

PREVALENCE OF AND RISK FACTORS FOR WORK-RELATED MUSCULOSKELETAL DISORDERS IN INFORMAL OCCUPATIONAL GROUPS IN CHA-OM SUB-DISTRICT, KHANGKOI DISTRICT, SARABURI PROVINCE, THAILAND

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ABSTRACT: The research was a cross-sectional study with the objectives of finding the prevalence of and the risk factors for work-related musculoskeletal disorders (WMSDs) in informal occupational groups with majority (over 90%) of bamboo-thread production group at Cha-om Sub-district, Khangkoi District, Saraburi Province, Thailand. The work process of the bamboo-thread production group includes raw material acquisition, preparation, production, drying-up of the finished products, packaging, and product uploading onto the truck, most of which tend to cause the micro-trauma, especially the work postures while producing. Through the funding by the Thai Health and Bann Nee Mee Suk Project (Happy Home Project) initiated by Chulalongkorn University, data collection was conducted by a purposive sampling of 52 volunteered-villagers who mostly produced bamboo-thread in 2011 with informed consent. The standardized NORDIC Musculoskeletal Questionnaire (NMQ) was employed for face-to-face interview. SPSS version 17 was used to analyze the measurement on socio-demographic data, exposures (current health status and work postures), including pain regions. Descriptive statistics and Chi-square test/Fisher's Exact test with p-value of <0.05 considered statistically significant were employed. The results revealed that 90.4% (n = 47) indicated their WMSDs annual prevalence (12-month before the interview) for the top three body areas: low back (72.3%, n = 34); shoulders (53.2%, n = 25), and knees (48.9%, n = 23). The past 7 days of WMSDs complaints were made by 45 respondents (86.5%) with the same order of low back (55.5%, n = 25); shoulders (42.2%, n = 19), and knees (33.3%, n = 15), respectively. Main factor related to WMSDs past 7-day prevalence was the respondents' educational background (p-value=0.041). However, no relation was found for annual WMSDs prevalence. As ergonomics intervention can reduce the risk of musculoskeletal injuries, based on the current WMSDs prevalence data, tailor-made exercise regimen intervention program was recommended.

Keywords: musculoskeletal disorders, informal occupational groups, bamboo-thread production, Thailand

INTRODUCTION

Work-related musculoskeletal disorders (WMSDs) remain the most expensive categories of workplace injuries [1]. The annual losses resulting from work-related diseases and injuries, in terms of compensation, lost productivity, insurance premiums, and medical expenses, amount to over 4 per cent of the total gross national product of all the countries in the world [2]. O' Neill [3] suggested that the task of ergonomics is to design a lifestyle support system that elicits the behavior required to reduce the severity of WMSDs problems. This is a particularly challenging task in the settings of

informal sectors (small workplaces) as they usually are inferior to those large-sized enterprises. The workers in these informal sectors are often forced to work in poor occupational safety and health environments [4].

Saraburi Province in central Thailand possesses more than 8,000 groups of micro-enterprise with various production lines [5]. The report made by the Provincial Bureau of Public Health at Khangkoi District revealed the percentage of musculoskeletal disorders-attributable sickness from 1999-2006 between 8.05-9.25 which was lower than, yet on an same increasing trend with, the national-level statistics provided by the Thai Health Profile Report 2005-2007 [6] with an estimated prevalence of musculoskeletal disorders among the Thai

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population at 11-16 percent from year 1991-2006. In particular, Cha-om Sub-district, Khangkoi District, occupies one type of informal sector - bamboo-thread production group - where the workers tend to have awkward work postures during the production time with high force in a repetitive manner for a long duration - the fundamental factors causing WMSDs among the workers [7]. In addition, other minor informal occupational groups in the area were weaving group and rug production group. In order to improve the sub-standard of work and to lessen work-related illness and injuries, the objectives of this pilot study were to find the prevalence of and the risk factors for WMSDs among the workers of informal occupational groups at Cha-om Sub-district before introducing meaningful intervention programs.

MATERIAL AND METHOD

This research was a cross-sectional study with data collection from a total of 52 workers in bamboo-thread production group (48 respondents); weaving group (2 respondents) and rug production group (2 respondents). They were from Moo/Village 3 (a total of 927 villagers); Moo 4 with 580 villagers; and Moo 5 with 987 villagers. On average, the villagers earn approximate only 1,000 U.S. dollars per year [8]. The purposive sampling was used on the basis of voluntariness of the participating respondents since earning one's own living is the first priority among the villagers who are on quite low socio-economic status. The inclusion criteria was to ensure respondents' exposures and required that the respondents live and work in the area for more than 6 months. Data collection was conducted in 2011 with informed consent (COA no. 020.1/53 dated May 10, 2011). The research tool employed the standardized NORDIC Musculoskeletal Questionnaire (NMQ) to evaluate musculoskeletal disorders before providing appropriate ergonomic intervention. NMQ is an internationally respected instrument designed to standardize studies on evaluation of musculoskeletal complaints [9]. The NMQ in Thai version was used with an approval from Saetan, et al. [10] who translated the NMQ into Thai version with reliability through kappa statistics between 0.66-1.00). The pre-test of 15 sets was conducted with similar occupational group in the adjacent sub-district of Tubkwang, Khangkoi District, with reliability of 0.66. There were four parts of the questionnaire items: first was the respondents' socio-demographic data (e.g., personal data, pregnancy situation [for female respondents]; use of right/left hand when working; housework;

debts, for instance); second part was the respondents' health status (e.g., respondents' chronic disease (s); consumption of alcoholic drinks and tobacco; history of accidents; sleeping hour period; exercise activities, for instance); third part was the data on respondents' work postures (e.g., length of working hours per week and per day; positions of sitting/standing/walking while working; repetitive movements; carrying weight/ pushing/pulling during work, for instance); and last part was the respondents' top three pain areas based on the past 12 months and the past 7 days period before the interview. These pains focused on 9 anatomical areas: 3 upper limb regions (shoulders, elbows, and wrists & hands); 3 lower limb regions (hips/thighs; knees; and feet/ankles); 3 on the torso (neck, upper neck, and low back) with categorization of dichotomous scale (yes, no) [11]. To increase the reliability of self-reporting data, during the interview, all respondents were asked to indicate the location of their indicated pain areas on a schematic drawing of the human body seen from behind. All interviews were face-to-face which took approximately 30 minutes to complete the questionnaire.

With the use of statistical software SPSS version 17 (licensed for Chulalongkorn University), descriptive statistics was used in terms of frequency and percentage for personal data, health status, work postures, and pain areas. Maximum and minimum values, mean, and standard deviation were used for household responsibility (taking care of the young/the elderly), health status (numbers of sleeping hour), work postures (length of weekly/daily working hour periods; sitting/standing/walking work positions; weight of manual handling). The test of association by Chi-square test/Fisher's Exact test was used with p-value of <0.05 considered statistically significant.

RESULTS

In regards to socio-demographic characteristics, the study found that 86.5% were female (n = 45) and 13.5 % male (n = 7). Most respondents aged 41-60 years (61.5%, n = 32), were right-handed (84.6%, n = 44), married (90.4%, n = 47), had children (91.1%, n = 41) and finished elementary school (57.7%, n = 30). Their current occupation is majorly in bamboo-thread production (92.3%, n = 48) while 3.8% (n=2) in weaving group and another 3.8% (n = 2) in rug production group. Of 31 respondents (59.6%) earned less than 1,667 US\$ per year (when 30 Thai baht is equivalent to 1 US\$) and 42.3% (n = 22) were not in debt (Table 1).

Table 1 Socio-demographic data of the respondents (n=52)

Items	Frequency	Percentage
<i>Gender</i>		
Male	7	13.5
Female	45	86.5
<i>Age (years)</i>		
Less than 20	2	3.8
21-40	10	19.2
41-60	32	61.5
61-80	8	15.4
<i>Skillful hand (s)</i>		
Right	44	84.6
Left	7	13.5
Both	1	1.9
<i>Marital status</i>		
Married	47	90.4
Single	1	1.9
Separate	4	7.7
<i>Having children (n=45)</i>		
No children	2	4.4
Now pregnant	2	4.4
Have children	41	91.1
<i>Educational background</i>		
No formal education	14	26.9
Elementary school	30	57.7
Secondary school	8	15.4
<i>Occupation</i>		
Bamboo-thread production (Sai-Mai-Tok in Thai)	48	92.3
Weaving	2	3.8
Rug production	2	3.8
<i>Annual income (Thai baht)</i>		
Less than 50,000 baht	31	59.6
50,001-100,000	18	34.6
100,001-300,000	3	5.8
<i>Debt (Thai baht)</i>		
No debt	22	42.3
Less than 50,000	14	26.9
50,001-100,000	6	11.5
100,001-300,000	8	15.4
300,001-500,000	1	1.9

For the exposures of health status, most respondents did not have any chronic disease (61.5%, n = 32). In case that they had one, hypertension was ranked first (73.3%, n = 11). Of 38.5% (n=20) drank alcohols occasionally while 42.3% (n =22) did not. The respondents of 61.5% (n =32) did not smoke cigarettes; 69.2% (n =36) never had any accidents but those who had one were in motorcycle crash for 87.5% (n=14). As high as 84.6% of the respondents did not exercise (n=44). On average, the respondents had 6.8 ± 2.1 hours of sleep.

With the exposures of physical workload, the respondents worked on average 6.2 ± 2.6 hours per day. When working, the respondents were mostly in the protracted sitting position (4.6 ± 2.1 hours) with interval walking and standing for 1.0 hour. The body parts that were static for long time were head

and neck (61.5%, n=32); torso (59.6%, n=31); legs and feet (25.0%, n=13). On the other hand, the body parts which were repetitively moved during work were arms (92.3%, n=48); shoulders (59.6%, n = 31); and fingers (21.1%, n = 11).

As for the WMSDs prevalence, 90.4% (n = 47) indicated their WMSDs annual prevalence with specified top three body areas: low back (72.3%, n = 34); shoulder (53.2%, n=25), and knees (48.9%, n =23). For the past 7 days of WMSDs complaints were made by 45 respondents (86.5%) with low back (55.5%, n =25); shoulders (42.2%, n =19), and knees (33.3%, n=15) respectively (Figure 1).

It is worth noting that potential causes of WMSDs complained was gradually collected from work (95.3%, n = 41). Main factor associated with WMSDs for 7-day prevalence at p-value of less

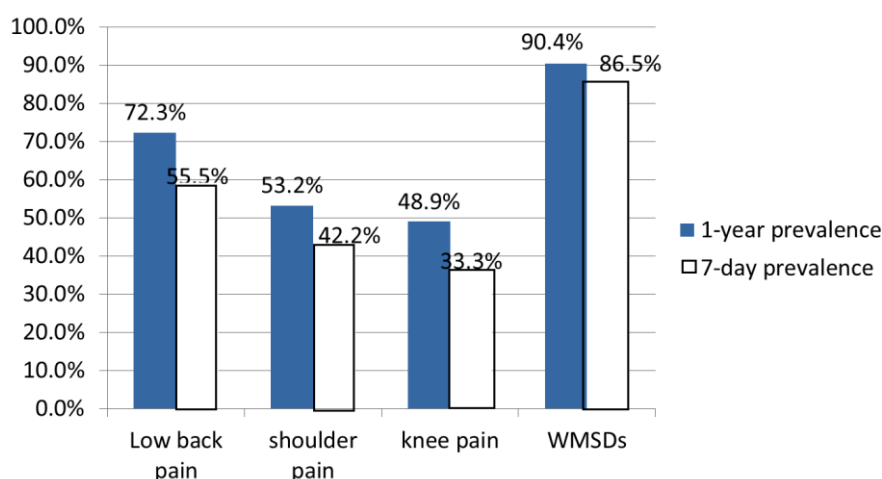


Figure 1 Comparison of annual and weekly WMSDs prevalence before the interview

Table 2 Relationship between independent variables and WMSDs prevalence of the respondents during the past 7 days

Education	Pain during the past 7 days		P-value (Fisher's exact test)
	No	Yes	
No formal education	0 (0.0)	14 (31.1)	0.041*
Elementary school	4 (57.1)	26 (57.6)	
Secondary school	3 (42.9)	5 (11.1)	
Total	7 (100.0)	45(100.0)	

*Significant level at <0.05

than 0.05 was educational level ($p=0.041$). There was no factor related to WMSDs for the annual prevalence (Table 2).

DISCUSSION

The demographic data of the respondents in the study indicated that the majority was female workers (86.5%) in the middle age to old age (61.5%) with marital status (90.4%) and worked for bamboo-thread production as the main group of occupation (92.3%). Since micro-enterprise in informal sector is hard to find in industrialized countries as stated by O'Neill [12] that though to design work stations in order to accommodate working postures may be regarded as unconventional in industrially advanced countries (IACs), such as the squatting which is so popular in South East Asia, it is an application of ergonomics specific to the industrially developing countries (IDCs). Consequently, it is difficult to find comparable literature review on bamboo-thread production in this aspect. Yet, two pieces of fact should be revealed: one, Thai middle age women tend to occupy with one steady job in addition to their housework, be it individually done or sharing with the small group among their colleagues in the village to earn some extra income; second, Thai occupational groups were locally born but with no

specific ministry advisory body unlike other groups which might be under the supervision of Interior Ministry or Labor and Welfare Ministry. This makes occupational group's safety and health issue more of the concern.

For respondents' chronic disease, hypertension was ranked first (73.3%, $n = 11$). Having hypertension in middle to old age among Thais is considered more and more common. Based on Thailand Health Profile Report 2005-2007, it was stated that percentage of causes of disability-adjusted life years (DALY) lost of Thai people by age group in 2004 for non-communicable diseases were 73.7% for the age bracket of 45-59 years and 85.8% for those in 60 years and over [13]. Non-communicable diseases, including hypertension, are on the steady rise due to unhealthy consumption behaviors (e.g., eating foods with high carbohydrate, sugar and fat content); physical inactivity and overweight [14]. From the first to the fourth health examination survey on Thai people (1999-2009) revealed that the prevalence of hypertension had a tendency to rise from 5.4% in 1991 to 11.0% in 1997 and to 21.4% in 2008-2009 [14]. As high as 84.6% of respondents did not exercise ($n=44$) which from extra interview, the respondents opined that the work of lifting and movement of body daily already meant exercising for them and they perceived no



Figure 2 Work posture of one respondent in bamboo-thread production group (Photo by Panada Taechasubamorn)

need for any other formal physical fitness. On average, the respondents had 6.8 ± 2.1 hours of sleep.

With the exposures of physical workload, the respondents worked on average 6.2 ± 2.6 hours per day which is considered a long daily working hours of physical demand. When working, the respondents were in the protracted sitting position (4.6 ± 2.1 hours) with interval walking and standing for only 1.0 hour. The body parts that were static for long time during work were head and neck (61.5%, $n=32$); torso (59.6%, $n=31$); legs and feet (25.0%, $n=13$), while those which were repetitively moved during work were arms (92.3%, $n=48$); shoulders (59.6%, $n=31$); and fingers (21.1%, $n=11$) (Figure 2).

As for the WMSDs prevalence, 90.4% ($n=47$) indicated their WMSDs annual prevalence with specified top three body areas: low back (72.3%, $n=34$); shoulders (53.2%, $n=25$), and knees (48.9%, $n=23$). For the past 7 days of WMSDs complaints were made by 45 respondents (86.5%) with low back (55.5%, $n=25$); shoulders (42.2%, $n=19$), and knees (33.3%, $n=15$). From the authors' observation, biomechanics causing these pains was mainly due to the respondents' sitting protractedly on the floor with their upper body part leaned forward, resulting in an increase of intradiscal pressure – a risk factor for low back pain. By nature, the workers require the movement of shoulders in a repetitive manner in a high speed with a long period of time, resulting in fatigues of muscles around shoulder areas. This can be worsened if there is a lack of adequate sleeping – a cause of “micro-trauma” to the muscles around

shoulder regions. One classic study by Nachemson et al. [15] indicated that the value of intradiscal pressure in the sitting position is higher than that in the sleeping and the standing positions. On the other hand, Riihimaki [16] stated that in addition to age and gender, possible risk factors for low back pain could be caused by protracted sitting. Intradiscal pressures may also increase in sitting position especially when the workers do not have anything to support their back. Lengthy static sitting possibly destroys the nutrition to intervertebral disc. Upon observation, there was no use of any measurement tool as David [17] stated that direct method such as measurement tool on body though yielding high reliability value yet may increase the expenditures, require high technical expert, consume time, and more important, measurement tool, such as sensors, needs to be put on the worker's body at all time to measure the factors related to the exposure at workplace which might cause not only discomfort of the workers but also the possible modification of their behaviors.

The study found that main factor related to WMSDs for the 7-day prevalence at p -value of less than 0.05 was educational level (0.041). There was no factor related to WMSDs for the annual prevalence. Klangsin [18] indicated that lower socioeconomic status workers were reported to have low back pain more frequently than those in upper socioeconomic status. On the other hand, Goubert et al. [19] reported that workers with low education may have misconceptions about low back pain and had poorer ability to solve their pains.

As far as there was no relationship for WMSDs annual prevalence with any independent variables,

one possible justification might be due to the fact that some of the respondents possessed recall bias in providing information regarding their exposures for the past 12-month period before the interview taking place.

Caple [20] stated that to be effective in practice, the ergonomist needs to be a good communicator and acts as an “agent of change” who can mentor others to develop simple, cost-effective interventions, especially at the workplace. Based on the prevalence data of the study, one can provide quite alternative suggestions/solutions: more breaks during working hours - an administrative approach, or frequent breaks to help prevent the muscle fatigues when the injury is related to prolonged sitting work posture. In addition, work organization such as improvement for the surroundings or tool change can also be introduced. Nevertheless, from the authors’ point of view, by applying these recommendations, there might be a lack of cooperation from the respondents as they are all used to work in their previous sitting position. It is a customary for the rural Thais to sit and work on the floor. As a result, the authors chose to initiate tailor-made exercise regimens instead. Teiger and Montreuil [21] described that the training of physical fitness activities by the ergonomists is one kind of ergonomics designs. Nachemson [15] cited by Linton, Hellsing, and Bergstroem [22] revealed that exercise and fitness are beneficial, in a biomedical sense, to maturation, strength, and healing of bones, tendons, and muscles. Exercise shows positive effect for a variety of pain conditions called exercise induced hypoalgesia (EIA) [23]. Exercise regimen is confirmed by Maher [24] who conducted a systematic review of workplace interventions to prevent low back pain and concluded that “At present, the only workplace intervention with demonstrated efficacy in the prevention of low back pain is exercise”.

LIMITATION OF STUDY

The standardized NORDIC Musculoskeletal Questionnaire (NMQ) was used as the study’s research tool. While the tool aims generally at evaluating the WMSDs complaints, it cannot, however, identify detailed symptom (s). The annual prevalence requires the respondents to recall their pain regions for the past 12 months before the interview which might relate to their recall bias. Nevertheless, all respondents were asked to indicate the location of their pain regions on a schematic drawing of the human body seen from behind to mitigate this limitation.

CONCLUSION

The work-related musculoskeletal disorders (WMSDs) have an impact on workers’ health and body comfort, group’s productivity and health expenditures. It is known that factors related to WMSDs include socio-demographic characteristics, health status, and work postures whose improvement helps improve the prevalence of WMSDs. Tailor-made exercise regimens are recommended to help improve physical fitness and reduce muscular imbalance. What is required is an investigation of detailed physical fitness for a proper design to be provided to the informal occupational groups where the effectiveness of the regimens should be included in future research.

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