



Journal of Human, Environment, and Health Promotion

Journal homepage: www.zums.ac.ir/jhehp



Assessing Prevalence of Musculoskeletal Disorders in Women Workers in an Automobile Manufacturing Assembly Line

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ARTICLE INFO

Article history:

Received September 5, 2015

Accepted November 11, 2015

Article Type:

Original Article

DOI: [10.29252/jhehp.1.2.75](https://doi.org/10.29252/jhehp.1.2.75)

Keywords:

WMSDs

Women

Assembly Line

ABSTRACT

Background: Work-related musculoskeletal disorders (WMSDs) may involve all parts of the body, and have been a worldwide problem. Employed women are two to five times more likely to report such problems, and assembly lines suspected to induce more WMSDs because of high rate of repetitive motions.

Methods: The aim of this study to determine the prevalence of WMSDs in women workers of an automobile manufacturing assembly line. In this cross-sectional survey, 50 women workers in an automobile manufacturing assembly line were studied. Data was collected based on Nordic questionnaire. The statistical analysis was performed by the SPSS 11 software.

Results: The MSDs prevalence rate was 98%. The most reported complaint was related to the back (68%) and there was a significant relationship between prevalence and pain severity with age and working years. Moreover, the duration of feeling pain per day, and pain severity had a significant relationship with the capability of the person to continue working.

Conclusion: Workstations ergonomically improvement and employing men instead of women would be effective to reduce the problems.

1. Introduction

Work-related musculoskeletal disorders (WMSDs) is defined as an "injury" or disorder of the muscle, nerves, tendons,

joints, cartilage and spinal disk associated with exposure to risk factors in the workplace [1].

To cite: Arghami Sh, Kalantari R, Ahmadi Kionani E, Zanjirani Farahani A, Kamrani M. Assessing Prevalence of Musculoskeletal Disorders in Women Workers in an Automobile Manufacturing Assembly Line. *J Hum Environ Health Promot.* 2016; 1(2):75-9.

WMSDs, that can affect virtually all parts of the body [2], have been a worldwide issue. According to the HSE reports, were the most common occupational illnesses, affecting 1 million people per year [3]. These disorders account for approximately 38.1% of all occupational diseases and 70% of all compensated occupational diseases in Korea [4]. In addition, WMSDs have heavy economic costs due to loss of productivity, new worker training, and compensation [5].

These disorders tend to occur in women, young ones, and migrant workers [4]. Employed women are 2– 5 times more likely than men to report these problems. The employed women's exposure to risk factors at both work and family usually differ widely from employed men's. The biological differences between men and women and housekeeping duties, are also reasons for this differences [6]. Because of less muscle strength, anthropometric dimensions, and hormonal changes in women, they are more susceptible to WMSDs than men [7].

The prevailing explanations of women's excess health risk revolve around two basic models. The first model called "work and family demands" states that the differences between man and women in exposure, at work, and at home, to risk factors of MSDs explain the markedly higher prevalence in women than in men. The second model is called "vulnerability". This model claims that women may be prone to MSDs due to sex-linked biological factors such as hormones and physiology. Nowadays, many women are working in the community [6], and using them in intensive manual labor causes an increase of MSDs [7]. Women tend to be clustered into lower status jobs, often sedentary, repetitive work, and static load with less job control and less substantive complexity. These consist of key biomechanical and psychological risk factors for upper body MSDs [6].

Jobs that need repetitive movement have a higher prevalence of MSDs. In assembly industries, the risk of repetitive motions and consequently WMSDs is very high [8]. In automobile part assembly

industries, workers directly involved in the manufacturing process and physical activities such as bending and twisting of the neck and back, manual material handling, and repetitive arm and wrist motions are prevalent. These factors are major WMSDs contributors [9].

Because of greater susceptibility in women to WMSDs and the job properties, the aim of this study is to assess the prevalence of MSDs in women workers of automobile manufacturing assembly line.

2. Materials and Methods

This cross-sectional study was conducted on 50 women workers of an automobile part assembly company in summer 2014. The workers who had less than 6 month work experience or basic MSDs, were omitted from the study. In addition all the workers, only worked during the day shift. The data was collected using a questionnaire. The first part of the questionnaire was about demographic characteristics [age, height, body mass, body mass index (BMI), marriage status, education level, and work experience]. The main part of the questionnaire was a Cornell Standard Questionnaire [10] that is used for assessing the prevalence of WMSDs in a target population. The validity and reliability of this questionnaire in Persian working population have been considered [11]. The pain severity is measured in 3 scales (low, moderate, and high) and thus, it is possible to determine pain and the impact of MSDs on an individual's capacity to work with 3 types of answers (with no effect, low effect, and high effect). Furthermore, the pain frequency in the body parts is divided into 4 types: 1- 2 times/week, 3- 4 times/week, 1 time/day, and multiple times/week. This questionnaire is designed separately for both men and women in standing and sitting work positions and its effective toll for determining the frequency, severity, and impact of pain in 12 parts of the body (in the Persian version). There are 4 ways to calculate the scores of pain for each

person [10]. In this study, we used the simple numbering method.

For the statistical analysis of data, we used the SPSS22 software and the chi-squared test to analysis the relationship between variables.

3. Results

The mean age of the workers was 27.98 ± 3.72 years, indicating that the surveyed population was young. In addition, the mean and standard deviation for the weight and height in workers was 160.54 ± 5.54 and 59.62 ± 8.10 , respectively, and the average BMI was 23.12.

The mean and standard deviation of the work experience were 2.72 and 2.06 years, respectively, demonstrating low work experience in the surveyed population. A total of 80% of workers were single and 20% of them were married. The population education level was high, because 76% of the workers had collegiate education.

The prevalence of WMSDs among the surveyed women was 98%. On the other hand, 98% of workers had a pain at least in one part of their body. This prevalence rate had a significant relation with age ($P = 0.005$) and work experience ($P = 0.018$).

Table 1 shows the frequency of WMSD in each part of the workers body. According to the table, the highest frequency of WMSDs that was reported was in the back (68%). In addition, discomforts in neck, shoulders, legs, low back, and wrists had a prevalence of $\geq 50\%$.

In addition to the origin of the work (repetitive and with fast movement of hands), discomforts came through in the shoulders, ulna, and wrist. Furthermore, because of badly designed workstations that lead to wrong posture in the body parts, pain was revealed in other parts of the body.

The most reported pains were in the upper back (34 cases), neck (31 cases), and shoulders (30 cases). Table 2 declares the A significant association was found between age and pain severity ($P = 0.01$) reported pain severity by the workers in different parts of the body.

Table 1: Frequency of reported WMSDs.

Body part	Reported Pain Frequency (%)
Neck	31 (62%)
Shoulder	30 (60%)
Upper back	34 (68%)
Upper arm	12 (24%)
Lower back	25 (50%)
Forearm	22 (44%)
Wrist	25 (50%)
Hip/buttocks	17 (34%)
Thigh	8 (16%)
Knee	23 (46%)
Lower leg	19 (38%)
Leg	56 (52%)

and between work experience and pain severity ($P = 0.024$). Despite this, there were no significant relations between work experience and work ability ($P = 0.065$). However, statistical tests revealed that there exists a significant association between pain frequency and impact on working ability ($P < 0.001$). More over, the pain severity had a significant association with the impact on the working ability ($P < 0.001$). Table 3 shows the effect of pain on the worker's work ability. According to the table, pains in neck and wrists have greater impact on work ability. On the other hand, hip/buttock pain had the lowest effect on working ability (no effect in 59% of the cases).

4. Discussion and Conclusion

This survey shows that the prevalence of WMSDs in the considered population is too high (98%). In the young population and population with low work experience, this prevalence is very concerning. Most of the reported discomforts were in the back, neck, shoulders, and upper limbs, which is similar to the results of the study by Cote et al., (2001) [12]. The discomforts are due to the assembly work's origin that needs repetitive and high effort hand movement. Furthermore,

Table 2: Pain severity in different parts of body.

Body part	Low pain frequency reported	Moderate pain frequency reported	High pain frequency reported
Neck	3 (6%)	15 (30%)	13 (26%)
Shoulder	7 (14%)	15 (30%)	8 (16%)
Upper back	3 (6%)	19 (38%)	12 (24%)
Upper arm	2 (4%)	4 (8%)	7 (14%)
Lower back	3 (6%)	12 (24%)	10 (20%)
Forearm	4 (8%)	9 (18%)	9 (18%)
Wrist	5 (10%)	8 (16%)	12 (24%)
Hip/buttocks	9 (18%)	5 (10%)	3 (6%)
Thigh	3 (6%)	3 (6%)	2 (4%)
Knee	4 (8%)	10 (20%)	9 (18%)
Lower leg	3 (6%)	6 (12%)	10 (20%)
Leg	4 (8%)	7 (14%)	15 (30%)

Table 3: Interfere of pain on worker's work ability.

Body parts	No interfere on working ability	Low interfere on working ability	High interfere on working ability
Neck	3 (6%)	10 (20%)	18 (36%)
Shoulder	2 (4%)	14 (28%)	14 (28%)
Upper back	2 (4%)	18 (36%)	14 (28%)
Upper arm	1 (2%)	4 (8%)	8 (16%)
Lower back	4 (8%)	8 (16%)	13 (26%)
Forearm	4 (8%)	4 (8%)	14 (28%)
Wrist	3 (6%)	6 (12%)	16 (32%)
Hip/buttocks	10 (20%)	5 (10%)	2 (4%)
Thigh	3 (6%)	4 (8%)	1 (2%)
Knee	6 (12%)	8 (16%)	9 (18%)
Lower leg	5 (10%)	5 (10%)	9 (18%)
Leg	8 (16%)	6 (12%)	12 (24%)

to the assembly work's origin that needs repetitive and high effort hand movement. Furthermore, some factors such as awkward posture and badly designed work stations influence the rate of disorders. Reported pain and discomfort in the lower legs and legs are approximately the same. This shows that the chairs are not standard and appropriate.

In the factory, lesser number of men compared to women reported musculoskeletal discomforts. This result satisfies the results by Leite et al., (2007) that gender (being a woman) is another risk factor for suffering from MSDs. In addition, Nunes et al., argued that the 4 main risk factors include physical, psychosocial, personal, and interaction between the three items. In this classification, gender lies in the third category (personal). The study by Fororesh et al., (2012) on hairdressers shows that the vulnerability for MSDs is greater in

women than in men [14]. Even surveys on office workers, confirm the results [15]. Regarding to the multifactorial development of MSDs, women have more exposure than men to factors that cause these discomforts. In addition to working outside home, working women do home related tasks and allocate more time than men to children and helping other people. Consequently, women have less time to rest. This lack of rest, disturbs retrieval after demanding work and repetitive movements and injuries are most likely to occur as a result [6]. It has also been reported that utilizing women for intensive manual labor is the most common cause of higher rates of WMSDs [5].

Factors such as improper work stations, awkward postures, and selecting unfit workers for assembly tasks cause increased prevalence of WMSDs even in workers who have low work experience. Consequently, it is better that women be employed for jobs that do not need

extreme forces and have less risk factors if possible.

In attention to higher susceptibility of women to WMSDs, we can claim that women are not suitable for hard physical extreme jobs. Furthermore, using single women for these type of jobs instead of married women can be an effective idea because single women have less responsibility than married ones, and being a mother reduces physical ability. Consequently, they will be more vulnerable to injury.

Acknowledgment

We are very grateful to the management of the company and all participants in this survey.

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