ORIGINAL ARTICLE

ERGONOMIC RISK ASSESSMENT OF MANUAL HANDLING TOOLS BY OIL PALM COLLECTORS AND LOADERS

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ABSTRACT

Oil palm workers are exposed to ergonomics problems in their routine works. Although many technological advances have been developed, a large number of workers are still using manual handling tools in their daily work. A study was done to identify and solve the problems or issues of material handling effect on oil palm collectors and loaders during their daily work activities. A cross sectional study was done in an oil palm plantation in Negeri Sembilan, Malaysia. Twenty five workers were selected randomly to participate in this study. Musculoskeletal symptoms were recorded using Modified Nordic Questionnaires and awkward postures of the workers were assessed using Rapid Entire Body Assessment (REBA). Result showed that 61% of workers were exposed to high risk level and 39% to very high risk level of working posture problems. In conclusion, majority of oil palm collectors and loaders need to correct their working posture as soon as possible. The manual handling activities need to be improved with respect to correct procedure for health and safety concerns.

***Keywords**: manual handling, postural analysis, oil palm plantation, oil palm collector and loader, REBA*

INTRODUCTION

Workers in agricultural industry mostly face many health hazards and musculoskeletal problems since most of them are exposed to hazardous outdoor manual occupations[1-2]. Most of the agriculture works involved manual materials handling (MMH) tasks such as loading and unloading, lifting, pulling or pushing, holding, carrying or turning of goods and materials[3-4]. In general, MMH is one of the main ergonomics risk factors causing back problems compared with other factors such as lifting heavy load, bent or twisted posture during work activities, body vibration, and repetition[5].

In the palm oil industry, employees prefer to use manual tools[6]. Majority of activities involve manual handling tasks such as during harvesting and loading of fresh fruit bunches (FFB) into carts[7]. Furthermore, job routines involved a wide range of postures and positions that may expose workers to risk of accidents and injuries[1]. The common tasks performed by harvesters and collectors of FFB comprise of activities such as pushing, pulling, bending, lifting, standing, walking and carrying[7]. Therefore, in these stressful situations due to long term exposure to material handling, awkward posture and combined stresses of repetitive movements will give rise to risk injury.

Apart from the harvesting of FFB, collectors and loaders also perform other tasks which require a lot of efforts. The collectors and loaders must have physical strength to collect manually the FFB by using a sharp metal skewer and place them in a wheelbarrow. The loader then pushes the fully loaded cart to the nearest collection station. These activities are a great concern in the oil palm industry and worth investigating as the workers need to carry and push loaded huge wheelbarrows with the FFB throughout the day and walk a considerable distance to its deposition area repetitively. In general, the weight of each FFB is about 10 to 20 kg. Most of the time, there are more than one FFB that need to be lifted and transferred. On the average, a total of 1000 kg of FFB need to be lifted and transferred daily. This clearly shows that the loaders and collectors are exposed to the risk of having musculoskeletal injury due to their work. Therefore, this study was carried out to investigate and suggest the correct working postures and also determine the risk level faced by the FFB collectors and loaders.

MATERIALS AND METHODS

This study was conducted with a sample of twenty five collectors and loaders at an oil palm plantation located in Negeri Sembilan, Malaysia. The respondents were asked to fill up questionnaires. Two sets of questionnaires were used in this study. The first set was used to determine the workers' background such as working experience, marital status and level of education. While the second set consists of Modified Nordic questions which is related to Work-related Musculoskeletal Disorder (WMSD) problems.

Modified Nordic Questionnaire

In order to obtain information on the samples' perceptions and level of discomfort experienced, a set of self-administered questionnaire of Modified Nordic Questionnaire translated into the Malay language was used. The questionnaire contained a diagram of nine body parts: neck, shoulder, upper back, lower back, elbow, hand, thigh, knee and leg, to assist the workers in identifying the correct body parts when answering the questions. To determine the level of WMSD experienced by each respondent, the workers need to score the pain felt using numeric scale ranging from number 1, that is "not painful" to number 10 that is "very painful"[8]. After answering the questionnaires, the workers were asked to perform their working activities as usual. Their work activities were captured and recorded using a video camera for the purpose of properly checking and evaluating them in the laboratory. Later, photos and video recorded during the observation were utilized to identify ergonomic working postures of the collectors and loaders while performing their tasks.

Rapid Entire Body Assessment (REBA)

The postural analysis of collectors and loaders of the FFB was performed using the Rapid Entire Body Assessment (REBA) evaluation technique. REBA was developed by Dr Sue Hignett and Dr Lynn McAtamney to associate risk of musculoskeletal injury with recorded postures[9]. The aim is to identify and evaluate the risk postures of work-related entire body segments which includes the neck, trunk, legs, arms and wrists. Overall score for all body parts were calculated using REBA worksheet (Figure 1) where the assessor assigns scores to postures. Muscle and force scores were added to the calculation and then the final score for both groups are summated to form the final action REBA score.

The REBA score is expressed on a scale of 1 to 15, as tabulated in Table 1. An analysis of scores represents the work risks and indicates possible actions to avoid or minimize the risks. One factor that distinguishes this method with other analysis methods is REBA method focuses on whole parts of human body. By exerting a focus on body posture is expected to reduce the potential of MSDs on the worker's body.

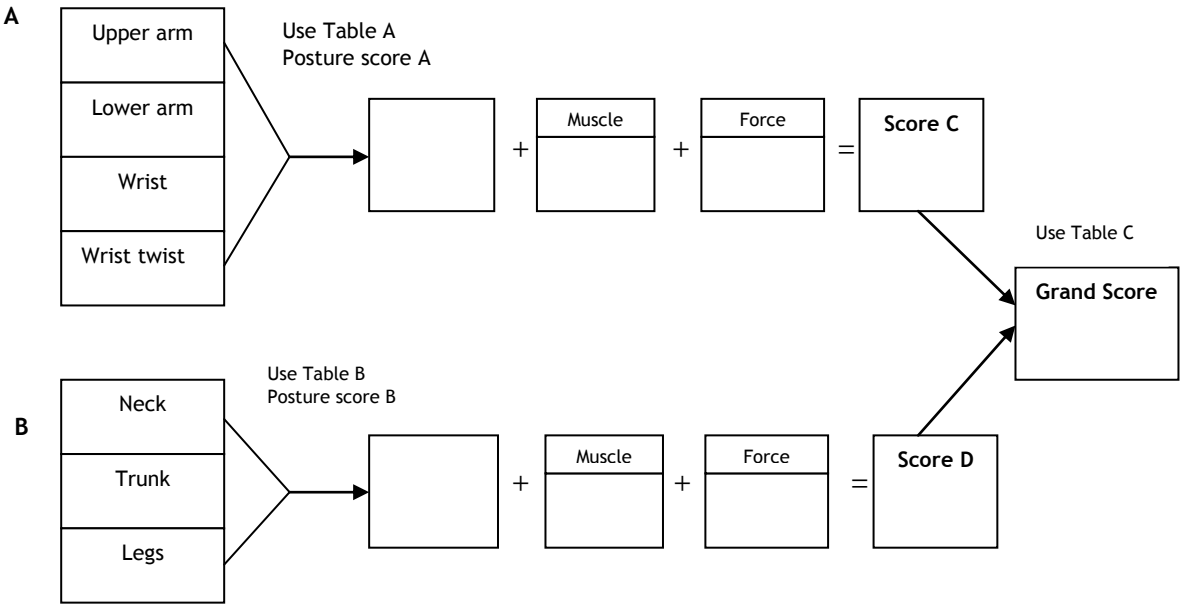

Figure 1- Rapid Entire Body Assessment (REBA)

RESULT & DISCUSSION

Table 1- Risk levels of ergonomic injury corresponding to REBA scores and indication

Risk level	REBA score	Corrective Measure
0 (Safe)	1	Not necessary
1 (Low)	2-3	May be necessary
2 (Medium)	4-7	Necessary
3 (High)	8-10	Necessary soon
4 (Very High)	11-15	Urgent

The number of collectors and loaders was 25, and the average age was 28 years old. In addition, more than half (68%) of the workers have secondary level education and 14 of them are married. On the average, the respondents had worked in the oil palm plantations for more than 2 years. Each day they will work for 8 hours with 27 minutes break time for 26 days a month. From the analysis, it was found that 92% of them are suffering from Work-related Musculoskeletal Disorder (WMSD).

Observation of postural analysis

The work activities were observed and recorded using a video camera, 3 common postures of the collectors and loaders while they are collecting and loading the FFB were chosen from the original camera image and placed in frames. A mannequin illustration generated from CATIA software was used to give greater clarity of the body postures. From the subjective evaluation and observation, the majority of the collectors and loaders had felt pain and discomfort at different body parts. The findings from the study indicated that the collectors and loaders were exposed to serious ergonomics risks factors especially when they are lifting and pushing wheelbarrows which are fully loaded with heavy FFB. It was also observed that the collectors and loaders performs their job continuously in awkward postures for a long period during the collecting and loading of FFB. An awkward posture includes repetition, twisting and bending movements. Consequently these workers may suffer from stress and discomfort at many different parts of their body.

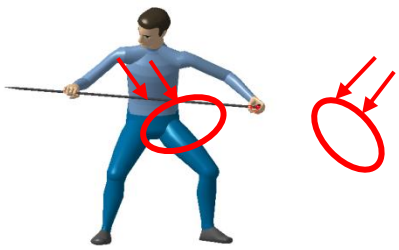

Figure 2 - shows the worker body is in bending posture with forced wrist and finger exertion.

The worker is holding and strongly swinging the skewer

Figure 3 - shows the worker is lifting a fruit bunch from ground and he is bending his body, leaning forward, and with forced shoulders, arms and finger exertion

Figure 4 - shows the worker may have to bend his body in an awkward posture when pushing the heavy wheelbarrow with forced wrist and finger exertion

Modified Nordic Questionnaire

The results of the Modified Nordic survey show that the collectors and loaders experienced frequent pain in the shoulder, with a maximum

prevalence of 60%, followed by upper back, 52% and neck 48%. Besides, it was found that the least pain most often occurs on the elbows and ankle. This suggests that the upper body area has the most significant impact to the workers while collecting and pushing FFB.

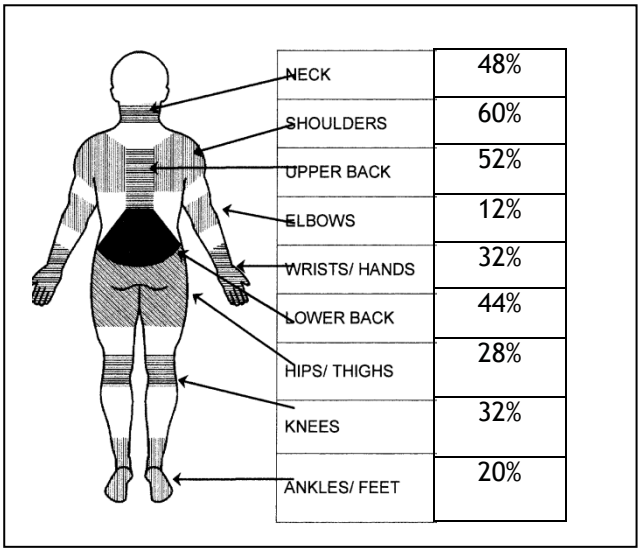

Figure 5 - Percentage of WRMD according to Nordic Body Map

Rapid Entire Body Assessment (REBA) Score

Rapid Entire Body Assessment techniques was used in this study as the workers are susceptible to greater risk due to prolonged standing and being in awkward postures in their daily work routines. From this study, the overall result showed that 61% of workers are exposed to high risk level and 39% to very high risk level of working posture problems. Lifting of the FFBs from the ground and loading them into the wheelbarrow showed a very high degree of risk level as compared to pushing a fully loaded wheelbarrow to a designated area. The body parts which are vulnerable to injury require immediate ergonomics intervention.

Table 2 - REBA scores, risk level and needed action

Posture and Activities	REBA Score	Risk Level (REBA)	Action
Collecting and loading FFB from ground to wheelbarrow	11	4 (Very High)	Urgent corrective action
Pushing fully loaded wheelbarrow to the collecting area	8	3 (High)	Necessary corrective action soonest possible

CONCLUSION

The Nordic result showed that collectors and loaders are exposed to high levels of body risk at the shoulder, upper back, and neck areas. While, REBA score indicates a very high risk level posture while collecting and loading FFB from the ground to the wheelbarrow. Based on the findings of this study, the existence of ergonomic risks factors are extremely high. Major ergonomic risks factors found in this work activity such as awkward bending, repetitive fingers, wrists and hands movements, long working hours with short rest periods and hilly ground conditions require extra energy to perform the work movements. This situation shows that the usage of manual tools by collectors and loaders of FFB adversely affected them if the tools are constantly and continuously used. Further investigations are needed to find solutions to avoid unnecessary injuries to the workers. The work techniques of the collectors and loaders should be improved so as to reduce the WMSD risks. Future research is necessary to propose suitable innovation design of material handling device which can help workers and effectively reduced the musculoskeletal disorders through ergonomics applications.

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