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Original Article

A Cross-sectional Study of Musculoskeletal Symptoms and Risk Factors in Cambodian Fruit Farm Workers in Eastern Region, Thailand

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ABSTRACT

Background: Work-related musculoskeletal disorders are accumulative disorders that are most frequently found in agricultural farmers. The purpose of this study was to investigate factors that affect symptoms resulting from work-related musculoskeletal disorders among Cambodian farm workers working in fruit plantations in the eastern region of Thailand.
Methods: The Nordic Musculoskeletal Questionnaire, Rapid Upper Limb Assessment, and Hazard Zone Jobs Checklist techniques were used to interview 861 farmers who participated in the study.
Results: The data showed that men who had been working for >10 years were more at risk of neck pain than those working for <1 year with adjusted odds ratio (aOR) 1.66, 95% confidence interval (CI) (1.90, 14.5). Among women those who had been working for >10 years experienced lower back pain with aOR 8.13, 95% CI (1.04, 63.74), compared with those who had been working for <1 year. Men whose tasks required raising the arms above shoulder height had a risk factor contributing to neck pain of aOR 1.68, 95% CI (1.08, 2.61) when compared with those who did not work with this posture, and women had aOR 1.82, 95% CI (1.07, 3.12) when compared with those who did not work with this posture.
Conclusion: Based on the results of this study, it is recommended that work-related health conditions are monitored in migrant plantation workers to reduce the risks of musculoskeletal disorders.

1. Introduction

Thailand is an agricultural country with a population of 65.7 million people [1]. Approximately 14.88 million people, or about 38.7%, work in the agricultural sector [2]. Over the past decades, the number of Thai agricultural workers has decreased gradually, which in turn has forced plantation employers to seek migrant workers to combat this critical lack of manpower [3]. Consequently, the number of migrant workers has been increasing continuously. According to the Thailand Bureau of Labor, the number of migrant workers in Thailand had increased from 1,248,064 in 2011 to Q4 1,437,716 in 2016 [4]. Cambodian migrant workers became popular employees in fruit plantations across the eastern region because of its proximity to the Cambodian border, which can easily be crossed into the area. Cambodian migrant workers were considered the largest population of migrant workers in the sector of fruit farms in the eastern part of Thailand [5]. Moreover, according to researchers' observation, these workers were notably exposed to the risks related to ergonomics in this work environment, as it is an occupation requiring various types of heavy workloads, repetitive work, standing tasks, etc.

The World Health Organization has stated that work-related musculoskeletal disorders (WMSDs) constitute a major occupational problem globally [6]. This was in accordance with musculoskeletal symptom risk studies of working activities and postures of migrant workers, in which they performed their work through various activities consisting of fruit tree care taking by applying fertilizers, mixing and spraying pesticides, harvesting, goods packaging, manually carrying packages, etc. In addition, their work postures comprise awkward body bending, heavy manual lifting, repetitive movement, daily prolonged working [7], and awkward neck bending. In addition, many lack the knowledge of safety and healthy working conditions such as the risk from vibrations [6,8]. All these are considered more significant risk factors for musculoskeletal symptoms than others [9–11].

Musculoskeletal symptoms generally contribute to poor quality of life, and illness results in costly treatment. It is anticipated that by the year 2020, numerous people will be suffering from severe

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health-related problems [12–14]. Recently, many studies investigating the prevalence of WMSDs among agricultural occupation in Thailand have been conducted; for instance, a study in sugarcane plantations found that sugarcane farm workers suffered physical illness symptoms, including back pain, muscle cramps, lumbar pain, and shoulder pain [15]. Another study on a rubber plantation conducted by Plykaew and Kaewthummanukul [16] demonstrated that the prevalence of musculoskeletal symptoms in the 12 months and 7 days prior to the study was 87.7% and 65.11%, respectively.

Many factors contribute to musculoskeletal symptoms [11,17,18], which can be categorized as personal factors [13], such as gender, age, etc.; working conditions involving repetitive movement, exertive force, and prolonged work for mostly 9–12 hours [19]; and awkward postures such as body bending, kneeling, body or arm twisting, and raising hands above the head [7,20,21]. Moreover, inappropriate working conditions and environment factors such as vibrations, combined with prolonged work hours, may also lead to musculoskeletal symptoms [8].

Most WMSDs are accumulative disorders [22]. Musculoskeletal disorders (MSDs) are most frequently found in arms and the back as a result of injuries and disorders across various parts of the body [23]. A variety of methods are widely used to diagnose MSDs, such as ultrasound imaging and medical/symptom examination methods [22]. One of the first signs of an increased risk of MSDs is muscle fatigue, which can eventually lead to decreased strength, reduced task performance, impaired exercise capacity, and/or less ability to exert force, and diminished power output [24,25].

Additionally, there are many methods for measuring the signs of muscle fatigue, including biomechanical manifestation via intracellular pH change, blood samples, and electromyography signals via invasive (needle electromyography) or noninvasive (surface electromyography) techniques [6,22,27,28]. However, for initial field assessment, Rapid Upper Limb Assessment (RULA) and the Hazard Zone Jobs Checklist, which requires basic and quick evaluation procedures, are still extensively used to evaluate the risks of work posture and lifting tasks, which contribute to MSDs affecting an upper body limb, and to evaluate lifting tasks, respectively [29–31].

Many studies relevant to ergonomic-related risk identification among Thai farm workers have been found in related literature reviews. These studies include the study by Swangnetr et al. [32] and others that studied ergonomic-related risk identification and pain analysis for farm workers involved in rice field preparation; Chanprasit and Kaewthummanukul [33] studied corn plantation farm workers and found that most of their working postures did not adhere to ergonomic recommendations such as the prevalence of body bending (9.2%), prolonged standing (97.7%), and manual heavy lifting (90%) [33]. In addition to those described above, studies were also conducted for sugarcane, rice, and rubber tree plantation workers [15,16].

Nevertheless, none of the identified studies included migrant farm workers, such as Cambodians working in Thailand. This study, therefore, focuses on musculoskeletal symptoms among Cambodian migrant workers in the region of eastern Thailand, where most of them were present. All information from this study may therefore help inform the provision of better future health monitoring practice guidance among farm workers in Thailand. The objectives of this research are to study the factors contributing to MSDs among Cambodian migrant farm workers in eastern Thailand.

2. Materials and methods

2.1. Population

The research participants were male and female migrant farm workers, who crossed the Cambodian border seeking employment in fruit plantations in the eastern provinces of Thailand. Working processes of fruit farming require different consecutive tasks, including fruit tree care taking by applying fertilizers, mixing and spraying pesticides, sprinkling water, harvesting, goods packaging, and manually carrying packages. However, only the processes of mixing, spraying pesticides, and harvesting fruits were selected for the study of musculoskeletal symptom risks, which involve working activities and postures of migrant workers.

Backpacks, cars, and stationary pesticide tanks were used as sprayer equipment. Backpack pesticide sprayers are used to apply insecticides directly over relatively small areas. Typically, migrant fruit farm workers used backpack pesticide sprayers by holding insecticide mixed with water. The volume of fully loaded sprayers varies from 8 L to over 22 L. When spraying insecticide using a car, insecticide mixed with water is poured in a large 1,000-L tank positioned on a car. Pesticide spraying usually involves a team of two to three people including a car driver, a sprayer, and an assistant. Farm workers usually spray insecticides along the distance of the area within the larger orchard. The method of using a stationary pesticide tank to spray follows the same pattern as the method of spraying insecticide using a car, except for the location of the large tank, which is placed on the ground. The insecticide team usually consists of two people, a sprayer and an assistant.

Inclusion criteria were that the participant was an immigrant of Cambodian nationality, was employed in a fruit plantation in the eastern region of Thailand as a permanent employee, and had been employed for at least 1 year. Those participating in this research did so on a voluntary basis, and permission from the employer was obtained beforehand.

2.2. Sample size

The sample size for this study was determined by the number needed to perform simple logistic regression [34].

$$n = \frac{4P(1-P)\left(Z_{1-\alpha/2} + Z_{1-\beta}\right)^2}{(P_1 - P_2)^2}$$

Here n is the required sample size and P the rate of use of health care services at a Thai hospital or medical facility. According to the study conducted by Lekcharoen et al. [34], regular exposure to a low temperature for more than 3 hours is equivalent to 61.4 ($p = 0.614$) and $p1 - p2$, respectively. The difference in incidence between the groups that had a physical risk and those that did not have the risk was small (0.15).

When the calculation and error approximation are put in place, α will be equal to 5% (=1.96). The formula for hypothesis testing is $(1-\beta)$ and is equal to 80% (=0.84). The calculation of the sample size indicates that 495.48 informants are required. However, there are variables in this study. Thus, the sample size has been adjusted [35]; np is the adjusted sample size and $n1$ the calculated sample size for simple logistic regression. R is the correlation analysis of multiple logistic regression, which has been set as 35% ($R^2 = 0.35$) for this study. Based on this formula, the total size of the sample is 762 informants.

This study was conducted among workers in fruit orchards and was carried out in three eastern provinces (Chonburi, Rayong, and Chanthaburi) where there were many workers in a relatively small geographic area; this allowed data to be obtained from 861 participants.

2.3. Research ethics

All participants were permitted to decline or withdraw at any time from the study without penalty. Those who agreed to participate signed an informed consent form. The Institutional Review

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