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Original Article

Ergonomic Risk Assessment on Oil Palm Industry Workers

Baba Mohd DEROS [1], Mohd Hafiz ALI [1], Darliana MOHAMAD [2], Dian Darina Indah DARUIS [3]

1. *Faculty of Engineering & Built Environment, Universiti Kebangsaan Malaysia, Bangi, Malaysia*
2. *Faculty Heritage & Creative Technology, Universiti Malaysia Kelantan, Kota Bharu, Malaysia*
3. *Faculty of Engineering, Universiti Pertahanan Nasional Malaysia, Kuala Lumpur, Malaysia*

***Corresponding Author:** Email: hjbaba@ukm.edu.my

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Abstract

Background: This study was an investigation conducted at two oil palm plantations in Slim River District, Perak, Malaysia on the prevalence of back pain among workers in the Malaysian oil palm industry. Many manual handling activities and tasks performed were not designed ergonomically, thus a high prevalence of musculoskeletal disorders was found among oil palm fresh fruit bunches (FFBs) manual workers. The three main objectives of this study were to determine the level of employee awareness on health and safety of manual handling tasks; to recognize the musculoskeletal symptom on the workers body parts; and to analyze their working postures and identify the relevant risk factors.

Methods: Modified Nordic questionnaire was used to collect data in 2012 at two oil palm plantations located in Slim River District, Perak, Malaysia. Later, Rapid Entire Body Assessment (REBA) analysis was conducted for high risk working postures. Seventy workers participated in the study.

Results: 81.4% of workers were aware on the correct methods to perform the manual handling tasks. The upper back and lower back pain were experienced by 87.1% and 94.3% of the workers respectively.

Conclusion: Manual workers have high level (81.4%) health and safety awareness on manual handling tasks but failed to practice it. As a result, 87.1% of them are sufferring from lower back and 94.3% from upper back pain. FFBs loading activity into the lorry is a high risk and changes needed to be done immediately. The two major risk factors identified were awkward lifting postures and repetitive lifting of FFBs.

Keywords: Oil palm industry, Ergonomics, Posture, Musculoskeletal pain, workers

Introduction

Presently about 5.07 million hectares of land in Malaysia are planted with oil-palm trees (1). Malaysia is the second largest producer and exporter of palm oil in the world; producing 11% of the world oil and fat production; contributing to about 27% of the total world oil and fat exports (2). The oil palm species which originally was brought from West Africa is now commonly planted in Malaysia. The species is called *Elaeis guineensis* (3). Oil palm plantation in Malaysia are mainly divided into large estates management system and smallholder schemes. This industry is able to provide job opportunities to more than half a million people nationwide (2).

It is very important that to ensure good quality oil, bruises on the palm fruits during are kept to a minimum during the operation and transportation of the fresh fruit bunches (FFBs). It is also important to transport the FFBs to the factory immediately after harvesting them and to process the FFBs as quickly as possible (4). The process of gathering the FFBs and putting them along the

access route is all done manually before the FFBs are then transported out of the plantations by lorry. For every harvest and collecting trip, a worker firstly collects the FFBs from the oil palm in area A (i.e. Fig. 1(a)) and loads the FFBs into a trolley in area B (i.e. Fig. 1(b)). After that, the FFBs from area B are transported to the major access route of the oil palm estate at area C (i.e. Fig. 1(c)). The final process is to load the collected FFBs into the lorry in area D (i.e. Fig. 1(d)). Fig. 1(a), 1(b), 1(c) and 1(d) show the related workers' postures involved in the A, B, C, and D areas.


(a) Collecting FFBs

(b) Loading FFBs into trolley

(c) Gathering FFBs at access route

(d) Loading into lorry

Fig. 1: The workers' posture at A, B, C and D area

Both lifting process that occur during the transfer of FFBs to the access route and during the loading process of the FFBs into the lorry involves several different awkward postures such as turning of the torso, raising of the hands above the shoulders, carrying heavy loads through manual handling. In the plantation, these tasks are done repetitively and almost continuously throughout the day. These tasks can potentially cause injuries to the workers and subsequently results in productivity loss. Generally, the FFBs collection process is a critical operation that can affect oil palm workers' health and working life.

Ergonomic risks comprise of several musculoskeletal problems such as neck pain, back pain, joint pain at buttocks, knees, whole body and arm vibration syndrome (5). The main cause for back pain is usually due to unintentional lifting of objects or loads that are heavier than normal (6). The main causes for lower back pain are awkward posture, lifting, driving and other psychosocial factors (7, 8). From the working postures of the oil palm workers, several ergonomic risks has been identified such as awkward postures and handling of heavy load. The tasks performed by the estate workers tend to cause bad effect to the spine (9). Some task such as collecting the harvest from the ground may require the workers to bend down with an awkward posture, repeated bending, turning and lifting of heavy load (5).

The three main objectives of this study were to determine the level of employee awareness on health and safety of manual handling tasks; to recognize the musculoskeletal symptom on the workers body parts; and to analyze their working postures and identify the relevant risk factors.

Materials and Methods

This study was carried out in 2012 at two oil-palm estates located in Slim River District, Perak, Malaysia. Seventy employees who were performing

manual handling tasks from the two oil palm estates took part in this study.

Modified Nordic Questionnaire

The questionnaire was divided into 3 main parts. The first part was on the employee's background, name; age, weight, height, sex, race and smokers or non-smokers. The second part was on the workers awareness in implementing and handling manual task safely. Meanwhile the third part was taken from the Nordic questionnaire, which was to identify the musculoskeletal symptoms (10). This part included questions on pain problem, rheumatic or discomfort experienced around the neck, shoulder, elbow, wrist, hand, upper back, lower back, knee, thigh, ankle and feet area.

REBA Posture Analyses

Rapid entire body assessment (REBA) analysis was developed to assess the type of work posture commonly found in health care and other services industry (11). According to Bongers et al. (12) the correct method in dealing with traditional risk factors and environment could prevent minor injuries. REBA comprises of six steps which are; to observe task, to select posture for assessment, to score postures, to process the scores, REBA score development and finally recommending the appropriate actions to be taken. Two REBA posture analytical methods used in this study were manual analysis using the REBA form and the usage of Ergo Fellow software 2.0.

In order to use REBA analysis, the researcher needed to choose the human body parts that need to be analyzed; load or postures at the neck, hip, leg, upper and lower arm. Then, stating the level of gripping force needed to perform the task, whether good, medium, weak or unacceptable. Once it is done, data on the work activity conducted is needed to establish the REBA score. The REBA score can also be determined by using the Ergo Fellow software.

REBA score 1 shows that the risk can be neglected, meanwhile a score of 2 or 3 shows low risk and changes are needed; and score of 4 to 7 shows a medium risk and changes are needed in the future. Meanwhile, a REBA score of 8 to 10 shows high risk, where investigation and changes are needed. Lastly, a REBA score of 11 or more show a very high risk and changes are needed immediately.

Results

Questionnaire Data

This study was conducted for over a period of 2 weeks and the respondents were all males. A total of 100 questionnaire forms were distributed to the respondents and 70 of the questionnaire forms were fully completed and returned.

Survey result shows the respondents age ranges from 15-25 (17.1%), 26-35 (35.7%), 35-45 (30.0%) and more than 46 (17.1%) years old. In terms of ethnic background, 21.4% of the respondents were Malays, 12.9% Indians, 5.7% Chinese and others 60% (i.e. Indonesian and Bangladeshi). Only two respondents were non-smokers.

Working Posture Analysis and Risk Factors

For the working posture analysis, the subjects were asked to continue their work as usual. Their postures while carrying out their work were recorded and later analyzed using the REBA method. The first activity observed was the posture of FFBs collection process from the oil palm trees. Once completed, the next task was to load the FFBs into a trolley towed by a buffalo to the main access route. At the access route, the FFBs were gathered on the ground along the access route to be loaded later onto the lorry.

REBA Analysis

During the study, potential risk postures that can contribute to back pain among manual oil palm workers were analyzed using REBA through Ergo Fellow 2.0 software. The postures analyzed using the software is shown in Fig. 2-5 respectively.

i) Collecting the FFBs from the oil palm tree posture: Fig. 2(a) shows various angle of task collecting the FFBs whereas Fig. 2(b) shows the neck posture angle at 46.33°.

Fig. 2: (a) Various angles of task collecting the FFBs; (b) Neck posture angle

ii) Carrying FFBs on shoulder posture: Fig. 3(a) shows various angles of FFBs carrying task on the shoulder whereas Fig. 3(b) shows the spinal posture angle at 18.81°.

iii) Dragging FFBs posture: Fig. 4(a) shows various angles for dragging the FFBs task whereas Fig. 4(b) show the hand posture angle at 65.95°.

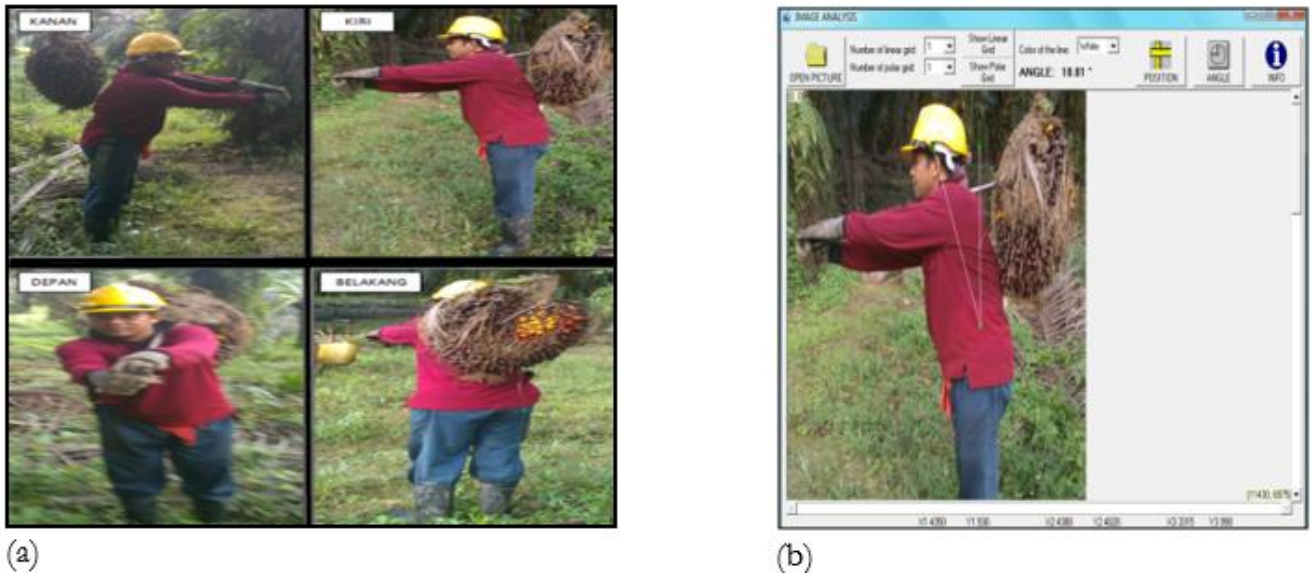

Fig. 3: Angles of carrying t(a) Various ask FFBs on shoulder; (b) Spine posture angle

Fig. 4: (a) Various angles of task dragging FFBs; (b) Hand posture angle

iii) Loading FFBs into lorry postures: Fig. 5(a) shows various angles of task loading FFBs into lorry whereas Fig. 5(b) shows the hip posture angle at 49.75°.

Fig. 5: (a) Various angles of task loading FFBs into lorry; (b) Hip posture angle

Discussions

In this study, 60% of the survey respondents working in the plantation as manual workers came from foreign countries such as Indonesia and Bangladesh. This is similar with another survey carried out by Abdullah et al. in 2011 (13). The plantation management informed the authors that all the respondents that participated in this study had undergone training for proper manual handling and lifting technique. This was in-line with the survey results, which showed more than 81% of respondents were aware on the correct procedure and method of manual handling and lifting work in oil palm plantation and only 18.6% were unaware. However, in terms of actual practice only 17.1% of the respondent practiced what they had learnt, while a high majority (82.9%) of them did not put their knowledge into practice. In other words, the result of this study showed the training

conducted on proper manual handling and lifting technique was not very effective, since it was only able to ensure that 17.1% the respondents practiced safe and proper FFBs manual handling and lifting. As a result of this low practice of correct and safe manual handling, the authors had conducted an investigation to find the reason why this has happened. The two main reason cited by majority of respondents for not practicing the correct manual handling and lifting technique was because it would slow down their work pace and they also felt uncomfortable in applying the suggested postures and techniques that they have learnt. A fast work pace is very important to them because they are contract workers and their pay depends on the amount of FFBs that they collect. With respect to the new suggested postures and techniques, they were very complacent with their original postures and techniques, thus they were resisting to the required changes. As for wearing full personal protective equipment (PPE), the survey results showed a high majority (84.3%) of the respondents did comply with the requirements and only and 15.7% of the respondents did not wear them.

The modified Nordic questionnaire was used to investigate musculoskeletal symptoms faced by the plantations workers. The investigation result showed a high prevalence of lower back pain at 87.1% and upper back pain at 94.3% symptoms were recorded among the respondents. This survey finding is similar with the previous result (14). These high figure in both lower and upper back pain may be due to the effect of awkward lifting postures and repeated lifting of heavy load (i.e. fresh fruit bunches, FFBs) performed by the manual handling and lifting workers.

Fig. 2(a) show various angles of task collecting the FFBs. Fig. 2(b) show the neck posture angle at 46.33°. Fig. 3(a) shows various angles of FFBs carrying the FFBs on the shoulder and Fig. 3(b) shows the spinal posture angle at 18.81°. Fig. 4(a) show various angles for dragging the FFBs and Fig. 4(b) show the hand posture angle at 65.95°. Based on observations during the study, these postures only occur when the workers became too tired and felt that their arms and shoulders could not take the load anymore. Hence, they dragged the FFBs but this posture is seldom practised due to the excess FFBs that will be left on the ground afterwards. All the postures shown in Fig. 2(a), Fig. 2(b), Fig. 3(a), Fig. 3(b), Fig. 4(a) and Fig. 4(b) were analyzed using Ergo Fellow 2.0 software which then obtained REBA scores of 5, which showed that the postures have medium risk and need for further investigation.

Meanwhile, the postures for loading of FFBs into the lorry has the highest ergonomic risk factor because besides lifting the heavy load, the awkward posture while performing repeated lifting of more than 10 cycles per minutes may also contribute to lower back pain. Fig. 5(a) shows the various angles of task loading FFBs into lorry and Fig. 5(b) shows the hip posture angle at 49.75°. This awkward work posture obtained a REBA score of 12, which shows it is very high risk and changes need to be done immediately. This REBA analysis finding is similar with the result found by Ng et al. (15).

Ergonomic Approach

One of the remedies to reduce the load on the spine is by using longer FFBs lifters so that the bending angle while lifting FFBs is reduced. As shown in Fig. 6, one of the feet needs to be extended outward a little, so that the workers do not need to bend down with a larger angle. Lower REBA score shows that the first suggestion can be used to reduce the risk to the workers. Besides that, instead of using an individual worker, two workers are needed to lift FFBs that weigh more than 40 kg. Work rotation and high technology machinery can also be implemented to eliminate the heavy load experienced on the workers' spine.

Fig. 6: First suggested posture of ergonomic approach

Conclusion

The manual FFBs handlers have high level of health and safety awareness at 81.4%, which is considered good. However, the workers have failed to translate their high level of awareness into actual practice as only 17.1% of them were practicing the knowledge and skills that they acquired during their training. As a result of this low practice; 87.1% of the manual FFBs handlers have sufferred from lower back pain and 94.3% from upper back pain. FFBs loading activity into the lorry is a high risk work posture and changes to this posture need to be done immediately. The two major risk factors identified were awkward lifting postures and repetitive lifting of FFBs.

Ethical considerations

The authors have completely observed all ethical issues, which includes plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission and redundancy.

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