muscles.

These results were similar to the other study in Thailand about sugarcane farmers which reported the prevalence of WMSDs for 7 days and 12 months periods as 82.9% and 88.7% (Phajan et al., 2014). The other studies in Thailand, except for the one from Phajan, reported the lower prevalence of WMSDs compare to this current study (Meeksawi et al., 2012; Thetkathuek et al., 2017). The similarity in working postures and environmental factors of these two agriculture jobs (coffee harvesters and sugarcane farmers) cause them to give similar results with the high prevalence of WMSDs.

The results by body parts for both 7 days and 12 months WMSDs were given that neck (59.2% for 7 days WMSDs and 60.7% for 12 months WMSDs) and shoulder (59.2% for 7 days WMSDs and 62.5% for 12 months WMSDs) were the parts which present with the highest pain followed by wrists (52.9% for 7 days WMSDs and 53.7% for 12 months WMSDs). The reason is that during the process of harvesting coffee cherries, farmers or harvesters have to reach up to the trees to pick up coffee cherries which requires a lot of motions and put strain on muscle in the upper extremities. The results given here were different from other studies because different farm operations give different results for the prevalence of pain in different parts of body. For examples,

in Thailand, studies on rubber plantation, sugarcane plantation, and different fruit orchards were all resulted that the pain is more common on the upper and lower back regions (Meeksawi et al., 2012; Phajan et al., 2014; Thetkathuek et al., 2017). In this study, though, the pains were more accumulated in shoulder, neck and wrist. These differences are all due to the exposure to vary work environments of different farm operators and the different working postures. Coffee harvesters use a lot of shoulder, arm and wrist muscles while other farmers may use a lot of muscles related to the back region.

Generally, beside the nine body regions, coffee harvesters are also performing a lot of hand motions which may cause them with pains in the hand areas. The results were given that all of the fingers' areas including knuckles were presented with high prevalence compare to the palm areas. None of the study for WMSDs on farmers have investigated closely on the hand region, but for this study, it is interesting to look closely in the prevalence of pain in hand regions because harvesters mainly used their hands and fingers in coffee harvesting process all day long. Further study on the analysis of agricultural occupation which mainly use hand should be done to see whether there is any association between WMSDs or carpal tunnel syndrome and related risk factors.

5.2 Associations between risk factors and WMSDs

1. Individual-related factors

For the individual related factors, the only factors which were statistically significant associated with WMSDs were age and smoking. However, all the factors which may have significant association with WMSDs from the literature review will be included for discussion.

1.1 Age

In this study, most of the participants were older and had long experiences in harvesting coffee. Age is one of the important significant risk factors associated with WMSDs. Both 7 days and 12 months periods resulted that WMSDs is significantly associated with age. (OR=2.47 for 7 days WMSDs and OR=2.17 for 12 months WMSDs). As the age increase, there is a higher chance for harvesters to experience muscle pains associated with WMSDs. This result was consistence with other studies about WMSDs among farmers which were given that people with older age especially those who are 40 years and older are experienced more pain than those who are younger (Jain et al., 2018; Thetkathuek et al., 2017). When people are aged or as they grow older, their bones, muscles, and joint naturally break down and become weakening; this, though, does not mean that people will get WMSDs automatically when their age increased (Luangwilai et al., 2014). The other environmental and physical factors play important role on affecting the muscle system as well. So, age along with other work environmental factors may increase the risk of WMSDs among workers with high physical exertion such as farmers.

1.2 Smoking

Smoking was considered as a significant factor associated with WMSDs in this study especially in 7 days WMSDs period. People who smoke increase the odd of the disease by 2.85 time compare to those who do not smoke (95% CI 1.22-7.36). Several studies indicated similar results in which smoking is associated with pain in muscles (Costa & Vieira, 2010; Leino-Arjas, 1998; Nunes & Bush, 2012; Thetkathuek et al., 2017). Nunes and Bush, 2012, further indicated that the pain is mainly associated with lower back region or intervertebral herniated disc by giving reason that back pain may be caused by coughing from smoking (Nunes & Bush, 2012). Coughing increases the abdominal pressure and intradiscal pressure and therefore produced strain on the spine; moreover, nicotine from cigarette could diminish blood flow to vulnerable tissue and diminished mineral content of bone causing micro-fractures to muscle and bone tissues (Nunes & Bush, 2012). Another similar reason is given by Leino-Arjas that smoking could cause nutritional deficiencies in muscle-tendon system, joint structures, and disc through vasoconstriction, fibrinolytic defect, or carboxyhemoglobin production (Leino-Arjas, 1998). Smoking could cause a lot of risks associated with muscle and bone systems due to the reasons mentioned above, and many studies, including this current one, have already pointed out that smoking is significantly associated with WMSDs.

In this study, although smoking was significantly associated with 7 days WMSDs, it was not significantly associated with 12 months WMSDs. There is no direct study

indicated the reason for these given results. However, the possibility for these results could be due to the time that nicotine remains in the body system before it degraded or eliminated out of the body. Some studies indicated that, for regular smokers, nicotine could remain in the body (in urine or hair/nail) for three to four days, and it may be remained in the blood up to three to four months (Konstantinos et al., 2014). Within the past 12 months the amount of nicotine in the body may be degrade and the perception of pain in muscles may not be accurate. So, the result was given with no significant association.

1.3 Gender

Many studies indicated that gender is significantly associated with WMSDs. Most results indicated that women are more exposed to ergonomic risk factor than men (Taechasubamorn et al., 2011; Thetkathuek et al., 2017). A research from Luangwilai, 2013 showed that female rice farmers were likely to develop the muscle pain than male and this may be due to the weaker physical structure of female. Although the result from this study is in line with previous studies and also indicated that the odd of women to experience WMSDs is 1.31 time higher than men, the result is not significant (95% CI [0.61-2.82] and p-value<0.05). So, in this study, gender is not considered as one of the important factor associated with work-related musculoskeletal disorders among coffee harvesters.

1.4 Education

People in Doi Chaang village are uneducated (63.2%) because they live up on the mountain and has low family economic support. In this study, education showed no statistical significant association to WMSDs. The odd of both 7 days and 12 months indicated that education was a protective factor meaning that people who have educated are less likely to get risk from WMSDs (OR<1). This mean that people who are educated, they have more knowledge on how to protect themselves from working injuries or how to perform correct working posture in order to avoid WMSDs. A few studies gave significant association of WMSDs and education. One study from India on manual-working farmers was given the result that low education is significantly increase the risk for WMSDs and it also indicated low education may lead to the lack of awareness and further occurrence of musculoskeletal disorders (Jain et al., 2018). So, education could be considered as one important factors although it is not one of the significant factors in this study.

1.5 BMI (Body Mass Index)

Although in this study the BMI (body mass index) is not statistically significant associated with WMSDs, a few previous studies did mention that BMI could be one of the important risk factors. Some of the studies which have been done regarding associated factors of WMSDs gave the result that people who are obese or overweight are more likely develop muscle pains by giving reasons that the increase of the fatty

tissue within the body could increase the pressure on muscles (Jain et al., 2018; Luangwilai et al., 2014). In this current study, there was no association between BMI and WMSDs, this may be due to the fact that only a few participants were considered as overweight people when compared to other studies. The association of BMI and muscle pain in general is hard to identify. Nunes and Bush indicated that BMI could be an important factor for WMSDs, mostly in lumbar disc herniation, but generally their study mentioned that there is no strong correlation between stature, body weight, body build and low back pain. Obesity could play only small role on WMSDs in general, although it may cause significant effects on lumbar disc (Nunes & Bush, 2012). So, the BMI could either considered as significant or insignificant factor depending on the other individual factors and the environmental factors associated with each individual person in that specific study area.

1.6 Exercise

Some studies were given that exercise could be effective treatment and prevention of musculoskeletal disorders, but although exercise has benefit on WMSDs, there were some reported that performing of intensive sport activities could increase risk of chronic WMSDs (Luangwilai et al., 2014). The result in this study showed that there is no statistically association between exercise and WMSDs. The odd ratio for exercise group in this study, both in 7 days and 12 months' time, were lower than 1 (OR=0.58 and 0.75 respectively) which indicated that people who exercise regularly

were protected from the disease. Participants in this study said that they exercise only about 2-4 times a week and what they usually do is just running, playing trakrow or football, which are not considered as hard exertion force kinds of exercise. So, these types of exercise could help strengthen their muscle instead of causing harm to them.

2. Psychosocial related to stress

In this study, stress was one of the most significant factor associated with WMSDs. Stress could come from may related factors. The psychosocial related to stress could happen from family support, social support, fatigue from work, time for relaxation, job satisfaction and others (Meeksawi et al., 2012). The psychosocial factors in this study were all use as descriptive explanation of how physical conditions at work could lead the individual worker to emotional problems of stress. Stress was significantly associated with 7 days and 12 months WMSDs with the odd of 2.84 and 2.49 respectively (p-value<0.05). This means that people with psychosocial problems or people with stress are increased the risk of WMSDs by approximately two times compared to the one without stress. The same results were found in several studies which indicated that high exposure to physical and psychosocial risk factors was positively associated with self-report neck, shoulder, upper back, lower back, elbows/arms and hand/wrist musculoskeletal pains (Devereux, Rydstedt, Kelly, ston, & Buckle, 2004; Jain et al., 2018). The reason that stress could have effects on musculoskeletal system is that when body stress, muscles tense up. When there is

stress, muscles tense up all at once and will release their tension only after the stress has passes. So, when people have stress, they increase the muscles' pain perception and decrease pain threshold; so, people would feel that they have more muscle pains when they are stress (Meeksawi et al., 2012). This is why stress is related or associated with WMSDs.

3. Work-related factor

3.1 Work load

None of the work-related factors were associated to WMSDs in the final adjusted logistic model; only the work load or the kilogram of coffee harvested per day was shown to be significantly associated to 7 days WMSDs in the univariate analysis. The univariate analysis of 7 days WMSDs implied that the lower the amount of coffee harvested per day, the higher the risk of developing WMSDs (OR=0.52, 95% CI [0.28-0.95], p-value<0.05). However, when this variable was put in final model with adjusted odd ratio for each variable, it was founded to have no significant association anymore. This result indicated the negative association between the number of kilogram of coffee harvested and WMSDs which was comparable to a few studies which also indicated that the odd of higher work load is negatively associated with WMSDs (Chaikleang & Nithithamtara, 2016; Luangwilai et al., 2014). The reason that this work load is negatively associated with WMSDs could be that the kilogram of coffee that each harvester harvested each day is varied, some days he or she harvested more

some days less, the exact amount of work load could not be measure since each day the amount of kilogram would keep changing.

Beside the kilogram of coffee harvested, the farm size could also be considered as work load factor. In this study though, farm size has no significant association to WMSDs and both 7 days WMSDs and 12 months WMSDs the bigger the farm size, the less likely that workers would get pain related to muscles. This result is contrast to several studies. A study on Cambodian fruit farmers in the eastern part of Thailand signified that plantation areas of 20-39 and >39 acres impose an increased risk of pain in many body regions compared to plantation with fewer than 20 acres (Thetkathuek et al., 2017). The other study from Ireland also specified that larger farms of more than 31 acres tend to increase the risk of WMSDs when compared to the smaller farms because of higher activity which require greater labor input (Osborne et al., 2013). The different which presented in this study could be the proportion of harvester in each group of farm size were similar in number. In addition, although the harvesters own or work in bigger farms areas, they might have co-workers or helper to help them harvested the coffee; in one farm, there could be up to ten harvesters working in the same farm.

3.2 Work experience

In this study work experience gave no significant association to WMSDs. However, the result did indicate that people who work >10 years (people who work

longer time) are less likely to be the group at risk of WMSDs (OR<1). This means that the longer time you work, the more protective risk you are from the muscle disorders. This result is in line with a few studies which also showed that the longer duration of employment, the lower the chance of participant to develop muscle related pains (Guan Ng et al., 2015; Jain et al., 2018). A study on palm oil farmers in Malaysia gave result that people who work more than 20 years decreased the risk of WMSDs by 0.41 when compare to those who have less than 20 years of work experience (Guan Ng et al., 2015). The reason for this work experience related factor could be that farmer who work for longer period of time are used to the routine of the job, and they learn how to protect themselves. They have more experience and knowledge on what would be the correct working position or habit that they should do in order to prevent the muscle pains. For the younger farmers, although they might be stronger, they have less experience and may perform incorrect postures or tasks which could lead them to muscle injuries or muscle pains.

3.3 Work hours

The working hour in this study also showed no statistically significant association to WMSDs though the result was given that the group with work hour of >8 hours a day increased the odd of the disease compare to the group with <8 hours a day in both 7 days and 12 months WMSDs (OR of 1.13 and 1.21 respectively). The result was given that the longer time you work, the higher risk of getting pain from

musculoskeletal disorders. This result is similar to a study on Indian farmers which indicated that the working hours of more than 6 hours a day increase the muscle pain in upper back, hands/wrists, fingers, and elbows/forearms (Jain et al., 2018). The reason to explain this fact is that when you work for long hours without any break, you exert force on muscle and the muscle tensed up; so, you develop the pain in muscle because your muscle consistently tight up for long hours.

3.4 Work postures

Work posture is considered as one of the important factor associated with WMSDs. If farmers perform correct postures in their work, it would be less likely for them to develop problem with musculoskeletal disorders. In this study, it was found that different postures effect on different parts of body. The pains of each body part were analyzed separately with working postures of harvesters, so that the association would be clearer because some postures may cause pain to specific region in the body and not the other regions. The posture that related to the most parts of body was twisting body, follow by lifting arms above shoulders for long time, carry heavy objects of >25 kg, twisting hands/wrists, bending and walk up and down hill. These are all postures that coffee harvesters do regularly and these postures are related to all nine body regions accordingly.

This study indicated that twisting body and lifting arm for long time is possibly associated with upper back in both 7 days and 12 months period because both

postures require heavy movement on the upper extremity's muscles. The result is supported with a study on back pain among farmers in Thailand which was also given that farmers experience higher prevalence of back pain due to the postures of twisting body in awkward position (56.2%) and bending forward (70.8%) (Taechasubamorn et al., 2011). Beside back region, the other upper extremities' muscles which could be affected on were neck and shoulders. A research on palm oil farmer which also indicated that the prevalence of neck and shoulder pain of the palm oil farmers were high due to the fact that they perform activities involving movements of neck and shoulder (Herry et al., 2015). The process of harvesting coffee is required a high force exertion on upper extremities because harvesters need to do a lot of twisting body and reaching up to the tree to pick up coffee cherries, so the harvesters would experience more pain in the upper parts of body.

In addition, the posture of lifting arms above shoulders was significantly associated with 12 months lower back pain but not significantly associated with 7 days pain. This may be due to how muscles in the upper extremities are all related, thoracic muscle, upper back muscle and lower back muscle. The pains in upper extremities may accumulate in the lower back region over the 12 months period and may cause significant association to the posture of lifting arms above shoulder.

Furthermore, this study also indicated that posture of twisting hands and wrists was also associated with wrist muscle pain, although without a significant value, because the muscle in those areas have been used regularly. This fact was reasonable

and it gave the same result as a study from Phajan on sugarcane farmers which indicated that the extending or twisting of wrist repeatedly increase the odd of WMSDs by 2.70 (95% CI [1.29-5.65], p-value<0.050) (Phajan et al., 2014). Harvesting coffee and sugarcane, both require to use a lot of hand motions, so it leave strain on the hands' muscle which would then cause the pain.

The other interesting posture which should be taken in consideration is lifting heavy object which in this study was associated to knees. Many studies suggested that lifting heavy object was considered as forceful exertion and associated with WMSDs (Kolstrup, 2012; Phajan et al., 2014). However, none has identified the parts in the body which associated to the posture. In this study knees' pains were associated to the lifting heavy object because the harvesters would carry sack or basket of coffee and have to walk up and down hill or walk for long time; these would cause pain to the associated body regions such as knees and may also cause some effect on arms and back muscles as well.

In short summary, all the postures mentioned in this research were associated with WMSDs although one posture may be presented to cause more pain to specific body region than the other body regions.

Conclusion

Work-related musculoskeletal disorders are still common among farmers of different plantations. Coffee harvesting requires a lot of the usage of muscles in the upper extremity. The results were given that the prevalence of 7 days and 12 months WMSDs were 79.4% and 81.6% respectively with the most prevalence pain in the regions of neck (59.2% and 60.7%), shoulder (59.2% and 62.5%), and wrist (52.9% and 53.7%). The risk factors that significantly associated with 7 days WMSDs were age (OR=2.47, 95% CI=1.01-1.08), smoking (OR=2.85, 95% CI=1.22-7.36) and stress (OR=2.84, 95% CI=1.44-6.00), while the risk factors that associated with 12 months WMSDs were only age (OR=2.17, 95% CI=1.10-4.32) and stress (OR=2.49, 95% CI=1.26-4.95). The postures which significantly associated with the nine body regions were twisting body, lifting arms, and carrying heavy object. These postures were significantly associated with different body's regions accordingly.

This study gave the results that the prevalence of work-related musculoskeletal disorders among coffee harvesters is still high. The reported pain was mainly in shoulder, neck, wrist, upper back and lower back regions. The risk factors such as individual factor, psychosocial factors and work-related factors are still considered as the important risk factors associated with WMSDs.

The uniqueness of this study is the population which are harvesters from Akha ethnic minority group who mostly are uneducated. In the future, the factory or the

health care providers in the village should develop a guideline of work instruction to demonstrate correct working postures to the coffee harvesters, including indication of maximum weight for carrying. There could be picture tutorial or the seminar to explain and show harvesters how to work properly in order to reduce muscle pains. In addition to that, precaution should be taken in concern of those vulnerable groups especially those who are with older ages and those who may have some symptoms of stress. The work checklist could be done, and so these people would not have to work as hard when compare to the group of normal population. The health surveillance control guideline should be done to reduce WMSDs among coffee harvesters.

The awareness and understanding of farmers and low-income workers on this topic are still very few. The high prevalence may due to the lack of education on WMSDs and lack of knowledge to protect themselves against WMSDs. The findings from this research can provide useful information for future study on this topic. Further studies to identify the cause-effect relationship between the important factors and the symptoms of WMSDs are needed for good prevention and intervention program of reduce work-related musculoskeletal disorders. The future studies should also include the detailed assessment using ergonomics approach such as biomedical evaluation, physiological evaluation and psychophysical evaluation to evaluate further associated risk factors that may be the cause of WMSDs. So, that in the future, the problems of WMSDs among farmers can be solved and that farmers will not have to suffer from WMSDs anymore.

Ethical Consideration

This proposal was submitted to the Office of Ethics Review Committee for Research Involving Human Research Subjects, Health Science Group, Chulalongkorn University for ethical approval prior to conduct the research. The approval number was 024.1/61. The consent form was explained by the researcher to the participants, and it was signed by the participants who volunteer to participate in the study prior to the interview. All participants were permitted to decline or withdraw at any time from the study without any harmful effect. All of the information from the interview was kept confidentially with respect to the rights of all participants in this study.

Limitations

Firstly, the cross-sectional study design could not determine the causal relationship with risk factors of musculoskeletal disorders. Second, participants may give information bias or recall bias, due to the limitation of time during an interview. Since this study used the convenience sampling technique, the selection bias may also occur. Third, this research only focused on coffee harvesters in Doi Chaang factory, the results may not be used to generalize whole population of coffee harvesters in Thailand.

Expected Benefit and Application

This study provided information for identification of the prevalence of Work-Related Musculoskeletal Disorders (WMSDs) among low income coffee harvesters in Chiang Rai, Thailand. The individual factors, work-related factors, health-related factors, life-style factor and psychological factors associated with work-related musculoskeletal disorders among coffee harvesters was identified. The results of these information could be used to initiate the programs for improving the musculoskeletal health and quality of life for farmers in general.

Obstacles and Strategies to Solve the Problems

The first obstacle that occurred during conducting this study was the recruitment of the harvesters to participate in the study. As the harvesters had to work during the harvesting season, it was hard for them to find time to participate in the interview. The way to solve this problem was to arrange with the factory owner about the time and place that suitable for harvesters to join the interview. The interview took place when harvesters came to sell their products and was asked to participate if he or she could.

Next, some of these people were from ethnic minorities, so it was hard for them to communicate clearly in the Thai language. Although they understand, they cannot read or speak clearly in Thai. The translators were needed to acquire the most possibly correct information.

Time Schedule

No	Activities	2017				2018							
		Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.
1	- Review literature - Determine topic and - Working on draft proposal - Develop questionnaires	↔	↔	↔	↔								
2	Proposal examination					↔							
3	Get approval from prosal exam committees					↔							
4	Test for the validity and reliability of questionnaires					↔							
5	Submit the research for ethical consideration						↔						
6	Steps for conducting data Data collection Data analysis						↔	↔	↔				
7	Thesis examination									↔	↔		
8	Journal submission										↔	↔	

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APPENDIX A

AF 01-12

คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย
254 อาคารจามจุรี 1 ชั้น 2 ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330
โทรศัพท์/โทรสาร: 0-2218-3202 E-mail: eccu@chula.ac.th

COA No. 050/2561

ใบรับรองโครงการวิจัย

โครงการวิจัยที่ 024.1/61 : ปัจจัยซึ่งมีความสัมพันธ์กับความผิดปกติของระบบกระดูกและกล้ามเนื้ออันเนื่องมาจากการทำงานในเกษตรกรชาวสวนกาแฟของโรงงานดอยช้าง อำเภอแม่สรวย จังหวัดเชียงราย

ผู้วิจัยหลัก : นางสาววิภาวี ส่องแสง

หน่วยงาน : วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย

คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย ได้พิจารณา โดยใช้หลัก ของ The International Conference on Harmonization – Good Clinical Practice (ICH-GCP) อนุมัติให้ดำเนินการศึกษาวิจัยเรื่องดังกล่าวได้

ลงนาม.....
(รองศาสตราจารย์ นายแพทย์ปรีดา ทีฆนประดิษฐ)
ประธาน

ลงนาม.....
(ผู้ช่วยศาสตราจารย์ ดร.นันทรี ชัยชนะวงศาโรจน์)
กรรมการและเลขานุการ

วันที่รับรอง : 5 มีนาคม 2561 **วันหมดอายุ** : 4 มีนาคม 2562

เอกสารที่คณะกรรมการรับรอง

1) โครงการวิจัย
2) ข้อมูลสำหรับกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัยและใบยินยอมของกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย
3) ผู้วิจัย
4) แบบสอบถาม
5) ใบประชาสัมพันธ์

เลขที่โครงการวิจัย 024.1/61
วันที่รับรอง - 5 มี.ค. 2561
วันหมดอายุ - 4 มี.ค. 2562

เงื่อนไข

1. *ข้าพเจ้ารับทราบว่าเป็นการผิดจริยธรรม หากดำเนินการเก็บข้อมูลการวิจัยก่อนได้รับการอนุมัติจากคณะกรรมการพิจารณาจริยธรรมการวิจัยฯ*
2. *หากใบรับรองโครงการวิจัยหมดอายุ การดำเนินการวิจัยต้องยุติ เมื่อต้องการต่ออายุต้องขออนุมัติใหม่ล่วงหน้าไม่ต่ำกว่า 1 เดือน พร้อมส่งรายงานความก้าวหน้าการวิจัย*
3. *ต้องดำเนินการวิจัยตามที่ระบุไว้ในโครงการวิจัยอย่างเคร่งครัด*
4. *ใช้เอกสารข้อมูลสำหรับกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย ใบยินยอมของกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย และเอกสารเชิญเข้าร่วมวิจัย (ถ้ามี) **เฉพาะที่ประทับตราคณะกรรมการเท่านั้น***
5. *หากเกิดเหตุการณ์ไม่พึงประสงค์ร้ายแรงในสถานที่เก็บข้อมูลที่ขออนุมัติจากคณะกรรมการ ต้องรายงานคณะกรรมการภายใน 5 วันทำการ*
6. *หากมีการเปลี่ยนแปลงการดำเนินการวิจัย ให้ส่งคณะกรรมการพิจารณารับรองก่อนดำเนินการ*
7. *โครงการวิจัยไม่เกิน 1 ปี ส่งแบบรายงานสิ้นสุดโครงการวิจัย (AF 03-12) และบทคัดย่อผลการวิจัยภายใน 30 วัน เมื่อโครงการวิจัยเสร็จสิ้น สำหรับโครงการวิจัยที่เป็นวิทยานิพนธ์ให้ส่งบทคัดย่อผลการวิจัย ภายใน 30 วัน เมื่อโครงการวิจัยเสร็จสิ้น*

AF 02-12

The Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University
Jamjuree 1 Building, 2nd Floor, Phyathai Rd., Patumwan district, Bangkok 10330, Thailand,
Tel/Fax: 0-2218-3202 E-mail: eccu@chula.ac.th

COA No. 050/2018

Certificate of Approval

Study Title No. 024.1/61 : FACTORS ASSOCIATED WITH WORK-RELATED MUSCULOSKELETAL DISORDERS (WMSDs) AMONG COFFEE HARVESTERS IN DOI CHAANG COFFEE FACTORY, MAE SUAI DISTRICT, CHIANG RAI PROVINCE, THAILAND

Principal Investigator : MISS WIPAWEE SONGSAENG

Place of Proposed Study/Institution : College of Public Health Sciences, Chulalongkorn University

The Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University, Thailand, has approved constituted in accordance with the International Conference on Harmonization – Good Clinical Practice (ICH-GCP).

Signature: Prida Tasanapradit Signature: Nuntaree Chaichanawongsaroj

(Associate Professor Prida Tasanapradit, M.D.) Chairman

(Assistant Professor Nuntaree Chaichanawongsaroj, Ph.D.) Secretary

Date of Approval : 5 March 2018 Approval Expire date : 4 March 2019

The approval documents including

1) Research proposal
2) Patient/Participant Information Sheet and Informed Consent Form
3) Researcher
4) Questionnaire
5) Advertising leaflet

Protocol No. 024.1/61
Date of Approval - 5 MAR 2018
Approval Expire Date - 4 MAR 2019

The approved investigator must comply with the following conditions:

1. *The research/project activities must end on the approval expired date of the Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University (RECCU). In case the research/project is unable to complete within that date, the project extension can be applied one month prior to the RECCU approval expired date.*
2. *Strictly conduct the research/project activities as written in the proposal.*
3. *Using only the documents that bearing the RECCU's seal of approval with the subjects/volunteers (including subject information sheet, consent form, invitation letter for project/research participation (if available).*
4. *Report to the RECCU for any serious adverse events within 5 working days*
5. *Report to the RECCU for any change of the research/project activities prior to conduct the activities.*
6. *Final report (AF 03-12) and abstract is required for a one year (or less) research/project and report within 30 days after the completion of the research/project. For thesis, abstract is required and report within 30 days after the completion of the research/project.*
7. *Annual progress report is needed for a two- year (or more) research/project and submit the progress report before the expire date of certificate. After the completion of the research/project processes as No. 6.*

APPENDIX B

แบบสัมภาษณ์

วันที่.....

รหัสผู้มีส่วนร่วมวิจัย.....

หัวข้อ ปัจจัยที่มีความสัมพันธ์กับความผิดปกติของระบบกระดูกและกล้ามเนื้ออันเนื่องมาจากการทำงาน ในเกษตรกรชาวสวนกาแฟ โรงงานดอยช้าง อำเภอแม่สรวย จังหวัดเชียงราย ประเทศไทย

ชี้แจง แบบสัมภาษณ์มี 2 ตอน

ตอนที่ 1 ข้อมูลทั่วไปเกี่ยวกับเกษตรกร (มี 5 ส่วน)

ส่วนที่ 1 ข้อมูลทั่วไป

1.1 อายุ.....ปี

1.2 เพศ ☐ ชาย ☐ หญิง

1.3 น้ำหนัก.....กิโลกรัม. ส่วนสูง.....เซนติเมตร

1.4 กลุ่มชาติพันธุ์ ☐ อาข่า ☐ อีซอ ☐ จีน ☐ อื่นๆ.....

1.5 การศึกษา

☐ ไม่เคยได้รับการศึกษา ☐ จบการศึกษาชั้นประถม

☐ จบการศึกษาชั้นมัธยมต้น ☐ จบการศึกษามัธยมปลายหรือเทียบเท่า

☐ วุฒิบัตร ปวช. ปวส. ☐ จบการศึกษาชั้นปริญญาตรีหรือสูงกว่า

1.6 สถานะ ☐ โสด ☐ แต่งงาน ☐ หย่าร้าง ☐ หม้าย

1.7 จำนวนบุตร (ถ้ามี).....คน

ส่วนที่ 2 ข้อมูลเกี่ยวกับงานที่เกษตรกรทำ

2.1 รายได้เฉลี่ยของคุณต่อเดือน (ทั้งในการเก็บกาแฟและจากอาชีพอื่นๆที่คุณทำ).....บาท

2.2 คุณมีสวนกาแฟเป็นของตัวเองหรือไม่ ☐ มี ☐ ไม่มี

2.3 คุณเก็บกาแฟโดยวิธีใด ☐ ใช้มือ ☐ ใช้เครื่องมือช่วยเก็บ

2.4 คุณได้ทำอาชีพเก็บเกี่ยวกาแฟมาเป็นเวลานานเท่าใด?.....ปี

2.5 ในฤดูเก็บเกี่ยวนี้ คุณเก็บกาแฟสัปดาห์ละกี่วัน?.....

2.6 คุณเก็บกาแฟวันละกี่ชั่วโมง?.....

2.7 ในหนึ่งวัน คุณได้พักจากงานเก็บกาแฟกี่ครั้ง?

☐ ไม่เคยพัก ☐ 1-2 ครั้ง ☐ มากกว่า 2 ครั้ง

หากคุณได้พัก ในแต่ละช่วงเวลาพัก คุณได้พักกี่นาที?.....

2.8 คุณเก็บกาแฟได้วันละกี่ตะกร้า?.....

จะได้กาแฟประมาณกี่กิโลกรัม ต่อวัน?.....

2.9 คุณได้รับเงินเท่าไหร่จากการขายกาแฟ หนึ่งกิโลกรัม?.....บาท

2.10 คุณได้เดินเป็นระยะทางโดยประมาณเท่าใดต่อวัน คาดคะเนจาก:

ไร่ของคุณมีความกว้างโดยประมาณเท่าใด?..... ไร่

ระยะทางจากไร่ไปโรงงานประมาณเท่าใด?.....กิโลเมตร

2.11 ในฤดูเก็บเกี่ยวกาแฟ คุณได้ทำงาน หรืออาชีพอื่นควบคู่ไปกับการเก็บกาแฟหรือไม่?

☐ ไม่ ☐ ใช่ โปรดระบุ.....

2.12 คุณมักจะทำงาน หรืออาชีพอะไรหลังจากดูดการเก็บเกี่ยวกาแฟ?.....

2.13 ในขณะที่เก็บกาแฟ คุณได้ใช้สิ่งเหล่านี้เป็นตัวช่วยหรือไม่

☐ ที่รัด/ลาดเอวป้องกันการเจ็บปวด ☐ ถุงมือ ☐ ผ้าพันมือป้องกันมือเคล็ด
☐ ผ้ารัดขาป้องกันการเจ็บปวด ☐ สนับเข่า ☐ อื่นๆ.....

<u>ส่วนที่ 3 ข้อมูลด้านสุขภาพทั่วไป และการใช้ชีวิตประจำวัน</u>

3.1 คุณได้เก็บกาแฟในช่วง 7 วันที่ผ่านมาไหม? (หากตอบว่าไม่ ข้ามข้อ 3.1.1)

☐ ไม่ ☐ ใช่ ระบุจำนวนวัน.....

3.1.1 หากคุณเก็บกาแฟในช่วง 7 วันที่ผ่านมา คุณเคยได้รับบาดเจ็บ หรือเจ็บป่วยจากการเก็บกาแฟไหม?

☐ ไม่เคย
☐ เคย เช่น
☐ ปัญหาเกี่ยวกับระบบการหายใจ ☐ ภูมิแพ้ ตามผิวหนังหรือส่วนอื่นๆ
☐ เป็นลมหรือ วิงเวียนศีรษะ ☐ ปัญหาการขาดน้ำ
☐ บาดเจ็บจากอุบัติเหตุ ☐ อื่นๆ.....

3.1.2 ใน 12 เดือน (หรือหนึ่งปี) ที่ผ่านมา คุณเคยได้รับบาดเจ็บ หรือเจ็บป่วยจากการเก็บกาแฟไหม?

☐ ไม่เคย
☐ เคย เช่น
☐ ปัญหาเกี่ยวกับระบบการหายใจ ☐ ภูมิแพ้ ตามผิวหนังหรือส่วนอื่นๆ
☐ เป็นลมหรือ วิงเวียนศีรษะ ☐ ปัญหาการขาดน้ำ
☐ บาดเจ็บจากอุบัติเหตุ ☐ อื่นๆ.....

3.2 คุณมีโรคประจำตัวหรือไม่?

☐ ไม่มี
☐ เบาหวาน ☐ ข้ออักเสบรูมาตอยด์ ☐ โรคเก๊าท์
☐ กล้ามเนื้ออักเสบ ☐ อื่น ๆ .....

3.3 คุณเคยสูบบุหรี่ไหม?

☐ ไม่
☐ สูบ เป็นเวลา.....ปี

3.4 คุณเคยดื่มสุราไหม?

☐ ไม่
☐ ดื่ม เป็นเวลา.....ปี

3.5 คุณออกกำลังกายบ่อยแค่ไหน? (การออกกำลังกายอย่างน้อย 30 นาที)

☐ ทุกวัน ☐ 4-6 ครั้งต่อสัปดาห์ ☐ 1-3 ครั้งต่อสัปดาห์
☐ น้อยกว่า 1 ครั้ง ต่อสัปดาห์ ☐ ไม่เคยออกกำลังกาย

3.6 คุณออกกำลังกาย อะไรบ้าง?

☐ วิ่ง ☐ เต้นแอโรบิก ☐ เล่นตะกร้อ ☐ เล่นฟุตบอล ☐ อื่น ๆ.....

ส่วนที่ 4 ข้อมูลด้านจิตสังคม

4.1 คุณได้รับการสนับสนุนดีแค่ไหนจากครอบครัว (ความสัมพันธ์กับคนในครอบครัว)?

☐ น้อย ☐ ปานกลาง ☐ ดีมาก

4.2 คุณได้รับการสนับสนุนดีแค่ไหนจากคนรอบข้าง (ความสัมพันธ์ของคุณกับคนในชุมชน)?

☐ น้อย ☐ ปานกลาง ☐ ดีมาก

4.3 คุณรู้สึกเมื่อยล้าจากการทำงานมากน้อยเพียงใด?

☐ น้อย ☐ ปานกลาง ☐ มาก

4.4 คุณคิดว่าคุณมีเวลาพักผ่อน หรือผ่อนคลายมากน้อยเพียงใด?

☐ น้อยเกินไป ☐ พอเหมาะ ☐ เพียงพออย่างมาก

4.5 คุณรู้สึกกลัวหรือกังวลเกี่ยวกับความปลอดภัยหรือความมั่นคงในงานที่คุณทำหรือไม่?

☐ ไม่รู้สึกกลัวหรือกังวล ☐ รู้สึกเป็นบางเวลา ☐ รู้สึกอยู่เป็นประจำ

4.6 คุณรู้สึกอย่างไรต่อรายได้ที่คุณได้รับ?

☐ น้อยเกินไป ☐ พอดี ☐ เพียงพอเป็นอย่างมาก

4.7 คุณรู้สึกอย่างไรกับอาชีพเก็บเกี่ยวกาแฟ (เลือกเพียงข้อเดียว)

☐ ฉันชอบงานนี้ ☐ ทำงานนี้ดีกว่าอาชีพอื่น ☐ ทำเพราะไม่มีตัวเลือก

☐ จำเจ น่าเบื่อ ☐ หากมีงานที่ดีกว่าจะเปลี่ยนงาน ☐ อื่น ๆ.....

4.8 คุณรู้สึกเครียดในระหว่างหนึ่งปีที่ผ่านมาไหม

☐ ไม่รู้สึก

☐ รู้สึก สาเหตุจาก:

☐ การทะเลาะหรือไม่พอใจกันในที่ทำงาน ☐ ปัญหาด้านการเงิน และหนี้สิน

☐ ปัญหาครอบครัว ☐ สาเหตุอื่นๆ.....

ส่วนที่ 5 ด้านความเครียด

โปรดอ่านข้อความแต่ละข้อและวงกลมในช่องหมายเลข 0, 1, 2 หรือ 3 ที่ระบุข้อความได้ตรงกับท่านมากสุดในช่วงสัปดาห์ที่ผ่านมา ทั้งนี้ไม่มีคำตอบที่ถูกหรือคำตอบที่ผิด ท่านไม่ควรใช้เวลามากนักในแต่ละข้อความ

เกณฑ์การประเมินมีดังนี้:

0 ไม่ตรงกับข้าพเจ้าเลย 1 ตรงกับข้าพเจ้าบ้าง หรือเกิดขึ้นเป็นบางครั้ง

2 ตรงกับข้าพเจ้า หรือเกิดขึ้นบ่อย 3 ตรงกับข้าพเจ้ามาก หรือเกิดขึ้นบ่อยมากที่สุด

คำถาม	คะแนน			
5.1 ข้าพเจ้ารู้สึกอยากที่จะผ่อนคลายอารมณ์	0	1	2	3
5.2 ข้าพเจ้ารู้สึกเริ่มมีปฏิกริยาตอบสนองต่อสิ่งต่างๆ มากเกินไป	0	1	2	3
5.3 ข้าพเจ้ารู้สึกว่าข้าพเจ้าวิตกกังวลมาก	0	1	2	3
5.4 ข้าพเจ้าเริ่มรู้สึกว่าข้าพเจ้ามีอาการกระวนกระวายใจ	0	1	2	3
5.5 ข้าพเจ้ารู้สึกไม่ผ่อนคลาย	0	1	2	3
5.6 ข้าพเจ้าทนไม่ได้กับภาวะใดก็ตามที่ทำให้ข้าพเจ้าไม่สามารถทำอะไรต่อจากที่ข้าพเจ้ากำลังกระทำอยู่	0	1	2	3
5.7 ข้าพเจ้ารู้สึกว่าข้าพเจ้าค่อนข้างมีอารมณ์อ่อนเคียงง่าย	0	1	2	3
คะแนนรวมของผลการทดสอบความเครียด				

ตอนที่ 2 ข้อมูลเกี่ยวกับสาเหตุ และอาการเจ็บปวดตามร่างกาย

<u>ส่วนที่ 1 สาเหตุ และอาการเจ็บปวดตามร่างกาย</u>

1.1 คุณถนัด ☐ *ซ้าย* ☐ *ขวา*

1.2 คุณได้ทำท่าทางใดต่อไปนี้ในการทำงานเก็บกาแฟของคุณ? (ตอบได้มากกว่า 1 ข้อ)

☐ *ยืนเป็นเวลานาน* ☐ *เดินขึ้นลงเนิน หรือทางลาดชัน* ☐ *บิดเอี้ยวตัว*

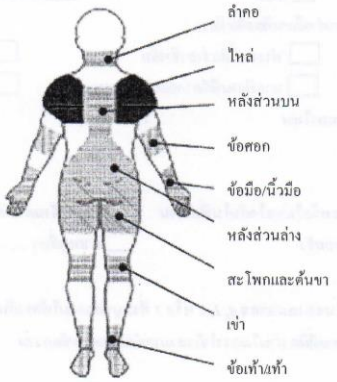
☐ *ยกแขนขึ้นลงบ่อยๆ หรือเป็นเวลานาน* ☐ *ก้มหลัง* ☐ *ใช้แรงบิดจากนิ้วมือและข้อมือ*

☐ *แบกของหนัก (ระบุน้ำหนักโดยประมาณ.....)* ☐ *ทำท่าเดิมซ้ำๆ*

☐ *อยู่ในท่าที่แปลกๆ หรือทำท่าทางแปลกๆ* ☐ *อื่นๆ ระบุ.....*

1.3 อาการเจ็บปวด

คุณสามารถดูตำแหน่งในร่างกายจากภาพด้านล่างนี้เพื่อใช้ตอบแบบสอบถาม ตำแหน่งต่างๆ ไม่ได้เจาะจงอย่างชัดเจน และอาจมีบางตำแหน่งที่ทับซ้อนกัน คุณสามารถระบุด้วยตัวเองว่าส่วนไหนของร่างกายที่ได้รับการเจ็บปวด (ถ้ามี)



กรุณาตอบคำถามโดยทำเครื่องหมายลงในช่องที่เหมาะสม โดยสามารถทำเครื่องหมายได้เพียงในหนึ่งตัวเลือกของแต่ละคำถาม กรุณาตอบทุกคำถาม ถึงแม้ว่าคุณอาจจะไม่มีปัญหาเจ็บปวดในส่วนต่างๆ ของร่างกาย

ปัญหาในอวัยวะที่ใช้ในการเคลื่อนไหว				
คุณมีปัญหา เช่นการเจ็บปวด เมื่อยล้า หรือรู้สึกไม่สบายตัว ตามอวัยวะเช่น :	*ใน 12 เดือนที่ผ่านมา คุณมีปัญหาเจ็บปวดในอวัยวะส่วนนี้ และทำให้เป็นอุปสรรค์ต่อการทำงาน*		*ใน 7 วันที่ผ่านมา คุณมีปัญหาการเจ็บปวดในอวัยวะส่วนนี้หรือไม่*	
คอ (ส่วนบน / ส่วนล่าง)	☐ *ใช่*	☐ *ไม่ใช่*	☐ *ใช่*	☐ *ไม่ใช่*
ไหล่ (ซ้าย/ขวา/ทั้งสองข้าง)	☐ *ใช่*	☐ *ไม่ใช่*	☐ *ใช่*	☐ *ไม่ใช่*
ข้อศอก (ซ้าย/ขวา/ทั้งสองข้าง)	☐ *ใช่*	☐ *ไม่ใช่*	☐ *ใช่*	☐ *ไม่ใช่*
ข้อมือ หรือนิ้วมือ (ซ้าย/ขวา/ทั้งสองข้าง)	☐ *ใช่*	☐ *ไม่ใช่*	☐ *ใช่*	☐ *ไม่ใช่*

หลังส่วนบน	☐ใช่	☐ไม่ใช่	☐ใช่	☐ไม่ใช่
หลังส่วนล่าง	☐ใช่	☐ไม่ใช่	☐ใช่	☐ไม่ใช่
สะโพก หรือต้นขา	☐ใช่	☐ไม่ใช่	☐ใช่	☐ไม่ใช่
เข่า (ข้างใดข้างหนึ่งหรือทั้งสองข้าง)	☐ใช่	☐ไม่ใช่	☐ใช่	☐ไม่ใช่
เท้า (ข้างใดข้างหนึ่งหรือทั้งสองข้าง)	☐ใช่	☐ไม่ใช่	☐ใช่	☐ไม่ใช่

1.4 ในส่วนไหนของร่างกายที่คุณปวดหรือเมื่อยล้าเป็นประจำ ในช่วงการเก็บกาแฟ (ทำเครื่องหมายตรงกับช่องที่ตรงกับระดับความเจ็บปวด)

ส่วนของร่างกาย	ระดับความเจ็บปวด			
	ไม่รู้สึก	รู้สึกเล็กน้อย	รู้สึกปานกลาง	รู้สึกมาก
คอ	0	1	2	3
ไหล่ซ้าย	0	1	2	3
ไหล่ขวา	0	1	2	3
มือข้างซ้าย	0	1	2	3
มือข้างขวา	0	1	2	3
ข้อศอกซ้าย	0	1	2	3
ข้อศอกขวา	0	1	2	3
หลังส่วนบน	0	1	2	3
สะโพก ต้นขา	0	1	2	3
เข่า	0	1	2	3
เท้า	0	1	2	3

1.5 ขณะที่คุณเก็บกาแฟ คุณรู้สึกปวดในส่วนต่างๆ ของมือดังต่อไปนี้หรือไม่

นิ้วชี้
☐ *รู้สึกปวด* ☐ *ไม่รู้สึก*

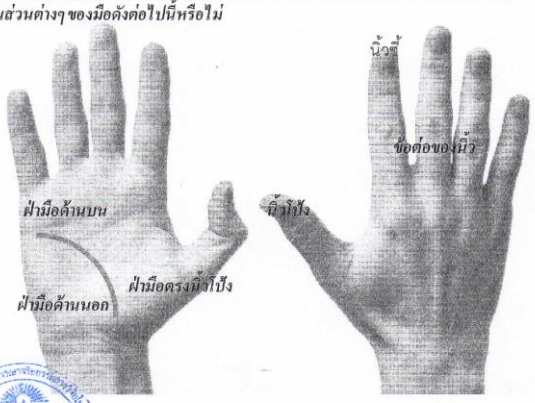
นิ้วโป้ง
☐ *รู้สึกปวด* ☐ *ไม่รู้สึก*

ฝ่ามือตรงนิ้วโป้ง
☐ *รู้สึกปวด* ☐ *ไม่รู้สึก*

ฝ่ามือด้านบน
☐ *รู้สึกปวด* ☐ *ไม่รู้สึก*

ฝ่ามือด้านนอก
☐ *รู้สึกปวด* ☐ *ไม่รู้สึก*

ข้อต่อของนิ้ว
☐ *รู้สึกปวด* ☐ *ไม่รู้สึก*



APPENDIX C

AF05-07

หนังสือแสดงความยินยอมเข้าร่วมการวิจัย

ทำที่.....

วันที่.....เดือน.....พ.ศ. .....

เลขที่ ประชากรตัวอย่างหรือผู้มีส่วนร่วมในการวิจัย.....

ข้าพเจ้า ซึ่งได้ลงนามท้ายหนังสือนี้ ขอแสดงความยินยอมเข้าร่วมโครงการวิจัย

ชื่อโครงการวิจัย ปัจจัยซึ่งมีความสัมพันธ์กับความผิดปกติของระบบกระดูกและกล้ามเนื้ออันเนื่องมาจากการทำงาน ในเกษตรกรชาวสวนกาแฟ โรงงานดอยช้าง อำเภอแม่สรวย จังหวัดเชียงราย

ชื่อผู้วิจัย นางสาววิภาวี ส่องแสง

ที่อยู่ที่ติดต่อ 289 หมู่ 3 ต.ริมกก อ.เมือง จ.เชียงราย โทรศัพท์ 093-243-6438

ข้าพเจ้า ได้รับทราบรายละเอียดเกี่ยวกับที่มาและวัตถุประสงค์ในการทำวิจัย รายละเอียดขั้นตอนต่างๆ ที่จะต้องปฏิบัติหรือได้รับการปฏิบัติ ความเสี่ยง/อันตราย และประโยชน์ซึ่งจะเกิดขึ้นจากการวิจัยเรื่องนี้ โดยได้อ่านรายละเอียดในเอกสารชี้แจงผู้เข้าร่วมการวิจัย และได้รับคำอธิบายจากผู้วิจัย จนเข้าใจเป็นอย่างดีแล้ว

ข้าพเจ้าจึงสมัครใจเข้าร่วมในโครงการวิจัยนี้ ตามที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย โดยข้าพเจ้ายินยอม ให้สัมภาษณ์และตอบแบบสอบถามของผู้วิจัย จำนวนหนึ่งชุด *ซึ่งประกอบด้วย 46 คำถาม เป็นจำนวนหนึ่งครั้ง ในเวลา 20-25 นาที และข้าพเจ้าอนุญาต ให้ผู้วิจัยมาสังเกตการทำงานและถ่ายภาพของข้าพเจ้า ในเวลาที่ข้าพเจ้าเก็บเกี่ยวกาแฟ หรือขายผลผลิตให้กับโรงงาน*

ข้าพเจ้ามีสิทธิถอนตัวออกจากการวิจัยเมื่อใดก็ได้ตามความประสงค์ โดยไม่ต้องแจ้งเหตุผล ซึ่งการถอนตัวออกจากการวิจัยนั้น จะไม่มีผลกระทบในทางใดๆ ต่อข้าพเจ้าทั้งสิ้นไม่ว่าจะเป็นด้านหน้าที่การงาน ครอบครัว สุขภาพ หรือชีวิตส่วนตัวของข้าพเจ้า

ข้าพเจ้าได้รับคำรับรองว่า ผู้วิจัยจะปฏิบัติต่อข้าพเจ้าตามข้อมูลที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย และข้อมูลใดๆ ที่เกี่ยวข้องกับข้าพเจ้า ผู้วิจัยจะเก็บรักษาเป็นความลับ โดยจะนำเสนอข้อมูลการวิจัยเป็นภาพรวมเท่านั้น ไม่มีข้อมูลใดในการรายงานที่จะนำไปสู่การระบุตัวข้าพเจ้า *และเอกสารหรือภาพถ่ายทั้งหมดที่เกี่ยวกับข้าพเจ้าจะถูกทำลายเมื่องานวิจัยเสร็จสิ้น*

หากข้าพเจ้าไม่ได้รับการปฏิบัติตรงตามที่ได้ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย ข้าพเจ้าสามารถร้องเรียนได้ที่คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย 254 อาคารจามจุรี 1 ชั้น 2 ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330 โทรศัพท์/โทรสาร 0-2218-3202

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ข้าพเจ้าได้ลงลายมือชื่อไว้เป็นสำคัญต่อหน้าพยาน ทั้งนี้ข้าพเจ้าได้รับสำเนาเอกสารชี้แจงผู้เข้าร่วมการวิจัย และสำเนาหนังสือแสดงความยินยอมไว้แล้ว

ลงชื่อ.....
(นางสาววิภาวี ส่องแสง)
ผู้วิจัยหลัก

ลงชื่อ.....
(.....)
ผู้มีส่วนร่วมในการวิจัย

ลงชื่อ.....
(.....)
พยาน

เลขที่โครงการวิจัย 024.1/61
วันที่รับรอง - 5 มี.ค. 2561
วันหมดอายุ - 4 มี.ค. 2562

V.2.4/2558

APPENDIX D

The other jobs that some harvesters were doing at this time were picking cherry, taking care of tea plantation, doing construction work, working in vegetable farm, working in chili farm, working in the coffee factory as part time, and getting daily employ job.

In the table for work-related risk factors, the amount of coffee harvested per day indicated the work load which mean how much work each harvesters have done per day. This weight of coffee in kilogram are the amount that has been harvested, it does not mean that each harvester would carry the coffee with this weight by himself or herself. The weight that coffee harvesters have to carry was asked in the working postures part, which asking whether each harvester have to carry the weight of more than 25 kg of a back of coffee each day. This weight is the standard required by law in general population of Thailand.

There were some issues related to DASS-21 questionnaires. First, it was suggested that in the part of DASS-21, the whole set of questionnaire should be used instead of picking only 7 questions on stress. None of the studies have chosen only one scale section to analyze, although it was suggested by some research to do that. So, for a better and more solid result, the study should include the whole set of questions from DASS-21, instead of choosing only 7 questions. Second, although this questionnaire is used to measure stress, we cannot be sure that this stress may

come from work. So, a better and more detailed assessment should be used to analyze whether the stress might have come from work. These may help strengthen the outcome of this current study.

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