

# Work-Related Musculoskeletal Disorders Among Tea Pluckers

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## ABSTRACT

*Tea is cultivated in Asian and African Countries, while the whole world is its consumer including the U.S., Japan, United Arab Emirates, Singapore, and Brunei. Food and Agriculture Organization of the United Nations ranked Malaysia as the 18<sup>th</sup> largest producer of tea in Asia. For the tea pluckers, they have to work in varying condition and situation like temperature, humidity, rainfall, and velocity. Moreover, all workers performed their work for the whole day and at the same time they have to maintain awkward static work posture while plucking in repetitive movement. Unnatural and static posture has also been described as contributing factor to Work-Related Musculoskeletal Disorders (WMSDs) in different types of occupations. Therefore, this study will be focusing on observation by using digital camera through the questionnaire survey on the workers to identify a level of body discomfort area and source of injury. Rapid Entire Body Assessment (REBA) method will be used to evaluate posture, forces and muscle activity. As expected, with new administrative controls and direct practices can reduce or prevent exposure of ergonomics risk factors.*

**Keywords:** *Tea Pluckers, REBA, Nordic, Ergonomics.*

## Introduction

Tea is cultivated in Asian and African Countries, while the whole world is its consumer including the U.S., Japan, United Arab Emirates, Singapore, and Brunei. Although Malaysia produces only 0.45 percent of the world's total tea production, in 2011, the Food and Agriculture Organization of the United Nations ranked Malaysia as the 18th largest producer of tea in Asia. Tea in Malaysia is produced year-round due to the climate and is harvested every three to four weeks when the new shoots flush. The BOH plantations are Malaysia's major tea growers, producing about 4,000 tons of tea annually, which is about 70% of the country's total yearly tea production. Tea is harvested using such as hand-held cutting machines, raised tractor harvesters and manual plucking (by hand). Tea pluckers have to work in varying climatic conditions like temperature, humidity, rainfall and wind velocity. They have to maintain awkward static work posture that causes back injury and pain in work place such as poor sitting posture, poor standing posture, poor driving posture, poor lifting and carrying techniques while plucking tea. Position each body can cause discomfort and fatigue if it is maintained for long periods of time. Nevertheless, the causative factors of musculoskeletal disorders among tea pluckers are work accessories, poor working posture, manual handling, repetitive work, twisting, lifting and forceful movements, vibration and etc. The increasing of the WMSDs will have a significant impact towards environment and energy conservation.

The main objective of this research to investigate the prevalence of related musculoskeletal disorder among tea pluckers in Malaysia. By referring to the main objective, the detail objectives are determined are as follow: to determine the prevalence of Work-Related Musculoskeletal Disorders (WMSDs) among tea-pluckers in Malaysia; to determine the relationship between physical work factors and WMSD among tea pluckers; to conduct Rapid Entire Body Assessment (REBA) among tea pluckers. Work Related Musculoskeletal Disorder (WMSD) among tea pluckers was collected at Cameron Highlands in Pahang, West Malaysia. The scope of this research is to determine Work-related musculoskeletal disorders (WMSDs) for symptoms caused by discomfort, impairment, disability or persistent pain in joints, muscles, tendons and other soft tissues.

## Literature Review

Dul & Neumann [1] defined, ergonomics as the practice of learning about human characteristics and understanding on how to improve people's interaction with the things they use and with the surrounding environments. Improving the quality of these environments through user-

centered design would provide enormous health, social, and economic benefits to society.

The goal of ergonomics according to Hameed [2], better physical environment will boost the employees and ultimately improve their productivity and at the same time to improve the safety, comfort and efficiency at the work place. The benefits resulting from the application of ergonomics also include the following:

1. Reduction of back and upper extremity musculoskeletal injuries and illness
2. Improved employee comfort
3. Reduced OSHA compliance risk
4. Improved productivity
5. Reduced equipment damage
6. Reduced rework

Musculoskeletal disorders (MSDs) are injuries and disorders from muscles, nerves, tendons, ligaments, joints, cartilage and spinal discs [3]. Ergonomic intervention can be done to help improve worker comfort, safety and also productivity and at the same time it can prevent or control injuries and illnesses by eliminating or reducing worker exposure with WMSD risk factors [4].

Static position each body part can cause discomfort and fatigue if it is maintained for long periods of time. Nevertheless, factors of musculoskeletal disorders among tea pluckers are poor ergonomic design of work place, work accessories, poor working posture, manual handling, repetitive work, and static work, frequent bending and twisting, lifting and forceful movements and also vibration [5]. Individual factors like age, sex, anthropometric, dimensions, muscle strength and physical fitness, lack of task variation, insufficient rest break, psychological and social factors contribute to musculoskeletal disorders [6].

The causes of musculoskeletal pain are varied with activities among tea pluckers. Moreover, trauma to an area such as movements, auto accidents, falls, fractures, sprains, dislocations and direct blows to the muscle also can cause musculoskeletal pain and muscle tissue can be damaged. Hazard of musculoskeletal injury include:

Performing forceful exertions requires an application of considerable contraction forces by the muscles, which causes them to fatigue rapidly [7]. Therefore, excessive to forceful exertions also lead to overuse of muscles and may result in muscle strain, soreness and damage. Performing forceful exertions can also irritate tendons, joints and discs, which lead to inflammation, fluid buildup, and constriction of blood vessels and nerves in the area [8].



Figure 1: Forceful exertions on tools

According to Malmivaara [9] many jobs that involve repetition muscles and tissues where motions are repeated every few seconds such as data processing jobs, walking, cutting, lifting and package sorting. Evidence in the Health Effects section shows a strong association between the occurrence of MSD and jobs involving exposure to repetitive motions.



Figure 2: Performing repetitive motion tasks

Jobs that do not provide short breaks between motions are often a problem. This is because muscles do not adequate time to recover before the motion is repeated [10]. Based on Figure 3, if there are no pauses between motions or pauses are too short, the muscles cannot recover back to the rested condition. Thus, the effects of forces on the muscles accumulate and the muscles become fatigued and strained. If the longer motions or job tasks are performed, adequate recovery time will be less [10].



Figure 3: Jobs involving constant muscle activity

Based on Figure 4, many job tasks involve long reaches such as working overhead, putting items on a high shelf, reaching across a conveyor or bending over to reach a part in the bottom [10]. Long reaches usually have the greatest impact on the shoulders and lower back, which can result in an ergonomic injury. Employees also have to perform extended reaches when there is not adequate access to the work area, extending the elbows away from the body such as lifting a bulky object [11].



Figure 4: Long reaches

Most of the workers if they are in static position for a long time in the same position they may feel stiff, sore and tired. Based on Figure 5, static postures increase the amount of force because contraction forces must be applied to hold the body in position and the effects of maintaining the same work positions can occur in any of the body joints [12].



Figure 5: Carrying tea leaves for a long period

## **Research Methodology**

The research methodology is an important aspect to ensure goals and objectives of the study are achieved. The research was conducted at the Cameron Highlands. Observation was the first step of this method by using

digital camera. By this observation, ergonomic stressors in work places can be identify. During site visit, questionnaire was distributed to the workers, which include personal info and ergonomic problems. The outcome of the study will be measured using survey (through Modified Nordic Questionnaire), REBA, and observational (on-site and with videotape recordings). The findings will be interpreted the influence of workstations, awkward postures, lifting load and repetitive activities with the risk of Work related Musculoskeletal Disorders (WMSD) development.

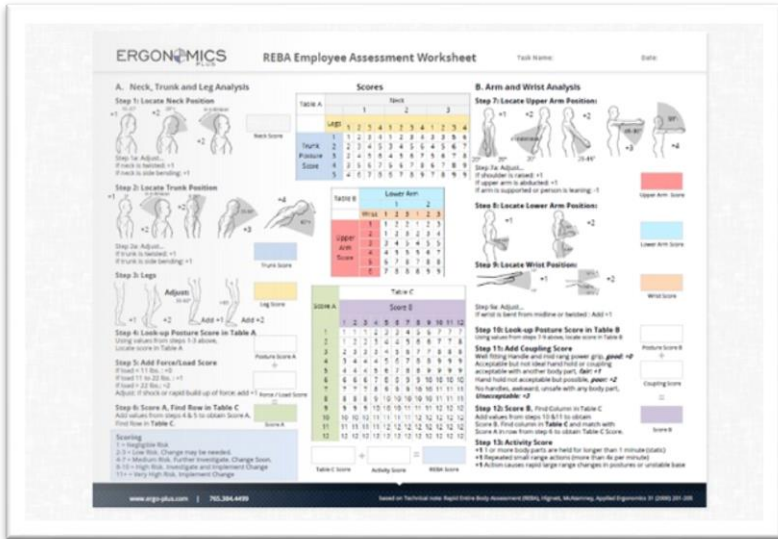


Figure 6: REBA worksheet

The physical environmental factors and tasks among tea pluckers shall be measured through observational methods by using digital camera. It will be proposed as the standard for assessing ergonomic exposures in the field. The ergonomic risk will be assessed through direct observation of workers posture at their workstation. Respondents will be observed at least 10 minutes each throughout their working duration. Questionnaire survey is common by used in field measurement method. The survey will provide the understanding of subject's characteristic and their general physical health status. The questionnaire were distributed to the workers in workplace during site visit. By using Modified Nordic Questionnaire ,prevalence of Work related Musculoskeletal Disorders (WMSD) among tea pluckers will be determine, which consist personal information, ergonomic problem and health information. Rapid Entire Body Assessment (REBA) method will be use to

estimate the final score of working posture. The aim is to identify the postural method for estimating the risk of work related to entire body disorders and body posture among tea pluckers.

## Results and Discussions

### Survey Questionnaire

Modified Nordic Survey Questionnaire was distributed among 236 respondents, which consists of 85% (n=201) males and 15% (n=33) females. Among them includes workers from Nepal (38.9%), Bangladesh (14.5%), Indonesia (14.1%), Malay (11.1%), Orang Asli (10.7%), Indian (6.8%), Sri Lanka (0.4%), and others race (3.4%). The age distributions of this population are workers <20 years old (2.6%), 20-29 years old (37.2%), 30-39 years old (33.3%), 40-49 years old (20.1%), >50 years old (6.8%).

Table 1 shows the ergonomics risk factors involved while performing work tasks in tea plantations such as lifting, lifting with one shoulder, lifting above the shoulder, pushing, pulling loads more than 25 kg that results in musculoskeletal disorders.

Table 1: Manual handling (load >25kg)

Task	Prevalence (%)
Lifting	38.5
Lifting with one shoulder	29.5
Lifting above shoulder	29.5
Pushing	24.5
Pulling	29.5

Table 2 showed the ergonomic risk factors that involve work posture, which duration of exposure is more than 15 minutes, which indicate that high usage of the lower limb.

Table 2: Posture (>15 minutes)

Task	Prevalence (%)
Kneeling	11.1
Squatting	11.1
Bending	19.7
Sitting	13.7
Standing	35
Climbing	26.5
Over-reach	13.2
Hand over-shoulder	13.7

Figure 7 shows the prevalence of workers having musculoskeletal pain for the past 12 months according the body parts on: neck (34.6%), shoulder (24.8), elbow (22.2%), wrist (38.5%), upper back (26.9%), lower back (35%), hip (24.4%), knee (32.9%), ankle (18.4%) and feet (24.4%).



Figure 7: Prevalence of workers having musculoskeletal pain for past 12 months

Figure 8 shows higher prevalence of workers having long-term musculoskeletal pain (pain more than 1 month) at knee (15.8%), lower back (15%), wrist (13.7%) compared to other body parts.

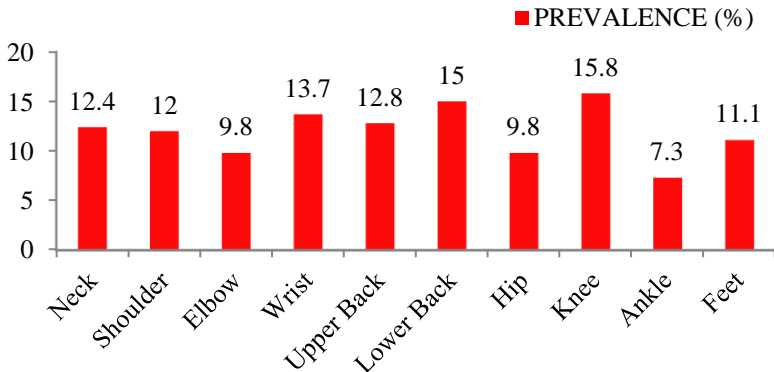


Figure 8: Prevalence of workers having long-term musculoskeletal pain according to sites of the body



Figure 9 shows higher prevalence of workers complaints of having long terms musculoskeletal pain (more than 1 month) at lower limb (19.2%), neck shoulder (18.4%), and upper limb (16.7%) compared to other region of the body.

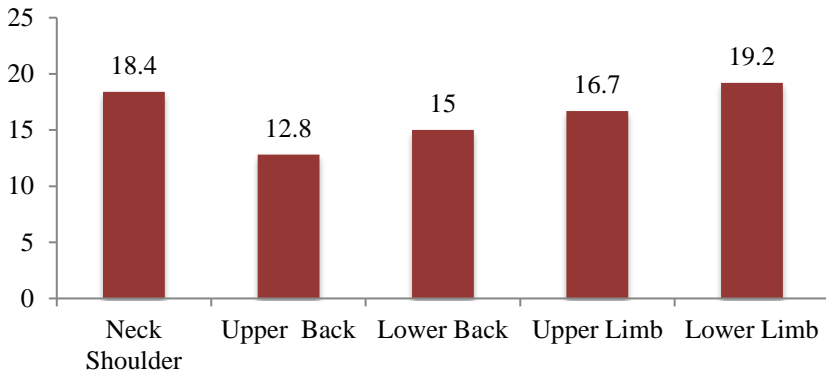


Figure 9: Prevalence of workers' complaints long terms musculoskeletal pain at lower limb

Evaluation of the task indicate in Figure 10 that shows the average REBA scores for every single work sections (i.e. using scissors, machine cutter, collect tea leaves) for the tea pluckers. The values outlined which are categorized as: High risk, therefore must implement change because it be considered risky to the workers.

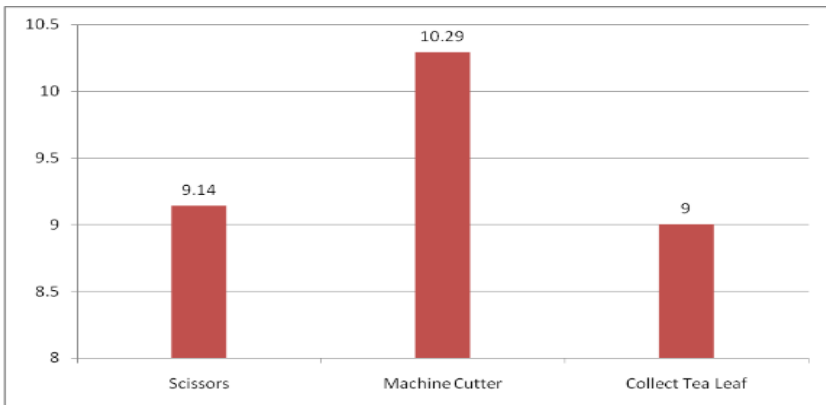


Figure 10: Rapid Entire Body Assessment (REBA) Score

## Discussion

Musculoskeletal disorder is common problems faced by agricultural workers. In this study, the prevalence of WMSD for the past 12 months was 38.5% on wrist, and 32.9% at knee, which quite similar as compared to another study by Vasant [13], among tea pluckers in India was 25.9% at wrist and 43.9% at knee respectively. However, 35% complaints at lower back found in this study, was different as compared to 58% Vasant [13] at population of tea pluckers in India. This is because the tools that have being used to plucking tea and environment of these two countries are different. The prevalence of pain more than 1 month at lower back in this study was 15% as compared to other tea pluckers in India was 51.3% [13]. This possibly suggest because of in Malaysia they are using sheer and machine to plucking tea rather than conventional way by carry a basket at the back of the workers which may contribute to high prevalence of lower back pain in India [14].

Higher prevalence of workers complaints of having long-terms musculoskeletal pain (more than 1 month), at lower limb (19.2%), and neck shoulder (18.4%), compared to other region of the body. This is same prevalence with workers at India which highest prevalence found in tea pluckers body region were neck and shoulder [13, 15]. High usage of lower limb (Table 2) is expected to contribute to musculoskeletal pain in lower limb region.

In a tea plantation in India, the load of the tea bags hanging from the plucker's head transmits the weight through the neck to the lower back; prolonged bending during plucking can also lead to discomfort in the lower back and continuous plucking for long hours leads to pain in the shoulder region [13]. This is similar in this study while manual handling with load more than 25kg may contribute high prevalence to lower back pain and long-term musculoskeletal pain at neck-shoulder region.

REBA score among tea pluckers was indicating high risk and require immediate changes either in work tools or in work station. Bhattacharyya [14] also found that high-risk involvement in the plucking activity using OCRA index.

## Conclusion

The ergonomics risk factors faced by the tea pluckers while performing their daily work tasks in the tea plantations are lifting, lifting with one shoulder, lifting above the shoulder, pushing, pulling loads more than 25 kg. This was in line with the high prevalence of workers having musculoskeletal pain for the past 12 months according the body parts especially on the neck (34.6%), wrist (38.5%), lower back (35%), and knee (32.9%). Implementing ergonomic interventions like, reduction of load carriage, improved work organization with

job rotations and sufficient rest during work to the tea pluckers may reduce WMSD symptoms and pain among tea plantations workers.

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