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# Prevalence of Musculoskeletal Symptoms among Foam Industry Workers

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## Abstract

**Introduction:** Manual material handling (MMH) or working heavy task maybe harmful for workers and causing musculoskeletal disorders. MMH includes pushing, pulling and lifting all of which pose the risk of injury to the back or other part of body. The aim of this study was to determine the prevalence of musculoskeletal symptoms in workers in the polyurethane factories.

**Materials and methods:** A total of 450 workers (92%) were selected to assess by The Nordic Musculoskeletal Questionnaire (NMQ). Participants were all of the workers were more exposed to physically demanding work in the workplaces. Based on NMQ heavy manual handling, bent legs and bent back were monitored to apply insufferable health risk on participants.

**Results:** The prevalence of musculoskeletal symptoms was 38% by questionnaires. There was no significant correlation ($P<0.05$) between musculoskeletal symptoms and working hours and age. Multiple regression analysis confirmed that, the duration of employment was significantly correlated with musculoskeletal symptoms disorders (MSDs) among workers. The higher prevalence of MSDs among workers and the correlation between their duration of employment implies that a higher risk of MSDs is related to the workplaces.

**Conclusions:** The results confirm that the higher risk of musculoskeletal problems is related to the workplaces. It was also demonstrated that the ergonomics risk factors are principally from the worker tasks, and it does not depend on their age and history of diseases.

**Keywords:** Musculoskeletal disorders; Working; Risk; Incidence; Employment

## Introduction

Musculoskeletal disorders are among the most common of human afflictions. They affect all age groups and frequently cause disability, impairments, and handicaps. There are many data concerning back pain related to developed countries and information about back pain in developing countries are lacking [1-3]. Low back pain, one of the most frequent of musculoskeletal disorders, affects up to 80 percent of people sometime in their lives, and in any given month 20 to 30% of adults have an episode [4-6]. They consist of a variety of different diseases that cause pain or discomfort in the bones, joints, muscles, or surrounding structures, and they can be acute or chronic, focal, or diffuse. Musculoskeletal disorder refers to conditions that involve the nerves, tendons, muscles, and supporting structures of the body [4,7].

Not only are musculoskeletal problems highly prevalent, but, because of their association with aging, they are likely to become more prevalent as the population ages throughout the world [8]. The result of another study about low back pain (LBP) among Iranian industrial workers showed that the 1-year prevalence of self-reported LBP in the Iranian industrial population was 21% (20% males and 27% females) [1] and the prevalence rate of absence due to LBP was 5% per annum. Also, the multiple logistic regression models indicated that the following remained risk indicators for LBP in the previous 12 months: increasing age, no regular exercise, heavy lifting, repetitive work and monotonous work.

In general, the most prevalent disorders are low back pain, osteoarthritis, and so called soft tissue rheumatism among the workers [9-11]. Even though they afflict millions of persons around the world, several of the common musculoskeletal disorders fall into the category of moderately prevalent, including gout, a form of episodic arthritis; fibromyalgia, a disorder of diffuse muscular pain and a subtype of soft tissue rheumatism; and rheumatoid arthritis, an inflammatory systemic disorder that causes widespread joint pain [12,13]. There are several studies on prevalence of the neck, shoulder, elbow and hand disorders have also been reported higher in workers of the fish processing industry than the general population [14,15,9]. In some factories most recent studies have also identified musculoskeletal disorders in the neck, shoulders, upper limbs and ankles as the most prevalent diseases in the industry among female workers involved in cod trimming; working at herring fillet machines, doing different types of packing activities can be found among male packers. [16,7,12,17].

In Iran, the awareness of back pain due to work is still at a potential stage. The subject is considered new in Iran compared to other developed countries, and it is still being promoted by the Occupational Safety and Health practitioners to enhance the awareness level to all Iranian workers. The aim of the study was to determine prevalence of musculoskeletal disorders among industrial foam workers. The first aim of this study was to determine the total prevalence of musculoskeletal disorders among manual operators and industrial workers in the Iranian industrial foam workers. Another aim was to estimate the association between musculoskeletal disorders and the duration of employment as an exposure variable, adjusted for individual characteristics.

## Methods and Materials

Using the sample sizes based on latest studies, the total number of

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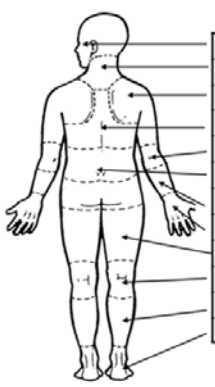
workers could be estimated to within 450 workers. As the total number of workers will be greater than or equal to the number of potentially exposed workers, it implies that these sample sizes also allowed the estimation of the total number of workers to within 10% or less.

This study was carried out at foam producing industrials in Iran. 450 workers were originally surveyed. Observers used a standardized, Nordic Musculoskeletal Questionnaire (NMQ) for workers. Since 1987 Nordic Questionnaire was established by Kuorinka and his colleagues in Occupational Health institutes of Scandinavian countries aiming to the determination of the incidence of musculoskeletal disorders resulted from the work [16]. The NMQ include demographic and personal characteristics such as height, weight, prior acute injuries, surgery, relevant systemic diseases, alcohol intake, tobacco use, sports, and hobbies. Subjects reporting musculoskeletal symptoms in the year preceding the interview were asked additional questions such as year of onset, symptom frequency, and duration within the past year. The questionnaire gathered data on individual, work related physical and psychological data as well as musculoskeletal symptoms in the head/neck, upper body and lower body regions and low back during the previous one year. The data gathering method was a walk through observation, followed by an interview of a supervisor and a worker. It was performed to understand the work process and the operations involved in the task.

Corlett and Bishop's [14] body part discomfort scale is a subjective symptom survey tool that evaluates the respondent's direct experience of discomfort at different body parts. It may seem easy to take this scale for granted because it is internationally recognized and universally practiced. The measuring postural discomfort technique is a survey of comfort level to all body parts which was carried out in an ergonomics assessment. Based on figure 1, 12 body parts were identified to be evaluated by the workers. This form was used as a scale method where the comfort levels were numbered from 1 to 5, the higher number means that more uncomfortable they felt at that certain part of the body.

All statistical analyses were performed with the SPSS software. The musculoskeletal symptoms incidence, for each case type, was calculated among the workers. The Pearson chi-square was carried out to signify the differences in musculoskeletal disorders by demographic details with the significance level at P=0.05. The Pearson correlation was also performed to consider the relationship between workers profiles and their musculoskeletal symptoms.



| | Extremely Comfortable | | | | Extremely Uncomfortable |
|---|---|---|---|---|---|
| Eye | 1 | 2 | 3 | 4 | 5 |
| Neck | 1 | 2 | 3 | 4 | 5 |
| Shoulder | 1 | 2 | 3 | 4 | 5 |
| Upper Back | 1 | 2 | 3 | 4 | 5 |
| Elbow | 1 | 2 | 3 | 4 | 5 |
| Lower Back | 1 | 2 | 3 | 4 | 5 |
| Arm | 1 | 2 | 3 | 4 | 5 |
| Wrist/ Hand | 1 | 2 | 3 | 4 | 5 |
| Thigh | 1 | 2 | 3 | 4 | 5 |
| Knee | 1 | 2 | 3 | 4 | 5 |
| Calf of leg | 1 | 2 | 3 | 4 | 5 |
| Feet/ Ankle | 1 | 2 | 3 | 4 | 5 |

**Figure 1:** Body Parts Symptoms Survey sheet [14].

## Results

The results from ergonomic assessment may indicate that excessive exposure has occurred in the workplace and this highlights the need to review the control measures in workplace. It is likely that a risk assessment will suggest that a high level of musculoskeletal disorders prevalence would be appropriate for personnel who are exposed to non-ergonomics position in the workplaces. This could be carried out by an occupational health specialist who is familiar with the risks of the process and principles ergonomics.

The data was obtained from NMQ and the questionnaire was completed by observers. A lot of 450 workers were chosen as exposed subjects. They were operators for manufacturing foam process. A history of pain or disorders was similarly abstracted from questionnaires in the body regions (eye, neck, shoulder, upper back, elbow, lower back, arm, wrist/hand, thigh, knee, calf or leg and feet/ankle). The workers were selected from among all other site employees excluding those ever assigned to the workplaces. Workers were selected at random from within the corresponding frequency categories, because there were few old employees in the study group. The following items were abstracted from visits to the clinic face to face related to exposure: date of event, ergonomics matter substances involved, a description of exposure circumstances, the signs and symptoms reported by the employee and medical treatment rendered, referrals, physician diagnoses, and any recommendations for temporary or permanent removal from the workplaces. Job specific work histories were coded for each person and linked to industrial hygiene measurements through social security numbers, job category, and date.

The mean age of workers at the industries was 34.48 years (SD=7.465, range 24-47), and the mean weight of workers was 69.64 years (SD=12.348, range 50-88). The mean duration of employment at the industries was 4.74 years (SD=2.94, range 2-13), the data are shown in table 1.

Based on NMQ questionnaire responses the extracted factors associated with each foam industries and their contributions are elaborated in following tables:

Table 1 which is a statistical table includes the descriptive analysis of individual history (symptoms of musculoskeletal disorders relevant to ergonomics exposures and smoking history) which obtained from 450 workers among the factories.

Likewise, 54% of total workers working in the factories were smokers. As well 54% of total workers had some symptoms relevant to ergonomics exposure (Tables 2 and 3).

The assessment of musculoskeletal prevalence by NMQ questionnaires for one-year revealed that, a total of 95% of the operators and exposed workers had experienced discomfort or pain in their body. The recognized disorders reduced mobility or other discomfort in one or more of the ten defined areas of the worker's body during the last year (Table 4).

The observed values of all ergonomics related parameters are shown in foam industries: the highest prevalence (41%) was seen in lower back, the lowest prevalence (9-10) in elbow, eye and feet/ankle.

Correlation analysis showed that the prevalence of musculoskeletal prevalence in selected areas of the body increased with weight and heath (body mass index) (P<0.001 for neck, shoulder, lower back, wrist/hand, knee and feet/ankle). Among selected body region there are the strongest correlation in area of lower back, wrist/hand, knee and feet/

| | N | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| Age (year) | 450 | 34.48 | 7.465 | 24 | 47 |
| Weight (kg) | 450 | 69.64 | 12.348 | 50 | 88 |
| Work history (year) | 450 | 4.74 | 2.94 | 2 | 13 |

**Table 1:** Individual characteristic of workers.

| Variables | Range | Frequency | Percent |
|---|---|---|---|
| Age (year) | 20-30 | 19 | 38 |
| | 31-40 | 16 | 32 |
| | 41-50 | 15 | 30 |
| Weight (kg) | 40-60 | 20 | 40 |
| | 61-80 | 11 | 22 |
| | 81-100 | 19 | 38 |
| Work history (year) | 0-5 | 35 | 70 |
| | 6-10 | 10 | 20 |
| | 11-15 | 5 | 10 |

**Table 2:** Range of characteristics.

| Variables | N | Percent |
|---|---|---|
| Smoking | 27- Smoker<br>23-None | 54<br>46 |
| Symptoms of disease | 27- have<br>23- without | 54<br>46 |

**Table 3:** Frequency of smoking and symptoms of disease.

| | Often/very often | Seldom/sometimes |
|---|---|---|
| Eye | 10 | 55 |
| Neck | 21 | 55 |
| Shoulder | 20 | 41 |
| Elbow | 9 | 32 |
| upper back | 18 | 30 |
| lower back | 41 | 55 |
| Arm | 11 | 32 |
| wrist/hand | 22 | 44 |
| Thigh | 13 | 30 |
| Knee | 15 | 40 |
| calf or leg | 11 | 35 |
| feet/ankle | 10 | 35 |

**Table 4:** Musculoskeletal symptoms among foam industries workers.

ankle with musculoskeletal prevalence (P<0.001). The musculoskeletal prevalence also increased with the work history of workers or duration of employment (P<0.001 for lower back, wrist/hand, knee and feet/ankle) (Table 5).

The current survey revealed a higher prevalence of musculoskeletal symptoms (MS) among workers. Based on observations the workers are more exposed to physical work stress such as heavy weight loading and handling, pulling and pushing, and since the prevalence of MS among the workers was correlated with the duration of employment and body mass index (weight and height).

A lot of two hundred workers performed the same task in the studied workplaces, repetitively. Repetitive work position has been shown to be the cause of MS and low back pain [1]. Two hundred and fifty workers engaged in standing positions work for a working shift and a quarter of time they worked in other positions.

Participants were asked about their insight on the workstation conditions in the workplaces. Most of the questionnaires data showed that the workstation was in need of more assessment based on ergonomics parameters. Overall, the tools designing were not acceptable, also the workstation (such as working table, chair and space) is not based on workers anthropometry; the space is not suitable for workers movement.The machines and tools were used to perform the work and which made a noisy working environment. As most employees (95%) had musculoskeletal symptoms, pain occurred most frequently in the lower back, wrist/hand, knee and feet/ankle.

According to the obtained results, the prevalence of musculoskeletal symptoms (95%) of the workers was high in comparison with other studies [18,2,6]. In other studies was carried out in other countries, the prevalence of musculoskeletal symptoms were 69% and 85%, respectively [18,2]. Also another study was performed in Sweden among construction workers; the result showed a prevalence of 92% [19]. Some researches may support the current study results that prevalence of musculoskeletal symptoms are most frequent in the lower back, knee, shoulders and neck [16,18,2,6,19]. There is a high prevalence of musculoskeletal symptoms among workers who were working with manual tools and the result of the current study is similar with other surveys [19-21].

In terms of duration of employment, there are some research that showed correlation between age and working duration and prevalence of musculoskeletal symptoms [22-24] but other research did not demonstrate a correlation between them [14,10,18]. The correlation between the prevalence of musculoskeletal symptoms and the duration of employment among workers revealed to be significant for assessed areas of the workers' body (except eye, neck, shoulder, elbow and upper back) as it was shown in other studies [8,17,19].

The statistical analysis showed that there is a relationship between the age of workers and prevalence of musculoskeletal symptoms as well; this results presented by other researchers was carried out in the same work positions [7,25].

The current study illustrated that prevalence of musculoskeletal symptoms are comparable in the same workplaces of industrial workers, but also infrequent in some workplaces according to previous study [10]. Among foam workers, some of them worked with prolonged sitting position, in this situation the results shown a risk factor for neck and leg/foot pain as it mentioned in the other study [26], moreover, the current findings are comparable to other studies illustrated that there are musculoskeletal symptoms in upper limb and upper and lower back areas [6,19].

| | During of Employment | | BMI (body mass index) | |
|---|---|---|---|---|
| | B | P- value | B | P- value |
| Eye | 0.18 | <0.067 | 0.16 | <0.12 |
| neck | 0.12 | <0.04 | 0.15 | <0.14 |
| shoulder | 0.9 | < 0.008 | 0.1 | < 0.09 |
| elbow | 0.09 | 0.07 | 0.16 | 0.13 |
| upper back | 0.1 | 0.1 | 0.15 | 0.14 |
| lower back | 0.18 | < 0.001 | 0.16 | < 0.001 |
| arm | 0.15 | < 0.06 | 0.18 | < 0.08 |
| wrist/hand | 0.05 | 0.001 | 0.05 | 0.001 |
| thigh | 0.1 | < 0.06 | 0.07 | < 0.01 |
| knee | 0.09 | 0.001 | 0.09 | 0.001 |
| calf or leg | 0.09 | <0.08 | 0.06 | <0.03 |
| feet/ankle | 0.17 | <0.001 | 0.15 | <0.001 |

Dependent Variable: During of employment (years), weight (Kg) and Height (Cm)

**Table 5:** Correlation for musculoskeletal prevalence and during of employment based on multiple regression analysis.

## Conclusion

The findings of the current study illustrated that most of the participants (95%) reported musculoskeletal symptoms in different regions of the body during their working experience. In different parts of the workers body, most of musculoskeletal symptoms occurred in the lower back, wrist/hand, knee and feet/ankle.

There was a correlation between prevalence of musculoskeletal symptoms and body mass index (weight and height) among foam workers. In this study no significant relationship was seen between prevalence of musculoskeletal symptoms and smoking (P>0.001). In addition, a correlation was seen between prevalence of musculoskeletal symptoms (P<0.001 for lower back, wrist/hand, knee and feet/ankle) and duration of work for participants in the foam industries.

Heavy lifting or handling, high pulling and pushing, non-ergonomics tool designing and bad posture of operators in the workplaces is causing musculoskeletal disorders and raises prevalence of musculoskeletal symptoms among participants.

Based on the current study results, most of workstations should be designed ergonomically, the position of working table and chair must be proper based on workers individual anthropometric information. There is a need for future study for prevalence of musculoskeletal symptoms assessment after ergonomic designing of workstations, tools and working rules to compare with last finding in the same workplaces.

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