FACTORS ASSOCIATED WITH MUSCULOSKELETAL DISORDERS AMONG RICE FARMERS: CROSS SECTIONAL STUDY IN TARNLALORD SUB-DISTRICT, PHIMAI DISTRICT, NAKHONRATCHASIMA PROVINCE, THAILAND

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ABSTRACT: Agricultural jobs are physically strenuous. Farmers and farm workers are at particular risk of developing symptoms of musculoskeletal disorders compared with others. Farm workers, especially rice farmer, expose to several of physical disorders activities, hazard, such as excessive bending, twisting, kneeling and carrying loads. These are activating factors associated with symptoms of musculoskeletal disorders. This is a cross-sectional design. Two hundred and ninety participant aged between 20 to 59 years old were selected by single stage cluster sampling from group of household, while the households of rice farmer were selected by simple random sampling. Between February and March 2014, the data were collected by face-to-face interviews from general and Standard Nordic questionnaires. The study revealed that the average ages of participants (± SD) was 47.6 ± 8.7 years old. The most common process that affecting the rice farmers were planting and transplanting process, high prevalence in shoulder pain (71.7%). They were planting and transplanting by themselves, 93.1% and 99.7%. Paddy preparation process, most rice farmers used wheel tractor machine walking along (78.3%).For harvesting, they had done by both machine and by manual with sickle (51.4%). Shoulder pain was the most reported cases in all process. The results were identified six factors that significantly associated with musculoskeletal disorders as the following: female (OR=3.180, 95% CI=1.966-5.143), abnormal BMI group (OR=0.607, 95% CI=0.377-0.977), education below high school (OR=0.535, 95% CI=0.313-0.915), non-smoker group (OR=2.169, 95% CI=1.137-4.141), farming experience 26 to 50 years (OR=2.169, 95% CI=1.350-3.483), have underlying disease (OR=2.013, 95% CI=1.202-3.372). The high prevalence of musculoskeletal disorders still is not uncommon among rice farmers. The results of this study were presented that all process of rice growing affected to musculoskeletal system by several related factors. Musculoskeletal disorders mainly associated with gender, BMI, education level, smoking status, farm experience, and underlying disease. This finding suggested that the improvement farming management systems in process of rice-growing including either education or recommendation can shrink the pain of the musculoskeletal system and aid rice farmers to understand in this study area.

Keywords: Musculoskeletal disorders, Nordic questionnaires, Rice farmer, Thailand

INTRODUCTION

Agriculture is one of the major occupations in Thailand. About 35.2 % of population in Thailand are agricultural workers which rice farming accounts for the major group of agricultural occupation [1].

Rice farm covers about 60 million km²of the total area used for farming purpose. More than half of rice farming is located in the north-eastern region of Thailand where covers about 32,881,657 km². The rice production has about 332 kg/ km². Rice is made up most exports and is considered to be a major food consumed by people in Thailand [2]. Due to increased demand, farming areas are expanding each

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year and the rice growth cycle is increasing so that more rice could be harvested. Although advanced machinery and new technology can help in farming process, farming is generally perceived as a healthy outdoor occupation and self-farming is preferred. They are often exposed and confronted with many occupational health and risk factors including ergonomics problem such as musculoskeletal disorders, lower back pain, muscle fatigue etc.[3-6].

The important problem is about musculoskeletal systems. During farmers work in the field they have to work at an uncomfortable posture for long time [7], repetitive motions, and awkward working posture, Even they have farming machined to supply or they have new technologies that can develop their farm. Frequently due to farm work such as work where the wrist is immoderately bent forward or tilted back, work squatting for long times, work with heavy material, work with hand and wrist repeatedly, or work with tilted or bended back. Previous study in SakonNakhon has found that 99.73% of the farmers had body pain from their occupation [8] while the 7-day prevalence of musculoskeletal pain among most farmers who were participants in Khon Kaen were lower back pain (56.91%), 28.62% in knee, 25.40% in hip pain and 25.04% in shoulder pain, respectively [9]. According to the health report from Phimai Hospital shows that there were 325 patients of musculoskeletal disorders in 2012 and 399 patients in 2013 [10].

There are many studies present document the prevalence of various musculoskeletal disorders in non-agricultural were similar to solid waste conductor, factory workers, Thai traditional massage practitioners, an audio compact cassette plant's workers, etc. [11]. But studies in Musculoskeletal disorder in agricultural among farmers in Thailand are very few at present. The aims of this study are to investigate factors associated with musculoskeletal disorders among rice farmers and to presence the prevalence of musculoskeletal disorders among rice farmers.

MATERIALS AND METHODS

Participants were recruited from Northeast Thailand where has more than half of rice farming. The study area was Tanralorn Sub-District within Phimai District, NakhonRatchasima Province. A group of households was selected by single state cluster sampling. Then, a household of rice farmers was randomly chosen by simple random sampling. There were 290 complete participants'data collected between February and March 2014.

The questionnaire was developed based on literature review [12] and selected standardized questionnaire. It consists of 3 parts. First, socio-demographic characteristics (e.g. age, gender, BMI, marital status, education level) were measured by General Demographic Questionnaire. Then, work-related with MSDs and symptom of musculoskeletal disorders were measured by General Questionnaire and Nordic Musculoskeletal Questionnaires. The reliability of the Nordic Musculoskeletal Questionnaires, using a test-retest methodology, the validity and reliability of the questionnaire were 0.966 and 0.70 respectively. The body pain score of musculoskeletal symptoms was separated into 12 parts of human body (neck, left shoulder, right shoulder, upper back, left elbow, right elbow, lower back, left hand/wrist, right hand/wrist, hip, knee, and foots) and the intensity of pain was categorized into 4 level (0=not pain, 1=mild pain, 2=moderate pain, 3=severe pain) [13].

The covering letters to publicize the research were sent to the Tambon Health Promoting Hospital (Tarnlalord sub-district). Afterwards, the president of Tambon Health Promoting Hospital and health volunteers informed rice farmers about the research by giving the poster announcement to them. Sample size was calculated by Yamane's formula [14]. Although at least 274 households calculated by the formula were needed, there were 290 households from Tarnlalord sub-district agreed to participate in the study. Data were collected by face to face interview from the questionnaire which was read aloud to each subject. After the interview, a pamphlet about musculoskeletal disorders was given to all participants after they had been interviewed.

Data were analyzed by using license SPSS statistics for windows. Descriptive statistics were used. Before finding associations, the total body pain score was separated into 2 groups; group 1=total body pain score less than 15.90 (average mean pain score) and group 2 = total body pain score higher than 15.9 (average mean pain score). In statistical analysis, a Chi-Square test is used to find association between 2 groups of factors (individual factors, work-related factors) and total body pain score of MSDs. Odds ratios (ORs) with 95% confidence intervals (CIs) were reported. The research protocol was approved by the Ethics Review Committee for Research Involving Human Research Subjects, Health Science Group, Chulalongkorn University COA No. 054/2557.

RESULTS

Two hundred ninety cases were obtained from Tarnlalord Sub-district, Phimai district
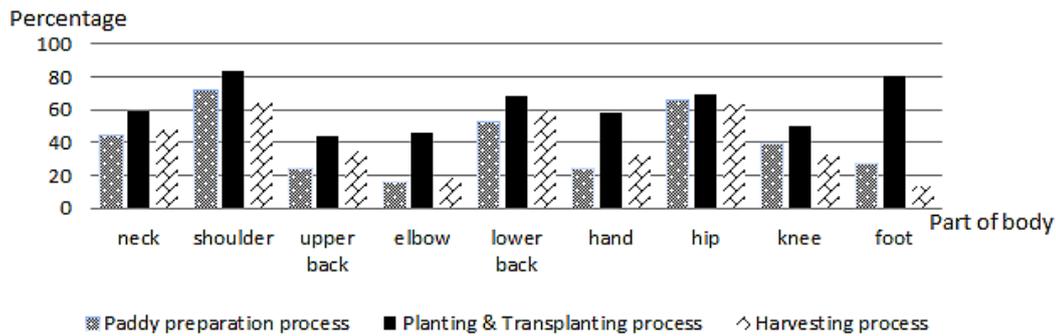
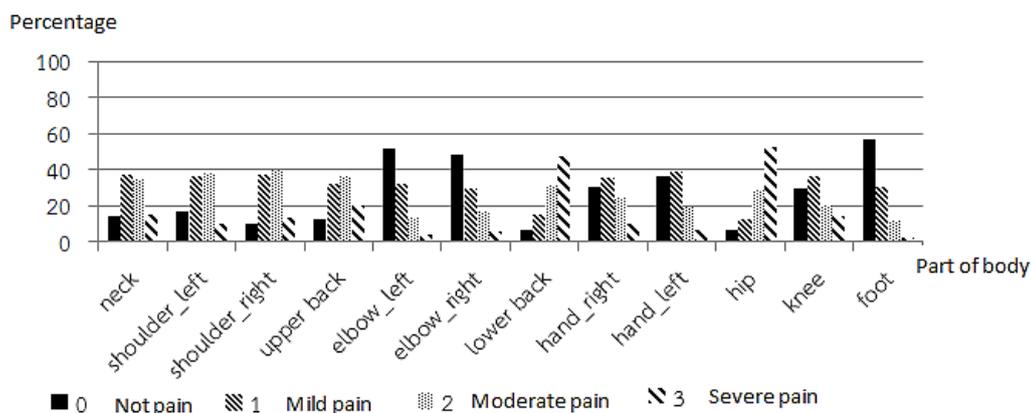**Figure 1** Musculoskeletal symptom in each process

Figure 2 The body pain score of musculoskeletal symptoms

NakornRatchasima Province in this study. Most of them aged between 46 to 55 years old (39.0%). The percentage of male (29.7) was slightly lower than female (36.2). The highest one for BMI group was the normal group (60.0%), followed by overweight, obesity and underweight group. Most respondents (92.0%) were married. In term of education, the largest proportion was primary school, where as university level was the least. It is able to find out that all respondents have more than a year of experience. Almost 30 % of the participants have been working between 21 to 30 years.

There are 3 major processes of growing rice: paddy preparation, planting and transplanting process and harvesting process. The farmers in this study have been growing rice by themselves. Most of them growing rice once a year (71.4%), others were growing rice twice (28.3%) and three times (0.3%) a year. Seventy point three percent had individual land owner, rent and others had 22.4%, 7.2%, respectively. In paddy preparation process, most of them had done by wheel tractor walking along (78.3%). For the period of paddy preparation process, 75% of them reported to be able to complete within 2 days. In planting process, most of the participants were done by themselves (93.1%) and mostly done within 2

days (82.1%). In transplanting process, almost all had done by themselves (99.7%) and were able to complete in less than 5 days (34.5%). The combination of machine and sickle was the most reported method in harvesting process (51.4%). Most of rice farmers reported that they were able to finish within a week.

In the questionnaire, the intensity of musculoskeletal symptoms was categorized into 9 parts (neck, shoulder, upper back, elbow, lower back, hand, hip, knee, and foot). In the paddy preparation process, shoulder pain was the most reported cases, followed by hip, lower back, neck and so forth. Shoulder pain was also being the most reported case in planting and transplanting process (83.4%), where upper back pain reported to be the least. In addition; shoulder pain was once again being the number in harvesting process, which was up to 65%. Details presented in Figure 1.

The percentage of each body pain score of musculoskeletal symptoms in all of growing rice process in the study was presented in Figure 2.

Data on 290 participants of rice farmers were used to analyze the association between 2 groups of factors and total of body pain score by Odds Ratio (OR). The results were identified six factors

Table 1 The associated factors and total body pain score of MSDs (n=290)

Variables	n	Group 1** n (%)	Group 2*** n (%)	OR	95%CI	p-value
Individual factors						
Age (years)						
25 to 44	101	53(18.3)	48(16.6)	1	0.815-2.146	0.257
45 to 59	189	86(29.7)	103(35.5)	1.322		
Gender						
Male	135	85(29.3)	50(17.2)	1	1.966-5.143	<0.001*
Female	155	54(18.6)	101(34.8)	3.180		
BMI						
Abnormal group	116	47(16.2)	69(23.8)	1	0.377-0.977	0.039*
Normal group	174	92(31.7)	82(28.3)	0.607		
Education Level						
Below high school	216	95(32.8)	121(41.7)	1	0.313-0.915	0.021*
Beyond primary school	74	44(15.2)	30(10.3)	0.535		
Smoking status						
Smoke	47	30(10.3)	17(5.9)	1	1.137-4.141	0.017*
Non-Smoke	243	109(37.6)	134(46.2)	2.169		
Exercise						
Non-exercise	104	54(18.6)	50(17.2)	1	0.793-2.076	0.309
Exercise	186	85(29.3)	101(34.8)	1.283		
Farm experience (years)						
1 to 25	124	73(25.2)	51(17.6)	1	1.350-3.483	0.001*
26 to 50	166	66(22.8)	100(34.5)	2.169		
Underlying disease						
Do not have + do not know	202	107(36.9)	95(32.8)	1	1.178-3.298	0.009*
Have	88	32(11.0)	56(19.3)	1.971		
Work-related factors						
Extra work						
Not-do	60	22(7.6)	38(13.1)	1	0.311-1.004	0.05
Do	230	117(40.3)	113(39.0)	0.559		
Work load (Farm size=sqm.)						
1,600 to 16,000	172	80(27.6)	92(31.7)	1	0.544-1.390	0.559
More than 16,000	118	59(20.3)	59(20.3)	0.870		
Prolonged working hour						
1 to 5	229	105(36.2)	124(42.8)	1	0.381-1.187	0.170
6 to 10	61	34(11.7)	27(9.3)	0.672		
Time duration break (minute)						
0 to 30	86	90(31.0)	101(34.8)	1	0.559-1.478	0.701
More than 30	105	49(16.9)	50(17.2)	0.909		

* *Significant at 0.05 probability level using Chi-square test*
**Group 1=total body pain score less than average mean pain score
***Group 2 = total body pain score higher than average mean pain score

significantly associated with musculoskeletal disorders. Risk factors of musculoskeletal disorders are female (OR=3.180, 95% CI=1.966-5.143), non-smoker group (OR=2.169, 95% CI=1.137-4.141), over 25 years of farming experience (OR=2.169, 95% CI=1.350-3.483), and having an underlying disease (OR=2.013, 95% CI=1.202-3.372). Protective factors of musculoskeletal disorders are normal BMI group (OR=0.607, 95% CI=0.377-0.977) and education beyond primary school (OR=0.535, 95% CI=0.313-0.915). Other six factors were not significantly associated with musculoskeletal disorders: age (OR=1.322, 95% CI=0.815-2.146), exercise (OR=1.283, 95% CI=0.793-2.076), extra work (OR=0.559, 95% CI=0.311-1.004), work load (OR=0.870, 95% CI=0.544-1.390), prolonged working hour (OR=0.672, 95% CI=0.381-1.187) and time duration break (OR=0.909, 95% CI=0.559-1.478). The details were presented in Table 1.

DISCUSSION

Prevalence of musculoskeletal disorders in process of rice growing

Presented study for the farmers who were mainly involved in paddy preparation process reported overall high frequencies mainly in shoulder pain (71.7%), hip pain (65.5%) and lower back pain (52.4%), respectively. Farmers who growing rice, they need to use plough for preparing land. This involves repetitive hand or shoulder and extension movement done by farmer. And for farmers who use machine ether sitting machine or walking along with, they exposure to vibration by working with machine. Most of rice farmers in this study were done by wheel tractor walking along (78.3%). Vibration from using machine are risk factor for development of low back pain [15] and may also be factor in hip and shoulder pain. One reason for lower back pain, farmer usually sit with their neck and back in rotated posture when driving on sitting machine type, allowing them to look at the implement they are plowing the field. Exposure to whole-body vibration in combination with the twisted posture and prolonged sitting was responsible for the increased risk of low back pain in farmers [15]. For transplanting and planting process reported overall high frequencies mainly in shoulder pain, neck pain, lower back pain, hip pain, knee pain and foot pain, respectively. The possible reason of pain is pretty evident from using multitask of body. For example rice farmers who do transplanting process, they need to bend the knee, back forward bending. This involves treading a soil along with machine. Moreover these rice farmers also need to carry heavy rice spouts ether machine or basket. These all could explain the involvement of shoulder, neck, lower back, hip, knee and foot pain of rice farmers in this process. The participants were planting and transplanting by themselves, 93.1% and 82.1%, respectively. The present study showed high prevalence in shoulder pain (83.4%) when compared with others parts of body. In recent decades, Thailand has been technical development in harvesting process resulting in new production and devices e.g. machine for automatic harvesting, automatic milling rice. These technical developments on harvesting process of rice farm in recent decades should mean that rice farmers are exposed to lower levels of physical workload an expected decrease in the prevalence of MSDs. However, high frequencies of reported MSDs still seem to be associated with rice farmer. Study in SakonNakorn Province reported that 99.73% of rice farmers had body pain from their occupation and harvest process statistically related to body pain [8]. In this study rice farmers mostly had done by both with machine and manual (51.4%). They use machine first and then follow by manual with sickle. Rice farmers mostly reported to have pain in shoulder (64.8%) followed by hip (63.4%), and lower back (59.3%). Using sickle in harvesting process needs to bend the knee, holding sickle and forward bending for most of the time in the fields. These postures put excessive pressure on shoulder and back. In addition, most of rice farmers need to carry harvested rice and put in a sack. This assuming of prolonged multitasks posture could possibly explain the development of shoulder, lower back and hip pain of rice farmers in harvesting process.

In overall, prevalence of symptom of MSDs was higher in planting & transplanting process. Prevalence among rice farmers in neck (59.0%), shoulder (83.4%), upper back (43.8%), elbow (45.9%), lower back (68.6%), hand (58.3%), hip (69.0%), knee (50.0%), and foot (80.3%). Similarly, the study of Ergonomics problems and risk factor of farmers in Sriwichai sub-district of Sakon Nakhon province [8] shown prevalence of pain in planting & transplanting process approximately 99.72%.

Association between factors and the total body pain score of MSDs

In several study, age were found significant with MSDs [16, 17]. In this study, the result showed no significant association between total body pain score of MSDs and age. The result presented group of older age was more likely to develop total body pain score of MSDs than group of younger. MSDs increase in older group of age between 46 to 59 years. This result consists with the result from study among farmers. Study from Lowa farmers had showed the result aged between 45-59 years more likely to develop MSDs than younger [16]. The result presented female rice farmers were more likely to develop total body pain score of MSDs than male. This finding was consistent with finding reported among rice farmers in Pitsanulok, Thailand [18]. The higher prevalence rate might be due to a weaker physical structure of females. Besides that, it is also possible that women had to perform house works on a regular basis other than farming activities. Those factors mentioned above could possibility explain the higher total body pain score of MSDs in female farmers. A group of abnormal BMI more likely to have high total body pain score than normal BMI

group. According to proportion of abnormal BMI group in this study, the large proportions were overweight and obesity. Consistent with study from Netherlands, they showed the relation between BMI and MSDs in working population that for high BMI can increase prevalence of MSDs (overweight: OR=1.13, 95% CI=1.08-1.19 and obesity: OR=1.28, 95%CI=1.19-1.39). For education level, the result showed significant association between total body pain score of MSDs and education level (P-value=0.021). The Odd of high education group (beyond primary school) is 0.535 lower than in low education (below high school) (95%CI=0.313-0.915). This result consist with Dionne 2001 found an association between formal education and back pain, reported that 16 out of 19 studies showed an association between low levels of formal education and frequency of back pain [19]. Significant association between total body pain score of MSDs and smoking status (P-value=0.017). The Odd of non-smoke group is 2.169 higher than in smoker group (95%CI=1.137-4.141). This result was contrast with study of low back pain among farmers in Sweden [20]. From that study, they showed farmers who are smoked association with low back pain. Difference from this results may be due to the prevalence of smoker because in all of 47 smoker in this study are male. And the result of association between gender and total body pain score of MSDs showed increase in female group. This could be explained association between smoking status and symptoms of MSDs in presented study. Exercise has been widely accepted as effective in the treatment and prevention of musculoskeletal disorders [21]. Although exercise has a beneficial on MSDs, study in 2009 reported that performing intensive sporting activities were at an increased risk of chronic MSDs [22]. The result showed no statistically significant relationship was found between these factors and total body pain score of MSDs. The total pain score of MSDs in exercise group higher than non-exercise group. The reason may due to time and activities for exercise of rice farmers in this study. Even the proportion of who do exercise is more than who not do exercise but most of them do an exercise less than 1 to 2 times per week, only 12.4% of them do exercise in every day. This reason could be explain why a group of exercise more likely to have high total body pain score of MSDs. Farming experience was associated with total body pain score. The reason could be explained due to background of rice farmers in this study. Most of them stared occupation in farming as a child or youngster. They expose hazard from process of rice farming in long

periods of time and the prevalence of pain continuous to rise with age. The study of risk management of occupational health and safety in rice farming farmers reported various hazard including ergonomics come from process of rice growing [4]. Another study reported the risk for persistent neck and shoulder complaints increased with years of working [23]. In this study, no statistically significant relationship was found between work load and total body pain score of MSDs. The Odd high workload is 0.870 lower than low workload (95%CI=0.544-1.390). This result contrast with study in 2006, study reported work load was a significant factor with body pain at p-vale=0.021, the OR for high workload was 1.62 compared to low workload [24]. The reason could be explained may be due to number of rice farmer in high workload group, which this group was equal numbers of rice farmers in both group of total body pain score. The association between symptoms of MSDs and prolonged working hour is of interest. Our study showing increased total body pain score of MSDs in the group of rice farmers who are prolonged working hour between 1 to 5 hours. This is contrast to another study, the study of musculoskeletal disorders among Thai women construction-related work has showed the Odd ratio was 7.6 times more likely to develop MSDs in prolonged working hours for 4 hours or more group than those without [11]. The reason that could be explain, mostly rice farmers in this study work more than 6 hour per day even they mostly prolonged work not so long. This reason can assume that rice farmer still work hard in a day and can possibly to develop symptom of MSDs.

LIMITATIONS

The rice farmer were asked to rate their pain while rowing rice that the high prevalence of total body pain score may cause from subjective sign and symptom reported because rice farmers were asked to rate their body pain score. It was difficult to exclude pain from others work or hobbies and the recall bias of musculoskeletal disorders in each process of farming due to limitation of time rice farmer may answer in current symptoms.

CONCLUSION

The high prevalence of musculoskeletal disorders was still not uncommon among rice farmers. From presented study, all process of rice growing were affected to musculoskeletal system by several related factors. Musculoskeletal disorders mainly reports factors that associated were gender, BMI, education level, smoking status,

farm experience, and underlying disease. This requires improved farming management systems in process of rice growing and including education or recommendation to decrease the pain of the musculoskeletal system.

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REFERENCES

1. National Statistical Office. Statistic of argricultural workers 2012. [Cited October 2013]. Available from: http://web.nso.go.th/eng/en/agriculture/agr_census2003.htm

2. Office of Agricultural Economics. Agricultural Economics 2012. [Cited 10 Oct 2013]. Available from: http://www.oae.go.th/main.php?filename=index_EN

3. Gupta G, Tarique. Prevalence of musculoskeletal disorders in farmers of Kanpur-Rural, India. J Community Med Health Educ. 2013; 3: 249. doi: 10.4172/2161-0711.1000249

4. Yonelia A, Kurniawidjaja LM. Risk management of occupational health and safety in ricefarmers in Ngrendeng, east java in 2012. International Journal on Advanced Science, Engineering and Information Technology. 2013; 3(1): 28-32.

5. Xiang H, Stallones L, Keefe TJ. Back pain and agricultural work among farmers: an analysis of the Colorado Farm Family Health and Hazard Surveillance Survey. Am J Ind Med. 1999 Mar; 35(3): 310-6.

6. Anton D, Rosecrance J, Merlino L, Cook T. Prevalence of musculoskeletal symptoms and carpal tunnel syndrome among dental hygienists. Am J Ind Med. 2002 Sep; 42(3): 248-57.

7. Sprince NL, Zwerling C, Lynch CF, Whitten PS, Thu K, Logsden-Sackett N, et al. Risk factors for agricultural injury: a case-control analysis of Iowa farmers in the Agricultural Health Study. J Agric Saf Health. 2003 Feb; 9(1): 5-18.

8. Pengseesang MS. Ergonomic problems and risk factors of farmers in Sriwichai Subdistric Wanon Niwat district of Sakon Nakhon province. [S.l: S.n]; 2012.

9. Puntumetakul R, Siriratratiwat W, Boonprakob Y, Eungpinichpong W, Puntumetakul M. Prevalence of musculoskeletal disorders in farmers: Case study in Sila, Muang Khon Kaen, Khon Kaen province. Journal of Medical Technology and Physical Therapy. 2011; 23(3): 297-303.

10. Phimai Hospital. Patients of musculoskeletal disorders. [Phimai, Nakhonrattachasimm: Hospital]; 2013.

11. Hanklang S, Kaewboonchoo O, Silpasuwan P, Mungarndee SS. Musculoskeletal disorders among Thai women in construction-related work. Asia Pac J Public Health. 2014 Mar; 26(2): 196-202.

12. Harutaichun P, Somrongthong R, Pensri P, Neeser KJ. Quality of life and factors associated with foot pain in pre-retirement aged at Chulalongkorn University, Thailand. J Health Res. 2013; 27(5); 325-32.

13. Crawford JO. The nordic musculoskeletal questionnaire. Occupational Medicine. 2007; 57(4): 300-1.

14. Taro Y. Statistics: an introductory analysis. New York: Harper and Row; 1967.

15. Boshuizen HC, Bongers PM, Hulshof CT. Self-reported back pain in tractor drivers exposed to whole-body vibration. Int Arch Occup Environ Health. 1990; 62(2): 109-15.

16. Park H, Sprince NL, Whitten PS, Burmeister LF, Zwerling C. Risk factors for back pain among male farmers: analysis of Iowa Farm Family Health and Hazard Surveillance Study. Am J Ind Med. 2001 Dec; 40(6): 646-54.

17. Heiden B, Weigl M, Angerer P, Muller A. Association of age and physical job demands with musculoskeletal disorders in nurses. Appl Ergon. 2013 Jul; 44(4): 652-8.

18. 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.

19. Dionne CE, Von Korff M, Koepsell TD, Deyo RA, Barlow WE, Checkoway H. Formal education and back pain: a review. J Epidemiol Community Health. 2001 Jul; 55(7): 455-68.

20. Holmberg S, Thelin A, Stiernstrom EL, Svardsudd K. Low back pain comorbidity among male farmers and rural referents: a population-based study. Ann Agric Environ Med. 2005; 12(2): 261-8.

21. Henchoz Y, Kai-Lik So A. Exercise and nonspecific low back pain: a literature review. Joint Bone Spine. 2008 Oct; 75(5): 533-9.

22. Heneweer H, Vanhees L, Picavet HS. Physical activity and low back pain: a U-shaped relation? Pain. 2009 May; 143(1-2): 21-5.

23. Andersen JH, Gaardboe O. Prevalence of persistent neck and upper limb pain in a historical cohort of sewing machine operators. Am J Ind Med. 1993 Dec; 24(6): 677-87.

24. Hartman E, Oude Vrielink HH, Huirne RB, Metz JH. Risk factors for sick leave due to musculoskeletal disorders among self-employed Dutch farmers: a case-control study. Am J Ind Med. 2006 Mar; 49(3): 204-14.

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