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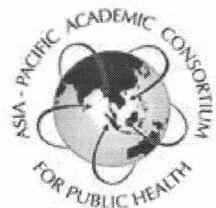
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What is This?

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Abstract

A cross-sectional study was conducted to determine the prevalence of musculoskeletal disorder symptoms and its risk factors among women rebar workers. A simple random sampling method was used and data were collected by face-to-face interview and ergonomic assessment from February to March 2011. A total of 272 women rebar workers with at least 6 months' job experience participated in this study. The findings revealed that 57.7% of workers reported musculoskeletal disorder symptoms with low back and shoulders as the most common body parts affected (46.0%). Multiple logistic regression analysis indicated 2 variables that are significantly associated with musculoskeletal disorders: prolonged working hours (adjusted odds ratio = 7.63; 95% confidence interval = 2.06-28.31) and awkward posture (adjusted odds ratio = 43.79; 95% confidence interval = 17.09-112.20). The high prevalence of musculoskeletal disorders among women rebar workers suggests that an appropriate ergonomic workstation design and ergonomic training for women rebar workers are necessary.

Keywords

musculoskeletal disorders, rebar, women worker, informal sector

Introduction

Musculoskeletal disorders (MSDs) are the most common health problems of people around the world.¹ They are the single largest category of work-related illness and the majority of cases of occupational disease.² In Thailand, the prevalence of MSDs places them in the top 5 of all patient visits for all outpatient health care providers under the Ministry of Public Health in 2005-2009.³ More than 26 000 MSD cases per year are claimed under the Thai Workmen's Compensation scheme.⁴ Work-related MSDs are associated with cumulative traumas, such as repetitive motion, awkward posture, excessive force, and prolonged sitting in the course of work.⁵ A high prevalence of MSDs has been reported among construction workers.^{6,7}

Reinforced bar bending (rebar) is a common job among construction workers. Rebar workers are at risk for MSDs caused by ergonomic factors, such as forceful pulling, continuous back

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bending, and heavy lifting.⁸ In Thailand, most rebar workers are in the informal workforce, that is, comprising primarily women who do piece-work at home. Studies on home-based workers in Thailand have shown that 90% of them report MSD symptoms.⁹⁻¹¹ Apart from being the most prevalent, MSDs have been identified as among the most serious hazards facing working women.¹² Women are exposed to these risks because of the types of jobs they do. Presently, in Thailand, the proportion of women engaged in rebar work is increasing.¹³ Therefore, this study aimed to investigate the prevalence of MSD symptoms and risk factors among female rebar workers.

Subjects and Methods

Recruitment of Subjects/Participants

This cross-sectional study was conducted among female workers using hand-operated rebar benders in a northeast province of Thailand. The study subjects were randomly selected. Sample size was estimated using the single proportion formula,¹⁴ with 95% confidence interval and 5.0% precision level. A sample size of 272 cases was calculated, based on a rate of 77% MSDs among informal sector workers of hand-operated rebar bender.¹³ Inclusion criteria for recruiting subjects were as follows: piece-work, female, age 18 years or older, resident in Nonsung district for at least 1 year, working with hand-operated rebar bender currently and for at least 6 months before participating in the study. Exclusion criterion was preexisting diagnosis of bone or muscle diseases. Data were collected from February to March 2011. Informed consent was obtained from all subjects. The research protocol was approved by the Ethics Committee of Faculty of Public Health, Mahidol University.

Instrumentation

The survey instruments were a self-administered questionnaire and an ergonomic assessment check list. The questionnaire comprised questions on the background characteristics of the subjects and working conditions, including age, education level, marital status, illness history, work experience, working hours per day, and MSD symptoms. The ergonomic check list was applied by 2 researchers on a one-to-one basis for each worker to assess the risk factors for MSDs, including repetitive movements and the posture of wrist, arm, neck, and trunk. Interrater reliability correlation coefficient between the 2 observers was .95.

Definition of Risk Factors

Based on the ergonomic assessment, subjects were classified into 3 groups as follows¹⁵: Work involving bending of neck or trunk, flexion of arms, or extension of wrists by more than 20° was classified as “awkward posture”; work involving repetitive movements 1000 times per day or more was classified as “repetitive task”; and work involving more than 8 hours per day was classified as “prolonged working hours.”

The rebar workers have to extend their wrist with a repetitive forceful pulling of the bender handle while flexing the other wrist to push a bar to the bender. Some workers have to bend their neck or trunk because of their work station level being lower than their elbow or because they have no back support.

Data Analysis

Data analysis was performed using SPSS for Windows Version 11.5.¹⁶ Descriptive statistics, such as frequencies, percentages, and means were used to describe the study variables.

Table 1. Characteristics and Working Conditions of Women Rebar Workers (n = 272).

Variable	Number (%)
Age (years)	
<40	46 (16.9)
≥40	226 (83.1)
Mean ± SD (range)	48.2 ± 9.7 (24-89)
Marital status	
Single	2 (0.7)
Married	249 (91.6)
Widowed/divorced	21 (7.7)
Educational level	
Elementary school and lower	232 (85.3)
Secondary school and higher	40 (14.7)
Illness	
No	191 (70.2)
Yes	102 (29.8)
Hypertension/diabetes mellitus	46 (45.1)
Hyperlipidemia	27 (26.5)
Others	29 (28.4)
Work experience (years)	
<5	133 (48.9)
≥5	139 (51.1)
Mean ± SD (range)	5.9 ± 3.7 (1-20)
Prolonged working hours	
No	134 (49.3)
Yes	138 (50.7)
Mean ± SD (range)	8.9 ± 1.8 (6-18)
Awkward posture	
No	103 (37.9)
Yes	169 (62.1)
Perceived high job demand	
No	107 (39.3)
Yes	165 (60.7)

Associations between independent variables and MSD were analyzed using χ^2 test and multiple logistic regression analysis.

Results

Of the 272 respondents, 83.1% were 40 years or older with the average age of 48.2 years. In all, 91.6% were married, 85.3% had education levels up to completion of elementary school, 70.2% did not have any chronic disease or other illness, and 48.9% had more than 5 years of work experience. All the subjects were categorized with repetitive tasks and wrist extension. A total of 62.0% were categorized with awkward position from bending neck or trunk or flexion arms whereas 50.7% had prolonged working hours. In addition, 60.7% perceived high job demand (Table 1).

The prevalence of MSDs among female workers in the past 12 months was 57.7%. The prevalence of shoulder and back pain were highest (46.0%), followed by wrist/hand (44.1%) and neck (40.1%). The prevalence of knee pain (23.9%) was lowest.

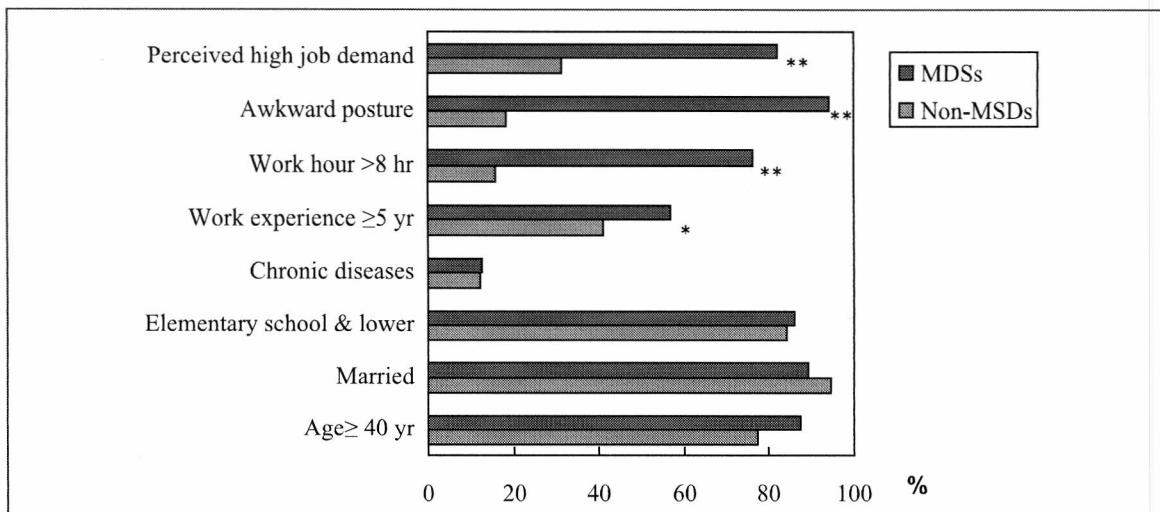


Figure 1. Distribution of characteristics and working conditions in MSDs (musculoskeletal disorders) and non-MSDs groups.

* $P < .05$; ** $P < .01$ by χ^2 test.

Table 2. Odds ratios for MSDs Among Women Rebar Workers by Multiple Logistic Regression Analysis ($n = 272$).

Variable	Adjusted ^a OR (95% CI)
Work experience (years)	
<5	1.00
≥5	1.79 (0.72-4.44)
Prolonged working hours	
No	1.00
Yes	7.63 (2.06-28.31)
Awkward posture	
No	1.00
Yes	43.79 (17.09-112.20)
Perceived high job demand	
No	1.00
Yes	1.16 (0.34-3.98)

Abbreviations: MSDs, musculoskeletal disorders; OR, odds ratio; 95% CI, 95% confidence interval.

^aAdjusted for age, marital status, educational level, and illness.

The distribution of characteristics and working conditions for the groups with MSDs and without MSDs (non-MSDs) are shown in Figure 1. The percentage with work experience longer than 5 years was significantly ($P < .05$) higher in the MSDs group than among non-MSDs. In terms of working conditions, prolonged working hours, awkward posture, and perceived high job demand were also significantly ($P < .01$) higher in the MSDs than in the non-MSDs group.

All variables in Table 2 were dichotomized. Univariate analysis revealed 4 variables to be statistically associated with MSDs—work experience, prolonged working hours, awkward posture, and perceived high job demand. In addition, variables with $P < .05$ in the univariate analysis were simultaneously analyzed by multiple logistic regression. The results showed that women rebar workers with prolonged working hours and awkward posture were more likely to develop

MSDs (work hours, age-adjusted odds ratio = 7.63, 95% confidence interval = 2.06-28.31; for awkward posture, age-adjusted odds ratio = 43.79, 95% confidence interval = 17.09-112.2).

Discussion

A high prevalence (57.7%) of MSDs was found among the women rebar workers in this study. The most frequent symptoms are shoulders and low back pain (46.0%), followed by wrist pain (44.1%). In this study, all women subjects were exposed to repetitive force and extension of wrists from pulling the rebar handle more than 1000 times a day; a type of job that causes MSDs. These findings are consistent with others findings indicating that repetitive loaded movements and poor wrist posture during work are risk factors for MSDs in upper limb disorders.^{17,18} The high prevalence of MSDs might affect the working life of women rebar workers through decreased productivity and increased cost of health care. A study estimated that 818 000 disability-adjusted life years were lost annually because of MSDs.¹⁹ Furthermore, Thailand's Social Security Office reported that the health care cost for MSDs is 38 820 baht per case per year.²⁰

The prevalence found in the present study, however, was slightly lower than in other studies reporting 76.7% prevalence of MSDs among home-based garment workers²¹ and 68.8% among fishing net weavers.²² This may be because of different work situations or tools used, which would expose the workers to different risks for MSDs. At the same time, most studies on the epidemiology of women's occupational health have focused primarily on hazardous exposures in the workplace.

Musculoskeletal disorders have been found by many researchers to be associated with various factors, both physical and psychosocial.^{23,24} With regards to rebar work, the physical risk factors identified may be categorized as follows: repetitive motion, awkward posture, forceful exertion, and vibration.²⁵ In the present study, the logistic regression analysis showed that the combination of awkward posture and prolonged daily working hours elevated the probability of MSDs among women rebar workers.

Women with awkward posture were 43.8 times more likely to develop MSDs than those with appropriate posture. The study revealed that the work station for rebar bending was poorly designed in the absence of inspections by safety control agencies. About 80% of the subjects work at a low work station table level below their elbow and 60% sit without back support. These working conditions cause the workers to bend their neck and trunk all the time as they carry out their job, which in turn causes MSDs to develop. The result is consistent with the findings of Choobineh et al²⁶ who reported that awkward posture was associated with MSDs among workers of an Iranian petrochemical industry and those reported by Gangopadhyay and Das²⁷ in potato cultivators. An association between low back disorders and work-related awkward posture was also reported in a review by the National Institute for Occupational Safety and Health.²⁸

Prolonged working hours is a recognized stressor contributing to increased risk in developing MSDs.²⁹ This study shows that women rebar workers with prolonged working hours were 7.6 times more likely to develop MSDs than those without. Specifically, about half of the workers worked more than 8 hours whereas 62.1% worked continuously for 4 hours or more. For home-based workers, income earnings depend on the number of work-pieces they produce, therefore, the rebar workers try to sit for long durations to perform their task for as long as they can. Limiting rest and recovery time may result in exacerbating MSDs. This result supports another study, which reported an association between MSD symptoms and sustained sitting postures.³⁰

This study has some limitations: (a) there may be reporting bias in the self-reported MSDs as subjects may be affected by recollection and recall; (b) the cross-sectional study design limits the ability to make valid causal interpretations of the findings; (c) since the risk of

MSDs are multiple, other factors, such as nonoccupational factors and psychosocial factors, cannot be excluded; and (d) the women rebar workers were selected from one district in a northeast region province, hence, the results may not be representative of other women rebar workers in Thailand.

In conclusion, the prevalence of MSDs among women workers was 57.7%. Reducing the prevalence and severity of work-related MSDs in the construction industry should be a primary goal for both governmental and private sectors, including but not limited to, employers, supervisors, contractors, and other concerning public health community. The results from this study identify areas that can be targeted by health personnel to reduce the MSDs. Workers with awkward posture and prolonged working hours were more likely to report MSDs. The wrists/hands and especially shoulders and low back were the sites where the maximum percentage of rebar workers frequently report pain, so targeting preventive measures in these areas should be emphasized. The results clearly point out the need for an appropriate ergonomic workstation design and ergonomic training for women rebar workers as preventive strategies.

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Declaration of Conflicting Interests

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