

Work-related musculoskeletal disorders among coffee harvesters in Chiang Rai, Thailand: Prevalence, severity, and risk factors

S112

Received May 2018
Accepted June 2018

Wipawee Songsaeng

College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand

Wattasit Siriwong

*College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand;
Center for Risk Analysis and Health Surveillance, Chulalongkorn University, Bangkok, Thailand*

Abstract

Purpose - Work-related musculoskeletal disorders (WMSDs) greatly impact the health of the working population, especially unskilled labor such as farmers and low-income workers. The study aimed to assess the occurrence and risk factors associated with WMSDs among coffee harvesters in Chiang Rai, Thailand.

Design/methodology/approach - This cross-sectional study was conducted in WMSDs among 272 coffee harvesters in Chiang Rai Province. The questionnaire was adapted from Standard Nordic Questionnaire; and the face-to-face interview was performed. Data were analyzed using descriptive statistics and binary logistic regression.

Findings - The occurrence of 7-days and 12-months WMSDs were 79.4% and 81.6%; the most prevalent pains were in the areas of neck, shoulder and wrist. The risk factors that were 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 associated with 12-months WMSDs were age (OR=2.17, 95% CI=1.10-4.32) and stress (OR=2.49, 95% CI=1.26-4.95). The work postures which were significantly associated with the nine body areas were twisting body, lifting arms above shoulders, and carrying heavy objects.

Originality/value - This information can be used for further study to find the causal-effect relationship between WMSDs and risk factors; moreover, it helps as a guideline to implement future intervention and prevention program to reduce WMSDs.

Keywords Work-related musculoskeletal disorders (WMSDs), Coffee harvesters, Thailand

Paper type Research paper

Introduction

Thailand is an agricultural country with population of 65.9 million people, and one-fifth of this population (12.57 million people) is working in the agricultural field [1, 2]. People who work in the agricultural fields are often exposed and confronted with occupational health risk factors including ergonomics problem such as musculoskeletal disorders, lower back pain, muscle fatigue etc. [3].

The World Health Organization (WHO) has stated that the major occupational problem is associated with work-related musculoskeletal disorders [4, 5]. Work-related musculoskeletal disorders (WMSDs) refer to wide ranges of inflammatory, degenerative discomfort, and disorders which lead to pain or functional impairment of muscles. The previous studies showed that WMSDs was caused or intensified by poor working environments and high physical demand work tasks such as lifting heavy objects, bending, reaching overhead, pushing and pulling heavy loads, performing similar tasks repeatedly, or performing awkward postures [6, 7]. In addition to working postures, the important risk factors from previous studies are also included age and gender [3, 4, 8, 9]. Work-related musculoskeletal disorders are increasing worldwide, they start to affect the health, quality of life and economic status which incurs substantially high financial cost of the world's population.

Farmers are at greater risk of getting WMSDs because farming and harvesting require high physical demands that impose strain on the body [8]. Coffee harvesters are also at risk of getting WMSDs because they exposed to poor working conditions by working outdoor in undesirable working environments with awkward or repetitive postures which mentioned above as the cause of WMSDs.

WMSDs became one of the main burdens of the country by affecting the working population in Thailand. The data from the department of disease control of Thailand indicated that since the year 2010, the number of patients who reported having musculoskeletal symptoms is increasing every year among working population [3, 4, 7, 10]. In fact, in 2012, there were about 274,832 cases of WMSDs reported in Thailand [9]. The prevalence of WMSDs ranges as high as 79% to 88% in Thailand [11].

Although recently, there are research studies focusing on work-related musculoskeletal disorders among many different occupations, the studies about WMSDs among farmers are still very few at present. In fact, in Thailand, there is rarely any study investigated the risk factors associated with WMSDs among coffee harvesters. Therefore, this study aims to investigate the prevalence and risk factors associated with WMSDs among coffee harvesters and Chiang Rai province is chosen as a study site because in Chiang Rai coffee is the main cultivation crops and many people are working as coffee harvesters.

Materials and methods

This cross-sectional study took place in a large coffee factory in Chiang Rai province, Thailand. Coffee harvesters were selected from the list of harvesters who registered their names to sell their coffee products to the factory. The convenient sampling technique was carried out for the 272 eligible participants on several evenings when coffee harvesters came to sell coffee cherries to the factory.

The questionnaire, developed from literature review and Standard Nordic Questionnaire [12], was used as a tool. The participants with history of muscle or bone injuries and those who are regularly taking muscle relaxant drugs were excluded from this research. The questionnaire consisted of questions related to individual factors, work-related factors, psychosocial factors related to stress (DASS-21), and the symptoms of musculoskeletal disorders [3, 12, 13]. In the questionnaire, musculoskeletal symptom of pain was categorized into nine body parts (neck, shoulder, elbows, wrist/hand, upper back, lower back, hip, knee and ankle). For overall category, 'Yes' meant there was pain in any parts of body, and 'No' meant there was no pain at any part. The validity and reliability were tested before data collection with the scores of 0.88 and 0.72 respectively.

The study took place in March 2018. Prior to data collection, the study was approved by the Ethical committee of Chulalongkorn University No.024.1/61. First, the covering letter asking for permission to publicize the research was sent to the manager of the factory who then announced about the research to coffee harvesters in the village who work in different coffee fields and sell their coffee to the factory. Face-to-face interview was done by the researcher and five well-trained interviewers for the harvesters who volunteered to participate.

The data was analyzed using the licensed SPSS version 22. The descriptive statistics were used to examine the characteristics of independent variables and the prevalence of WMSDs. The dependent variable was dichotomous, so binary logistic regression was used to find the association between risk factors and WMSDs. First, univariate analysis was done to find the significant value with Odds Ratio (OR) and 95% confidence interval (CI). Then the values with significant level less than 0.2 were

chosen to be included in the final model of multivariate analysis to find the adjusted odd ratio with 95% CI. The analysis was done for 7-days WMSDs (any pain experienced in the past 7 days) and 12-months WMSDs (any pain within the past 12 months) separately.

Results

Two hundred and seventy-two harvesters agreed to participate in this study. The participants were aged between 18 and 60 years old with the mean of 42.3 ± 12.2 years old. A little more than half of the participants were male (53.7%). The majority of the participants did not have any education (63.2%). The income per month ranged from 1,000 to 20,000 Baht. Almost all of the participants were from the Akha hill tribe ethnic minority group (90.4%). Most of the participants were married or had been married. Most of the participants were non-smoker (73.2%) and non-drinkers (66.9%).

The occurrence rate of WMSDs that perceived by participants was higher in the 12 months' period than the 7 days' period with 81.6% and 79.4% respectively. For both 7-days and 12-months WMSDs, upper extremities muscles like neck and shoulder were reported with the most pain (Figure 1).

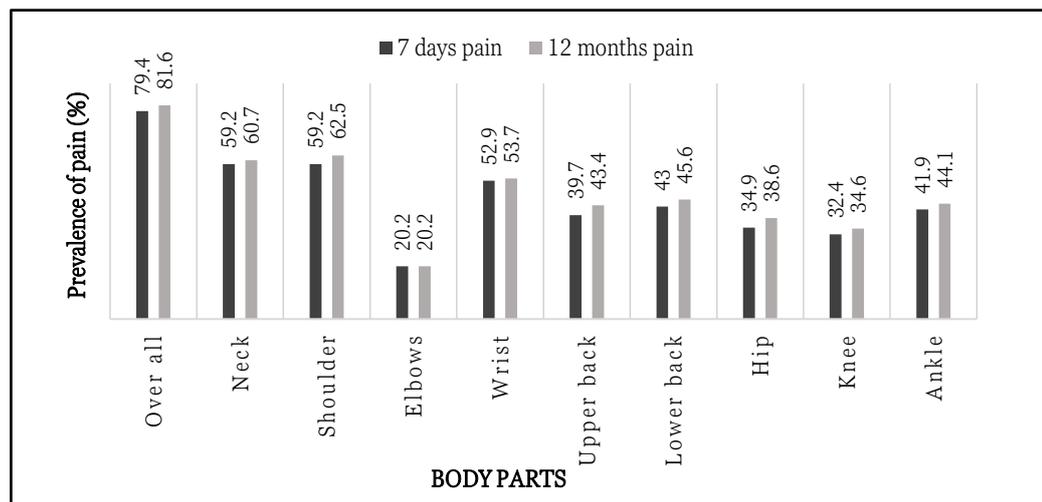


Figure 1. Prevalence of pain in each body part for 7-days and 12-months WMSDs

The univariate analysis of binary logistic regression was used to find the association between the risk factors and WMSDs, one by one. For both 7-days and 12-months WMSDs analysis, the factors with the p -value of <0.2 were further analyzed in the multivariate analysis table to find the association with adjusted value (Table 1).

The selected risk factors from the univariate analysis along with risk factors from the literature review were included in multivariate analysis of both 7-days and 12-months WMSDs.

The multivariate analysis model for 7-days WMSDs presented that individual factors such as 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]) were associated with 7 days WMSDs (Table 2).

Table 1. Univariate analysis of risk factors and WMSDs (7-days and 12-months period)

Risks factors	Total	7 days WMSDs			12 months WMSDs		
		OR	95% CI	<i>p</i> -value	OR	95% CI	<i>p</i> -value
Age (Years)							
≤ 45	143						
> 45	129	2.47	1.32-4.63	0.005	2.20	1.15-4.22	0.017
Gender							
Male	146						
Female	126	1.19	0.66-2.16	0.560	1.12	0.61-2.08	0.715
Education							
No education	172						
Educated	100	0.60	0.33-1.09	0.094	0.69	0.37-1.29	0.242
Income (Baht)							
≤ 5,000	180						
>5,000	92	0.90	0.49-1.67	0.737	1.11	0.57-2.13	0.763
Ethnicity							
Akha	246						
Others	26	1.10	0.40-3.06	0.857	1.81	0.52-6.29	0.350
Status							
Single	29						
Married/was married	243	1.55	0.65-3.71	0.327	1.48	0.59-3.68	0.400
BMI							
Normal (≤ 24.9)	207						
Obese (>24.9)	65	0.66	0.34-1.26	0.205	0.68	0.57-1.93	0.888
Disease							
No	235						
Yes	37	2.34	0.79-6.92	0.123	2.83	0.83-9.63	0.095
Exercise							
No	204						
Yes	68	0.58	0.37-1.36	0.300	0.75	0.47-1.89	0.857
Smoking							
No	199						
Yes	73	2.20	1.02-4.75	0.045	2.17	0.97-4.88	0.060
Drink alcohol							
No	182						
Yes	90	1.45	0.76-2.79	0.262	1.72	0.85-3.47	0.134
Stress							
Normal	189						
Stress at any level	83	3.05	1.54-6.07	0.001	2.72	1.39-5.35	0.004
Work experience (Years)							
≤ 10	159						
> 10	113	0.93	0.52-1.69	0.823	0.98	0.53-1.82	0.942
Farm size (Rai)							
≤ 10	163						
> 10	109	0.79	0.44-1.43	0.434	0.82	0.44-1.53	0.531
Work hours per day (Hours)							
≤ 8	152						
> 8	120	1.13	0.62-2.03	0.696	1.21	0.66-2.41	0.541
Break time (times/day)							
≤ 2	250						
> 2	22	0.72	0.25-1.79	0.421	1.0	0.32-3.14	0.980
Extra works							
No	222						
Yes	50	1.23	0.56-2.70	0.617	1.476	0.62-3.51	0.378
Weight of coffee harvest (Kg)							
≤ 60	137						
>60	135	0.52	0.28-0.95	0.032	0.66	0.36-1.23	0.192

Note: variables with *p*-value less than 0.2 were selected for multivariate analysis.

Table 2. Multivariate analysis of the association between risk factors and 7-days WMSDs

Risk factors	OR	95% CI	Adjusted OR	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	1.09-6.92	1.67	0.46-4.89	0.381
Smoke	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*
Weight of coffee harvested (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 $p < 0.05$

Table 3. Multivariate analysis of the association between risk factors and 12-months WMSDs

Risk factors	OR	95% CI	adjusted OR	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*
Weight of coffee harvested (Kg)	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 $p < 0.05$

Table 4. Multivariate analysis of different postures in different parts of body

Body parts/postures	7 days WMSDs			12 months WMSDs		
	OR _{Ajd}	95% CI	p-value	OR _{Ajd}	95% CI	p-value
Upper back						
Twisting body	2.27	1.03-4.99	0.041*	2.53	1.12-5.74	0.026*
Lifting arms above shoulders	2.36	1.35-4.11	0.002*	2.67	1.53-4.63	0.001*
Lower back						
Lifting arms above shoulders	1.78	1.05-3.03	0.330	2.36	1.38-4.03	0.002*
Knees						
Twist body	2.87	0.87-4.35	0.101	2.78	1.26-6.14	0.011*
Carry heavy object (>25 Kg)	1.88	0.66-2.21	0.533	1.92	1.06-3.48	0.031*
Ankle						
Twisting body	1.80	0.85-3.73	0.124	2.13	1.01-4.50	0.048*

Note: Adjusted for age, gender, BMI, and stress (from the 7 working postures that harvester perform, only working postures that significantly associated with different body regions was presented in this table); *p-value < 0.05

For the analysis of 12 months WMSDs, age (OR=2.17, 95% CI=1.10-4.32) and stress (OR=2.49, 95% CI=1.26-4.95) were presented with the significant (p -value<0.50) association to 12-months WMSDs (Table 3).

For the variable of working postures, it was interesting to analyze the association one by one with each body region rather than with overall pain category of WMSDs in the questionnaire because each working posture may be significantly associated with different regions of body. The univariate analysis of binary logistic regression was done first between WMSDs of each body region (nine anatomical regions in the questionnaires) and each working posture (postures that harvesters regularly perform such as lifting arms above shoulders, twisting body, standing for long time, walking up and down hill, twisting hand, carrying heavy objects of more than 25 kg, and bending). Then for each body region, the postures with p -value<0.2 along with

important factors from literature review were included in the multivariate analysis to find the adjusted OR.

The final adjusted value in 7-days WMSDs showed that the upper back region is significantly associated with twisting body and lifting arm for long time. In 12-months WMSDs, upper back pain is associated with twisting body and lifting arm above shoulders. Lower back pain is associated with lifting arms above shoulders. Knee pain is associated with twisting body and carry heavy objects. Finally, ankle pain is associated with twisting body. The other body parts did not have any association with any working postures (Table 4).

Discussion

Occurrence of WMSDs in each body region

Agriculture is a challenging occupation in which farmers have to suffer from work-related and health-related problems. From previous studies on WMSDs, the highest prevalence occurred among unskilled and low-income workers like farmers because of their working conditions and the lack of awareness of WMSDs [11, 14, 15]. In this study, the occurrence of WMSDs for the 7-days and the 12-months' periods were 79.4% and 81.6% respectively. These results were similar to the study in Thailand about sugarcane farmers which reported the prevalence of WMSDs for the 7-days and 12-months periods as 82.9% and 88.7% [9]. Although they may perform different working postures, sugarcane farmers and coffee harvesters are required to use a lot of upper extremities muscles which cause them to perceive pain within those regions. Therefore, they may experience more pain on the upper extremities when compare to other studies among different type of farmers in Thailand.

The results by body parts for both 7-days and 12-months WMSDs were given that neck and shoulder were the parts which presented with the highest pain followed by wrists. The reason for pain in these regions was that during the process of harvesting coffee, harvesters have to reach up to the trees to pick up coffee cherries, which requires a lot of motions and puts strain on muscles in the upper extremities.

Association between risk factors and WMSDs

The risk factors, in this study, which associated with WMSDs were age, smoking and stress. Both 7-days and-12 months WMSDs (OR= 2.47 and 2.17 respectively) gave results of significant association to age. As the age increases, there is a higher chance for harvesters to experience muscle pains associated with WMSDs. This result was consistent with other studies about WMSDs among farmers, which indicated that people with older age, especially those who are 40 years and older, experience more pain than those who are younger [14].

Smoking is also considered as significant factor associated with WMSDs in this study, especially for 7-days WMSDs. The risk of smokers to have WMSDs are 2.85 times higher than non-smokers. Several studies indicated similar results in which smoking is associated with pain in the muscles [16-18]. Nunes and Bush, 2012, indicated that the pain is mainly associated with lower back region or intervertebral herniated disc, by giving the reason that back pain may be caused by coughing from smoking [18]. Coughing increases the abdominal pressure and intra-disc pressure and therefore produces strain on the spine; moreover, nicotine from cigarette can diminish blood flow to vulnerable tissue and diminished mineral content of bone, causing micro-fractures to muscles and bone tissues [18].

In this study, psychosocial related to stress was significantly associated with WMSDs. Stress could come from many related factors. The psychosocial factors

related to stress could happen from low family support, low social support, fatigue from work, low time for relaxation, low job satisfaction and many others physical or emotional problems [11]. The psychosocial factors in this study were all used as explanation of how physical conditions at work can lead the individual to emotional problems like 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). The reason that stress could have effects on the musculoskeletal system is that when people feel stress, their muscles tense up. Social stress or emotions can increase the pain perception and decrease pain threshold, so people would feel that they have more muscle pains when they are stressed [11]. So, stress may cause perception of pain related to WMSDs.

Different working postures are well-related to the symptoms of WMSDs. Coffee harvesters may perform same working postures repeatedly and awkwardly, so they may develop the pain in different parts of body due to the postures that they performed.

This study indicates that twisting body and lifting arm for a long period of time are associated with upper back and lower back pain because both postures require heavy movements on all the back muscles. Another study on back pain among farmers in Thailand was also found that farmers experience higher prevalence of back pain due to the postures of twisting body in awkward positions (56.2%) and bending forward (70.8%) [19]. Farmers and harvesters are required to perform awkward postures and with those different working postures they may develop pain within the body regions.

Many studies suggest that lifting heavy objects is considered as forceful exertion and is associated with WMSDs [9, 20, 21]. In this study, knee's pain was identified as associated with the lifting heavy objects because the harvesters would carry sacks or baskets of coffee by using their arms, and having to walk up and down the hills, or walk for a long time; these would cause pain to the associated body regions such as knees and arms/elbows.

In short summary, all the working postures that coffee harvesters perform, mentioned in this research, could be considered as risk factors associated with WMSDs. When harvesters perform awkward and repetitive postures, they are at more risk of developing WMSDs.

Conclusion and recommendation

Work-related musculoskeletal disorders are still common among farmers on different plantations. This study's results show that the prevalence of work-related musculoskeletal disorders among coffee harvesters is still high in shoulder, neck, wrist, upper back and lower back regions. The important factors in this study were age, smoking, stress, twisting body, carrying heavy objects and lifting arms above shoulders. This information can be used to set up suitable programs for harvesters to be aware of WMSDs and to provide them with good and suitable working environments. Further studies to identify the cause-effect relationship between the important factors and the symptoms of WMSDs are needed for good prevention, and for intervention programs to reduce WMSDs.

Limitation

In our study, we used cross-sectional study design; thus, it was not possible to determine the causal relationship with risk factors and of musculoskeletal disorders. A second limitation is that the study was based on self-reporting, and the participants may have information bias or recall bias. Third, since this research used a convenient sampling method, selection bias may occur.

Acknowledgement

The authors are grateful for all contributors to this research study especially the coffee harvesters who participated. This study was supported by the CU Graduate School Thesis Grant and the Grant for International Research Integration: Chula Research Scholar, Ratchadaphiseksomphot Endowment Fund (GCURS 59-06-79-01), Chulalongkorn University. The first author would like to thank all professors and staff in the college of Public Health Science, Chulalongkorn University for their support with knowledge and information toward this research.

References

1. National Statistical Office [NSO]. Advance report 2013 agricultural census. Bangkok: NSO; 2013.
2. National Statistical Office [NSO]. Summary of the labor force survey in Thailand: December 2016. Bangkok: NSO; 2016.
3. Luangwilai T, Norkaew S, Siriwong W. Factors associated with musculoskeletal disorders among rice farmers: Cross sectional study in Tamlalord sub-district, Phimai district, Nakhonratchasima province, Thailand. *Journal of Health Research*. 2014; 28(Suppl.): S85-S91.
4. Thetkathuek A, Meepradit P, Sa-Ngiamsak T. A Cross-sectional study of musculoskeletal symptoms and risk factors in Cambodian fruit farm workers in eastern region, Thailand. *Saf Health Work*. 2018 Jun; 9(2): 192-202. doi: 10.1016/j.shaw.2017.06.009
5. World Health Organization [WHO]. Global database on body mass index. Available from: http://apps.who.int/bmi/index.jsp?introPage=intro_3.html
6. Henry LJ, Jafarzadeh Esfehiani A, Ramli A, Ishak I, Justine M, Mohan V. Patterns of work-related musculoskeletal disorders among workers in palm plantation occupation. *Asia Pac J Public Health*. 2015 Mar; 27(2): NP1785-92. doi: 10.1177/1010539513475657
7. Pintakham K, Siriwong W. Effectiveness of the multidimensional ergonomic intervention model to reduce musculoskeletal discomfort among street sweepers in Chiang Rai Province, Thailand. *Risk Manag Healthc Policy*. 2016; 9: 275-83. doi: 10.2147/rmhp.S110864
8. Osborne A, Blake C, Meredith D, Kinsella A, Phelan J, McNamara J, et al. Work-related musculoskeletal disorders among Irish farm operators. *Am J Ind Med*. 2013 Feb; 56(2): 235-42. doi: 10.1002/ajim.22092
9. Phajan T, Nilvarangkul K, Settheetham D, Laohasiriwong W. Work-related musculoskeletal disorders among sugarcane farmers in north-eastern Thailand. *Asia Pac J Public Health*. 2014 May; 26(3): 320-7. doi: 10.1177/1010539514528026
10. Department of Disease Control, Bureau of Occupational and Environmental Diseases [BOED]. Disease related to bone and muscle. Available from: http://envocc.ddc.moph.go.th/uploads/situation/4_5_situation.pdf
11. Meksawi S, Tangtrakulwanich B, Chongsuvivatwong V. Musculoskeletal problems and ergonomic risk assessment in rubber tappers: A community-based study in southern Thailand. *Int J Ind Ergon*. 2012; 42(1): 129-35. doi: 10.1016/j.ergon.2011.08.006
12. Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sorensen F, Andersson G, et al. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. *Appl Ergon*. 1987 Sep; 18(3): 233-7.
13. Parkitny L, McAuley J. The Depression Anxiety Stress Scale (DASS). *J Physiother*. 2010; 56(3): 204. doi: 10.1016/S1836-9553(10)70030-8
14. Jain R, Meena ML, Dangayach GS, Bhardwaj AK. Association of risk factors with musculoskeletal disorders in manual-working farmers. *Arch Environ Occup Health*. 2018 Jan; 73(1): 19-28. doi: 10.1080/19338244.2017.1289890
15. Kolstrup CL. Work-related musculoskeletal discomfort of dairy farmers and employed workers. *J Occup Med Toxicol*. 2012 Nov; 7: 23. doi: 10.1186/1745-6673-7-23
16. da Costa BR, Vieira ER. Risk factors for work-related musculoskeletal disorders: A systematic review of recent longitudinal studies. *Am J Ind Med*. 2010 Mar; 53(3): 285-323. doi: 10.1002/ajim.20750
17. Leino-Arjas P. Smoking and musculoskeletal disorders in the metal industry: a prospective study. *Occup Environ Med*. 1998 Dec; 55(12): 828-33.
18. Nunes IL, Bush PM. Work-related musculoskeletal disorders assessment and prevention. In: Nunes IL, editor. *Ergonomics: A systems approach*. Rijeka, Croatia: InTech; 2012. p.1-30.

19. Taechasubamorn P, Nopkesorn T, Pannarunothai S. Prevalence of low back pain among rice farmers in a rural community in Thailand. *J Med Assoc Thai*. 2011 May; 94(5): 616-21.
20. Ng YG, Mohd Tamrin SB, Mohd Yusoff IS, Hashim Z, Deros BM, Abu Bakar S, et al. Risk factors of musculoskeletal disorders among oil palm fruit harvesters during early harvesting stage. *Ann Agric Environ Med*. 2015 13 March 2014; 22(2): 286-92. doi: 10.5604/12321966.1152101
21. Lopez-Aragon L, Lopez-Liria R, Callejon-Ferre AJ, Gomez-Galan M. Applications of the standardized nordic questionnaire: A review. *Sustainability*. 2017 Sep; 9(9). doi: 10.3390/su9091514

Corresponding author

Wattasit Siriwong can be contacted at: Wattasit.s@chula.ac.th