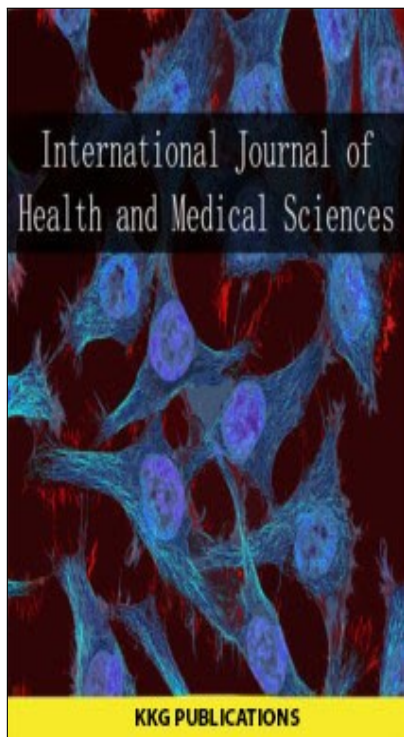


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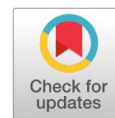


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PREVALENCE AND RISK FACTORS OF MUSCULOSKELETAL DISORDERS IN RUBBER TAPPERS: A CASE STUDY IN PHATTHALUNG PROVINCE, THAILAND

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Abstract. This cross-sectional study presents the prevalence of Musculoskeletal Disorders (MSDs) among rubber tappers in Paphayom District, Phatthalung Province, Thailand. A total of 250 rubber tappers participated in this study. A general questionnaire was used to collect demographic background data and physical work characteristics, while a modified Nordic Musculoskeletal Questionnaire was used to determine the prevalence of MSDs (within six months). Descriptive statistics were used to describe the general data and prevalence. Inferential statistics at 95% confidence interval analyzed the factors affecting to MSDs and Odds Ratio (OR). The results showed that the majority of participants were females (56.8%). The mean age of tappers was 42.1 ± 12.6 years. The average work experience and Body Mass Index (BMI) were 12.6 ± 8.3 years and 22.3 ± 3.5 , respectively. The prevalence of MSDs (in any body region) in the last 6 months was 36.40 (95% CI 30.42-42.69). The highest prevalence rates of MSDs were reported in the lower back, upper back, hip & thigh regions (30.4%, 6.8%, and 6.0%, respectively). Risk factors that significantly resulted in MSDs were the age of workers, work experience, and handedness behavior. The significant risk factors related to working conditions were plantation ground level, tapping light, handedness, grip tightness, standing posture, age of rubber tree, and tapping height. This study reveals that rubber tappers suffered from acute MSD (for the past 6 months) on the low back area. Various risk factors were found to be significant with MSD. Rubber tappers exposed to a combination of risk factors may have an increased risk of developing MSDs. Further study with a comprehensive strategy is essential to determine the need for appropriate intervention and health promotion for rubber tappers.

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INTRODUCTION

Rubber has been grown on plantations in many countries around the world. Especially in Asia, the countries with rubber plantation early are Thailand, Indonesia and Malaysia. In Thailand (2014), the total area for rubber plantation was 3.74 million hectare. It was distributed into each part of the country i.e. 63.09% in the south, 20.23% in the northeast, 11.43% in the east and central, and 3.74% in the north. Currently, Thailand is the highest rubber producer in the world [1]. Thailand had the first rank in global rubber output and production. It was reported that the natural rubber exports were 3.65 million tons, equivalent to 5,057 million USD [1]. The rubber production process is known as a labor intensive process. Many reports revealed that rubber tappers were continuously suffering from health problems [2], [3], [4], [5]. Before getting raw latex for rubber product manufacturing, rubber tapping is the process by which field latex is collected from rubber tree where the circumference of the tree trunk reaches 50 cm. The current rubber tapping process is highly labor intensive. This process is manually done by rubber tappers. Since the rubber tapping

is a repetitive work and unable to be replaced by machine, it is regarded as an occupational risk for MSDs [3]. A community-based investigation in upper south of Thailand done by [3] showed that over half (52.9%) of the rubber tappers had low back pain during the previous 3 months. The pains in other parts of body such as legs, neck, hands and wrists were also reported [2], [3], [5], [6], [7]. Risk factors related to MSDs such as load and postures were found to have significant association with MSDs. However, the study of some risk factors related to physical work such as plantation ground level, number of trees tapped per day, tapping light etc. is limited. The aim of this study was to investigate the prevalence of MSDs and mentioned physical risk factors in order to recommend preventive care to reduce injuries in rubber tappers.

METHODOLOGY

This descriptive cross-sectional study was designed to investigate prevalence and risk factors of MSDs among rubber tappers in Phatthalung province, Thailand. The data were col-

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lected by face-to-face interview with structured questionnaire. The study was conducted from January 2013 until March 2014.

Subject

The population of rubber tappers in Paphayom district, Phatthalung province, Thailand the study was 660. The simple sampling method [8] was used for selecting of 250 rubber tappers. The primary inclusion criteria for selection were ability of communication in Thai language, more than 6 months' working experience, and voluntary participation. The exclusion criteria was a past record of MSDs or congenital disease, the resulting musculoskeletal disorders, such as gout, rheumatoid, renal or a history of accidents and disorders affecting the skeletal system and muscles. The samples had been clarified on the objective of the study and the right to terminate the participation immediately on demand.

Questionnaire

The structural questionnaire was applied from [3]. The questionnaire consisted of three parts:

- 1) demographic characteristics,
- 2) physical work characteristics and
- 3) MSDs data (from the past 6 months) modified from Nordic Musculoskeletal Disorder Questionnaire [9].

Data Processing and Analysis

The obtained data were analyzed using Minitab 16 software. Descriptive statistics were used to generate frequency, percentage, mean and Standard Deviation (SD) for demographic characteristics and physical work characteristics. The prevalence of MSDs for the last 6 months was also descriptively analyzed for each body part. Total of MSDs was quantified for each individual who had complaint of pain in at least one part of the body. The results were tested for association with MSDs using binary logistic regression and OR at statistical significance of 0.05.

RESULTS

Demographic Characteristics

The data showed that participants were slightly more females than males. Average age, work experience and sleep per day were 42.1 ± 12.7 yr, 12.62 ± 8.35 yr and 5.62 ± 0.93 hrs, respectively. In addition, monthly income was 5,001-10,000 baht and the majority of education level was secondary school. It was found that one-fourth of them were non-smokers and one-third was non-drinker. Majority of the participants were Buddhists (99.2%), whereas two-thirds of them had been experienced on rubber tapping for more than 7 years, as shown in Table 1.

TABLE 1
DEMOGRAPHIC CHARACTERISTICS (n = 250)

Characteristic	n (%)	Characteristic	n (%)
Age(mean \pm SD) yrs = 42.1 ± 12.7			
Work experience(mean \pm SD) yrs = 12.6 ± 8.35			
Work time per day (mean \pm SD) hr = 3.2 ± 0.95			
Sleep per day(mean \pm SD) hr = 5.6 ± 0.93			
BMI (mean \pm SD) = 22.3 ± 3.54			
Gender		Exercise	
Male	108(43.2)	No	119(47.6)
Female	142(56.8)	Yes	131(52.4)
Educational level		Work experience	
Primary school	104(41.6)	≤ 7 yrs	80(32.0)
Secondary school	110(44.0)	>7 yrs	170(68.0)
Diploma	22(8.8)	Smoking	
Bachelor's degree or higher	14(5.6)	No	185(74.0)
Religion		Yes	65(26.0)
Buddha	248(99.2)	Drinking	
Islam	2(0.8)	No	174(69.6)
Ages		Yes	76(30.4)
≤ 27 yrs	34(13.6)		
>27 yrs	216(86.4)		

Physical Work Characteristics

The survey found that the most plantation ground level was flat (88.8%). The tapping height was normally at 51-100

cm (knee-waist). In addition, most working time was between 1 and 7 am with average breaking time of 15 min (max 30, min 5), as shown in Table 2.

TABLE 2
PHYSICAL WORK CHARACTERISTICS (n = 250)

Characteristics	n (%)	Characteristics	n (%)
Plantation ground level		Trees tapped per day	
Flat	222(88.8)	≤ 500	131(52.4)
Slope	28(11.2)	>500	119(47.6)
Tapping light		Handedness	
Sufficient	231(92.4)	Right	223(89.2)
Insufficient	19(7.6)	Left	27(10.8)
Break time		Grip tightness	
Yes	159(63.6)	Good fit	93(37.2)
No	91(36.4)	Tight	157(62.8)
Standing posture		Ages of trees	
Balance	211(84.4)	≤ 15 yrs	123(49.2)
Not balance	34(15.6)	>15 yrs	127(50.8)
Tapping height			
>100 cm	36(14.4)		
≤100 cm	214(85.6)		

The Prevalence of MSDs

The sixth month prevalence of MSDs in body regions of the participants was 36.40% (95% CI = 30.42-42.69). The

highest prevalence were of lower back pain, upper back pain, hip/thigh pain, shoulder pain and hand/wrist pain in percentage of 30.4, 6.8, 6.0, 5.2 and 4.8 respectively, as shown in Table 3.

TABLE 3
THE PREVALENCE OF MSDS IN BODY REGIONS

No.	Body Regions	Prevalence (%)	95% CI
1	Lower back	76(30.40)	(24.76-36.51)
2	Upper back	17(6.80)	(4.01-10.66)
3	Hip/ Thigh	15(6.00)	(3.39-9.70)
4	Shoulder	13(5.20)	(2.79-8.72)
5	Hand /wrist	12(4.80)	(2.50-8.23)
6	Upper arm	11(4.40)	(2.21-7.73)
7	Foot	10(4.00)	(1.93-7.23)
8	Lower arm	6(2.40)	(0.88-5.15)
9	Calves	6(2.40)	(0.88-5.15)
10	Neck	5(2.00)	(0.65-4.60)
11	Knee	3(1.20)	(0.24-3.46)
12	Elbow	2(0.80)	(0.09-2.85)

TABLE 4
THE MSDS AND ASSOCIATED FACTORS BY BINARY LOGISTIC REGRESSION (n = 250)

Factors	MSDs No.(%)		OR	95% CI	p
	Pain	No Pain			
1.Age (yr)					
≤ 27	7	27	2.45	1.02, 5.89	0.032
>27	84	132			
2. Work experience (yr)					
≤ 7	22	58	1.80	1.01, 3.21	0.042
>7	69	101			
3.Plantation ground level					
Flat	76	146	2.22	1.00 , 4.90	0.049
Slope	15	13			
4.Tapping light					
Sufficient	78	153	4.25	1.56 , 11.61	0.003
Insufficient	13	6			
5. Handedness					
Right	71	152	6.11	2.47, 15.13	0.000
Left	20	7			
6.Grip tightness					
Good fit	23	70	2.32	1.31-4.09	0.003
Tight	68	89			
7. Standing posture					
Balance	69	142	2.66	1.33 , 5.34	0.006
Not balance	22	12			
8. Age of trees (yr)					
≤15	36	87	1.85	1.09 , 3.21	0.021
>15	55	72			
9.Tapping height(cm)					
>100	7	29	2.67	1.12-6.38	0.017
≤ 100	84	130			

Statistic significant at $p < 0.05$

Factors Associated with Symptoms of MSDs

Binary logistic regression showed that the risk factors which were significant to the model were body age (OR = 2.45, 95% CI = 1.02-5.98), work experience (OR = 1.08, 95% CI = 1.01-3.21), plantation ground level (OR = 2.22, 95% CI = 1.00-4.90), tapping light (OR = 4.25, 95% CI = 1.56-11.61), handedness (OR = 6.11, 95% CI = 2.47-15.13), grip tightness (OR = 2.32, 95% CI = 1.31-4.09), standing posture (OR = 2.66, 95% CI = 1.33-5.34), age of trees (OR = 1.85, 95% CI = 1.09-3.21) and tapping height (OR = 2.67, 95% CI = 1.12-6.38) as shown in Table 4. Other selected factors such as exercise, smoking, drinking and break time were not significant as risk factors for MSDs.

DISCUSSION

Demographic and Physical Work Characteristics

This study showed that the rubber tappers were more females than males. About half of the participants had body ages between 30 and 49 years which was also consistent with finding reported by [3], [10], [11]. Nevertheless, these findings were inconsistent with a previous study from (49-58 yrs) [6] and (41.50 yrs) [4]. Moreover, the study found that the levels of education were secondary and primary school (90.5%). This also corresponds with previous finding of 86.4% for the same educational level which was reported by [12], [3] (85.6%) and [5] (59.1%). This could be explained that skill of rubber tapping should be trained in their own family. This is the reason which showed that most of rubber tappers were not necessary to graduate at higher level of education. The participants were smoking

where by 26%, since the participants were more women than men. It was different from [6], who reported that number of smokers was at 54.2%, due to all participants being men.

The average of working time per day was 3.2 hrs., this is corresponding finding with [6], who found that it is less than 5 hrs. per day, however it is different from [3] (6.2 hrs.).

The Prevalence of MSDs

This study investigated the prevalence of musculoskeletal disorders (MSDs) during the previous 6 months. The results from this study support previous findings that this problem is common in rubber tappers.

The most prevalence was of the lower back (30.40%), which corresponds to reported research [3], [5]. In contrast, [6] reported that the prevalence was highest in neck-pain among male rubber workers in FELDA settlement Malaysia, because the level of rubber tapping was over-head.

Leg pain (hip/thigh and foot) was 10% in the present study. Nevertheless, the findings from the study coincided with previous reports of 14.8% by [3], who investigated MSD problems among rubber tappers in Chumphon province, Thailand. It may be caused by the slope area which is often found in Chumphon more than Phatthalung province.

Factors Associated with Symptoms of MSDs

This study revealed that the demographic and physical work characteristic factors have significant association with MSDs.

In this study, rubber tappers with age more than 27 yrs. got more risk of MSDs, compared to younger rubber tappers. This finding was in contrast to [6] who showed that the young rubber workers in Malaysia were at greater risk than old rubber workers. In this study, working experience of more than 7 yrs. was reported as the risk factor associated with MSDs, compared to working experience of less than 7 yrs. In contrast, [12] reported that the rubber farmers with higher work-experience (average 20 yrs.) were no significant association with low back pain. They reported that the long work experience might screen individuals who could no longer tolerate the work requirement for this profession. In addition, this study found that the left

hand was risk factor for MSDs in rubber tappers. Because the conventional tapping knives (je-bong) were appropriate to the right hand. The explanation was common as other study, reported by [13], showed that the left-handers were more likely to report an injury requiring medical attention. Because the power tools required use of the right hand. The grip tightness for tapping was significant risk factor for MSDs. It was indicated that the tightened grip resulted in muscle exertion strain on fingers, hand and wrist. On the other hand, when gripping tapping knives, use a firm grip that allows participants to control the knives smoothly, but don't grip it too tight. This finding was consistent with a study conducted by [14] who reported that there is higher discomfort as there are increased required forces. According to comparison of this research with other researches, it found that prevalence rates are highest in the lower back [2], [3], [5] and is subordinate to the hands/wrists and upper back, respectively.

CONCLUSION

The results of this study showed that the prevalence of musculoskeletal disorders in any body region in the last 6 months of rubber tappers was comparatively lower than the 1-year MSDs prevalence found in other researches. However, the similar results of high prevalence in lower back were found in this study and others. Among risk factors associated with working conditions, plantation ground level, tapping light and tapping height were shown to have significant relationship with MSDs prevalence. Awkward standing posture at work and inappropriate grip (grip tightness) were also resulted in association with MSDs. This study recommended that detailed study should be carried out on biomechanics in order to comprehensively understand the mechanism of MSDs. Furthermore, the design of working tools such as lighting lamp and cutting tools should be taken into account. However, the effective remedy i.e. health promotion activities and guidelines should be introduced to reduce MSDs and minimize the risks. This may result in an increase of quality of life for rubber tappers.

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— This article does not have any appendix. —