*Original Article*

# Evaluation of musculoskeletal disorders through loading postural upper body assessment method in household appliances production companies in Tehran, Iran, in 2014

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**Abstract** **Received**: September 2015, **Accepted**: November 2015

**Background:** Work-related musculoskeletal disorders (MSDs) of the upper limbs are the most common occupational diseases and injuries and one of the causes of disability in workers. Therefore, this study was conducted to assess the prevalence of MSDs and the risk of these disorders using the loading postural upper body assessment (LUBA) method.

**Materials and Methods:** This descriptive study was performed on 100 male workers of appliance manufacturing industry. The study population included 15 workers of the foam injection workshop, 17 of the molding workshop, 17 operators of Press, 17 of the packaging, 17 of the cutting unit, and 17 of rivets. The Nordic Musculoskeletal Questionnaire (NMQ) was completed by the participants for the wrist, elbow, shoulder, neck, and back and their working postures were recorded through photography and observation. Then, The analysis and evaluation of the desired posture was performed using the LUBA method. Finally, the data were analyzed using SPSS software.

**Results:** NMQ results revealed that the highest rate of disorders was observed in the wrist (37%), neck (35%), and shoulder (30%), respectively. Moreover, ANOVA showed that age and work experience had significant correlation with prevalence of MSDs ($P < 0.01$, $P < 0.05$, respectively). The results of the LUBA method showed that the highest level of risk was associated with the rivet unit (risk level 4) and the lowest level of risk with the foam injection unit (risk level 2).

**Conclusions:** The results of this study showed that household appliances production workers, due to the nature of their occupations, are at risk of MSDs. Therefore, ergonomic interventions such as work station design based on ergonomic principles, the use of ergonomically designed tools, and training of workers about the work are necessary.

**Keywords:** Musculoskeletal Diseases, Household Products, appliances, Methods.

## Introduction

Injuries and muscle, joint, and bone disorders caused by physical jobs account for more than 34% of all injuries that result in lost workdays, costing employers $15 to $20 billion a year in worker compensation charges. A significant relationship was found between poor working postures and musculoskeletal-related lost workdays or low back disorders. According to the latest studies carried out On the relation between disease burdens and risk factors in Iran in the year 2004, musculoskeletal disorders (MSDs) occupy the second position after cardiovascular diseases among the most prevalent work-related diseases (1, 2).

Awkward and extreme force exertion and repetitive postures can increase the risk of MSDs. Therefore, cost effective quantification of physical exposure to poor working postures

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is important and necessary if the potential for injury as a result of postures is to be reduced (3). MSDs, muscle disorders, tendons, peripheral nerves, joints, bones, ligaments, and blood vessels disorders are the result of repetitive motion, unsuitable posture, and overexertion of force and occur over time or are a result of acute trauma (4). MSDs are an important public health issue in both developed and developing countries, with substantial impact on quality of life (QOL) and a substantial economic burden in compensation costs, lost wages, and productivity (5). Descriptive studies on MSDs in industrial populations have focused on workers who experience chronic pain and are on long-term paid sick leave due to temporary or permanent disability. Increased knowledge on active workers who exhibit symptoms of MSDs provides the opportunity to assess potential risk factors and to implement control measures (6). MSDs in the upper limbs have become a major health and safety problem. It has been estimated that around the year 2000, these problems will represent approximately half of all compensations (7). MSDs associated with work usually Organs back, neck cervical spine, and upper extremities are included. MSDs are the most common occupational diseases and injuries and they are the major causes of disabilities in workers (8, 9) According to the World Health Organization (WHO) reports, the second leading cause of work absenteeism in the United States is back pain and 20% of absence from work in Germany is related to disk injuries (10). Numerous studies have been conducted on work-related MSDs. Dohyung et al. examined and identified the risk factors of MSDs among the plastics factory. The results indicated that 28.4% of the employees require intervention regarding their physical condition to prevent the appearance of MSDs as soon as possible or immediately. MSDs of the upper limbs impose a substantial economic burden in compensation costs on the manufacturing industry. Loading postural upper body assessment (LUBA) is a method of observational that presented by Waldemar Karwowski et al. to evaluate the upper extremities of the body (11). The rate of occupational risk factors is high in household appliances production companies. Hence, the aim of the present study was the evaluation of MSDs using LUBA method and the Nordic Musculoskeletal Questionnaire (NMQ) in household appliances production companies.

**Materials and Methods**

This descriptive study was performed on 100 male workers of the appliance manufacturing industry in Tehran, Iran, in 2014. The study population included 15 workers of the foam injection workshop, 17 of the molding workshop, 17 operators of press, 17 packaging, 17 from the cutting unit, and 17 operators of the rivet. The NMQ was completed by the participants for the wrist, elbow, shoulder, neck, and back and their working postures were recorded through photography and observation. Data collection tools consisted of NMQ (12) and the LUBA checklist. The NMQ was completed to determine the prevalence of MSDs during the past 12 months, and then, demographic variables of gender, age, and work experience were recorded, and finally, the LUBA checklist was completed. LUBA method is an observation method that can identify ergonomic risk factors and has good reliability for the assessment of MSDs. The final score of the LUBA checklist ranges between 1 and 15 (1-5 = 1 risk level, 5-10 = 2 risk level, 10-15 = 3 risk level, and higher than 15 = 4 risk level). The scores of 1 to 5, 5 to 10, 10 to 15, and higher than 15 indicate low risk rate, medium risk rate, high risk rate, and very high risk rate, respectively. The NMQ is used to qualitatively evaluate MSDs of the neck, shoulders, back, elbow, wrist, hand, thigh, knee, and foot. This questionnaire is very useful for assessing musculoskeletal problems in epidemiological studies.

The inclusion criterion of the present study was at least 1 year of work experience. The

exclusion criterion was unwillingness to cooperate in completing the questionnaire. Data analysis was performed in SPSS (version 20, SPSS Inc., Chicago, IL, USA) using descriptive statistics and ANOVA. Moreover, all P values of less than 0.05 were considered statistically significant. This study was performed after obtaining permission from the Ethics Committee in Medicine.

**Table 1: Demographic characteristics of age and work experience**

| Variable | Mean ± SD | Minimum-maximum |
|---|---|---|
| Age | 34.7 ± 6.4 | 26 - 45 |
| Work experience | 9.8 ± 4.1 | 3 - 11 |

## Results

In this study, 100 male workers participated. The ages of participants in this study ranged between 26 and 45 year. Demographic characteristics of age and work experience are presented in table 1. The prevalence of MSDs in different organs in the previous 12 months using the NMQ is shown in table 2. According to table 2, most MSDs are, respectively, observed in the wrist (37%), neck (35%), and shoulder (30%).

**Table 2. Prevalence of musculoskeletal disorders in different organs in the previous 12 months using the Nordic Musculoskeletal Questionnaire**

| Variable | Foam injection (%) | Molding workshop (%) | Press operator (%) | Packaging (%) | Cutting unit (%) | Rivets operator (%) |
|---|---|---|---|---|---|---|
| Neck | 7 | 5 | 5 | 35 | 24 | 24 |
| Shoulder | 19 | 10 | 10 | 25 | 15 | 30 |
| Back | 8 | 5 | 7 | 25 | 30 | 25 |
| Wrist | 6 | 4 | 13 | 26 | 14 | 37 |
| Elbow | 10 | 30 | 10 | 5 | 40 | 5 |

ANOVA showed a significant relationship between LUBA score and work experience and age. The prevalence of MSDs and LUBA risk level increased with increase in variables of work experience ($P < 0.05$) and age ($P < 0.01$). Scores obtained using the LUBA method and percentages obtained using the NMQ showed that workers of household appliances production companies are at risk of MSDs. The results of LUBA method showed that the highest level of risk was associated with the rivet unit (risk level 4) and the lowest level with the foam injection unit (risk level 2) (Table 3).

**Table 3. Loading postural upper body assessment risk levels for each activity**

| Job | Risk level | Percentage |
|---|---|---|
| Foam injection | 2 | 7.5 |
| Molding workshop | 2 | 12.0 |
| Press operator | 2 | 8.7 |
| Packaging | 4 | 26.0 |
| Cutting unit | 3 | 19.2 |
| Rivet operator | 4 | 26.6 |

## Discussion

The present study has shown that household appliances production companies, due to the type and nature of their required activities, are at risk of MSDs. According to the results of the NMQ, the highest prevalence of MSDs was observed in the wrist (37%), neck (35%), and shoulder (30%), respectively. The results of LUBA method showed that the highest level of risk was associated with the rivet unit (risk level 4) and the lowest level with the foam injection unit (risk level 2). According to table 2, the highest incidence of MSDs in the foam injection, molding, press, packaging, cutting, and rivet units was, respectively, observed in the shoulder (19%), elbow (30%), wrist (13%), wrist (26%), elbow (40%), and wrist (37%). In the study by Theresa Newell in 2004, the highest prevalence of MSDs in dentists was in the wrist (39%), neck (56%), and shoulder (47%) (13). Mohammad Fam et al. in the study of the risk of musculoskeletal disorders in an industrial company by using LUBA and QEC and comparing the results found that 71.3% of working groups were at priority 4 for modifying (14).

Shuval et al. evaluated MSDs in manufacturing companies and came to the conclusion that the highest prevalence of MSDs was in the neck and shoulder (47.16%) and the hand and wrist (32.1%) (15). This finding was in agreement with that of the present study. Holmstrom et al. evaluated MSDs in the construction industry and found a direct significant correlation between age and job tenure and MSDs (16). This confirms the findings of the present study. Boschman et al. assessed MSDs in the manufacturing industry and found that the frequency of individual's complaints of MSDs in the wrist, shoulder, and arm was higher than other parts of the body (17).

This is in agreement with the findings of the present study. Schibye et al. studied MSDs in sewing machine operators (18). They found that the highest prevalence of MSDs were in the neck and shoulders. This finding confirms the findings of the present study. Brown et al. assessed MSDs in small industries using the Quick Exposure Check (QEC) method (19). They found that the highest incidence of MSDs were in the lower back, shoulders, and wrists, which confirms the findings of the present study (19).

Mohammadfam et al. investigated the analysis of working postures in manufacturing companies using the QEC and LUBA methods. Their results showed that the prevalence of MSDs was highest in the back and shoulders (41.7%) (20). This finding was consistent with that of the current study. Baroonyzade et al. analyzed working postures using the LUBA Method and reported that the highest prevalence of MSDs was, respectively, in the neck (63.3%) and back (43.3%) (21). This was also in agreement with the present study findings. Kamalinia et al. studied MSDs in the Telecommunication Manufacturing Company and concluded that most of the postures of the employees were of status 3 and 4 (22).

This was consistent with the results of this study. Zighaimat et al. investigated the frequency of musculoskeletal complaints among motorboat staff. Their results showed that the highest prevalence of MSDs was in the back (61.4%) (23). This finding is also consistent with the findings of the present study.

## Conclusion

The result of the present study showed that the prevalence of MSDs among the staff of household appliances production companies is high and ergonomic interventions such as workstation redesign, reduced working hours, cycle of rest-work development are necessary. Moreover, the most important causes of the high prevalence of MSDs in the rivet and packaging units may be undesirable postures of the neck, shoulder, wrist, and hand and applying excessive force and using non-ergonomically designed tools.

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**Conflict of interest:** None declared

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