Investigation of relationship between musculoskeletal disorders and working conditions among workers at a pharmaceutical industry in Iran (2011-2012)

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ABSTRACT

Musculoskeletal disorders may be observed in all industries and professions and most of these disorders are related to the back, upper and lower extremities of the body organs. In Pharmaceutical industry, almost lack of standard ergonomic conditions and sometimes can cause outbreaks of diseases and musculoskeletal disorders in various parts of the body. The aim of this study was to determine the relationship between musculoskeletal disorders and working on the packaging section of the pharmaceutical industry. The Nordic questionnaire and Rula method were used for collection of data and 392 workers were selected as the subjects of study.

Based on the results of this study, (28.5%) of workers working in Packaging Unit complained of severe pain and discomfort in their neck, (23.7%) in their shoulder, (27.9%) in their hand and wrist and (33.2%) complained of severe pain in their back.

The results indicate that workers in this industry could show musculoskeletal disorders based on age, education, gender and working conductions.

Key words: Musculoskeletal Disorders, Ergonomics, WMSDs (Work Related Musculoskeletal Disorders), Back Pain, Shoulder Pain

INTRODUCTION

Generally, statistical records show that musculoskeletal disorders are increasing as a silent epidemic tremendously, especially among those employed workers with sitting and repetitive activities in their workplace. Today, few studies have been done on identifying and eliminating problems associated with musculoskeletal disorders. Indemnities incurred from occupational disease and its relevant absences and medical and healthcare costs, moreover disrupting the life of employed individuals, indicate the significance of the subject for further studies.

The following reasons should be taken into consideration for selection of this subject:

- Increased musculoskeletal disorders in the industry, especially among workers employed in assembling and packaging unit as a silent epidemic [1].
- The fewest number of studies made on such employed individuals with musculoskeletal disorders doing repetitive and sitting activities at the workplace.
- Increased medical and healthcare treatment costs as a result of musculoskeletal disorders among employed individuals [2].
- Effect of unfavorable work conditions ergonomically and its basic role in addition to the emergence of musculoskeletal disorders, excessive fatigue, reduced motivation among workers, reduced efficiency and increase of incidents [3].
- High number of employed individuals working in Packaging Unit and dire need are felted to study problems, ergonomically in order to settle the problem.
- Musculoskeletal disorders are observed in all industries and professions and most of these disorders are related to the back, upper and lower extremities of the body organs [4].

A study conducted among staff of West Health Center of Tehran indicates the existence of cumulative effects and injuries caused by inappropriate posture (Cumulative Trauma Disorders) (CTD) among more stuff, so that 90 percent of staff were suffering from severe pain in the spine and backbone while 27.4 and 20.4 percent of them were complaining of pain in their

shoulder and neck muscles respectively. After intermediary, they showed that the amounts were decreased and complaining degree of staff reduced as much as 40.8 percent of feeling pain in the upper part of the spine while severe pain in their shoulder and neck was decreased 22 and 17.6 percent respectively. It should be noted that changes are significant using statistical test. (P_{value}≤0. 005) [5]

The main purpose of this study was to determine the relationship between musculoskeletal disorders and working in packaging pharmaceutical industry workers.

MATERIALS AND METHODS

Non-Probability sampling method is used in this study, based on which, individuals with similar conditions working in the packaging unit of pharmaceutical industries were selected. Sampling volume is conducted based on statistical calculations with the confidence level of 95% and a number of 392 workers, working in the packaging unit of pharmaceutical industries, were selected as the subject of study. [6]

Moreover, a ratio of one trait was determined in the subject. (P= initial estimation, with the studies made in this regard, ergonomic disorders and problems in similar industries were estimated 30 percent.)

The methods used in this study include: **RULA** method, Nordic Questionnaire **(N-M-Q),** computer software in **RULA** analysis, **EXCEL** software for drawing diagrams and SPSS software system for the analysis of data. [7]

A series of initial information (including age, work experience, gender, working shift, left- and degree of awareness of workers on accurate performance of work, and also information on musculoskeletal diseases in all body organs, etc.) is obtained using Nordic Questionnaire. The data of Nordic Questionnaire are analyzed, based on which, the main focuses involved in musculoskeletal disorders of workers.

In RULA method, movement of body organs is evaluated accurately due to the movement angle of limb. In this method, for the analysis of working postures, each main part of the body is evaluated based on degree of displacement from its relevant natural situation. Therefore, a number as posture code is earmarked to it according to the increased amount of deviation from natural situation. After a combination of codes obtained from various parts of the body and estimation of external forces and muscles, the final code, which indicates the severity of posture risk and urgency level of reform, is determined using the relevant tables [8].

Reliability and validity that have been approved of the questionnaire based on Nordic Questionnaire. Validity and Reliability of the Persian edition were done in 1392 by scientists of Shiraz university of medical sciences. [9]

Nordic questionnaire contains some basic information such as age, experience, gender, smoking, working, sports activities, awareness workers of working properly etc...We also obtained information about underlying and musculoskeletal diseases and the data were analyzed by SPSS software. Points of musculoskeletal disorder that workers had the most complaints were identified by RULA method, movement of body organs was evaluated accurately due to the movement angle of limb. In this method, for the analysis of working postures, each main part of the body was evaluated based on degree of displacement from its relevant natural situation. Therefore, a number as posture code was earmarked to it according to the increased amount of deviation from natural situation. After a combination of codes obtained from various parts of the body and estimation of external forces and muscles, the final code, which indicates the severity of posture risk and urgency level of reform, was determined using the relevant tables

RESULTS

Table 1 shows the demographic and personal characteristics of the study population. As can be seen in the table 1, age and gender composition, marital status, employment status and work experience, how do the educational status of the study population were expressed

Table 1: Specifications of Participants

No. of Women	**No. of Men**	**Mean Age**	**Marital Status (Married)**		**Work Experience**	**Additional Work**	
(40.7%) 159	(59.3%) 233	+-9.45 – 55.08	(67.9) 266		+-8.94 – 7.86	85%	
Employment Status			**Work Performance Method**			**Training**	
Official	**Contractual**	**Contracting**	**Sitting position**	**Standing position**	**Combination of the Duo**	**Trained**	**Non-Trained**
(1.20%) 118	(1.66%) 259	(8.3%) 15	(9.57%) 228	(8.5%) 23	(3.36%) 143	(3.60%) 231	(7.39%) 161

Table 2: Distribution of Frequency (dF) of Musculoskeletal Disorder Type among Participants of Study According to Their Gender

Type of Musculoskeletal Disorder	Neck Pain		Low Back Pain		Shoulder Pain		Wrist and Hand Pain	
	Without Pain	With Pain	Without Pain	With Pain	Without Pain	With Pain	Without Pain	With Pain
Woman	89	68	100	58	96	62	93	65
Male	195	36	157	72	202	28	86	41
Grand Total	284	104	257	130	298	90	279	106

Table 2 shows the distribution of frequency of musculoskeletal disorder among the participants. Based on the results of Table 2, 104 persons (16.8%) of participants were suffering from neck pain, 68 and 36 of who were women (43.3%) and men (15.6%) respectively. A significant difference was observed between the frequency of neck pain among women and men in this study ($P_{value} \leq 0.00$). 130 persons (33.6%) of participants were suffering from low back pain, 58 and 72 of who were women (36.7%) and men (31.4%) respectively. Any significant difference was not observed between the frequency of low back pain among women and men in this study ($P_{value} \geq 0.28$). 90 persons (23.2%) of participants were suffering from shoulder pain, 62 and 28 of who were women (39.2%) and men (12.2%) respectively. A significant difference was observed between the frequency of shoulder pain among women and men in this study. ($P_{value} \leq 0.00$). 106 persons (27.5%) of participants were suffering from hand pain, 65 and 41 of who were women (41.1%) and men (18.1%) respectively. A significant difference was observed between the frequency of hand pain among women and men in this study ($P_{value} \leq 0.00$). Fig 1 shows the distribution of Frequency of Musculoskeletal Disorders among workers based on education.

Based on the results of fig. 1, 106 persons (27.4%) of participants were suffering from neck pain, 48 (45.28%) of them had been trained necessary training courses for musculoskeletal disorders, but 58 of the workers (54.72%) had not been trained any education courses in this case.

Based on chi-square statistical test, the degree of outbreak of neck pain among workers of the two groups did not show any significant difference ($P_{value} \geq 0.20$). 129 persons (33.9%) of participants were suffering from low back pain, 52 of them (40.31%) had been trained necessary training courses for musculoskeletal disorders, but 77 persons (59.69%) of these workers had not been trained in this respect. According to Chi-Square Statistical Test, the degree of outbreak of low back pain among workers of the two groups did not show any significant difference ($P_{value} \geq 0.20$). 107 (28.3%) participants were suffering from hand and wrist pain, 51 of them (47.66%) had been trained necessary training courses for musculoskeletal disorders, but 56 (52.34%) workers had been trained in this respect.

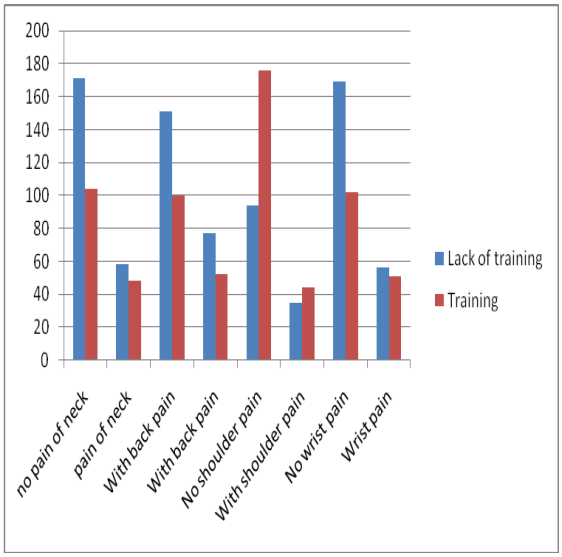

Fig. 1: The distribution of Frequency of Musculoskeletal Disorders among workers based on education

Based on Chi-Square Statistical Test, the degree of outbreak of hand and wrist pain among workers did not show any significant difference ($P_{value} \geq 0.08$). 79 (22.6%) participants were suffering from shoulder pain, 44 of the workers (55.70%) had been trained necessary training services, but 35 of the workers (44.30%) had not been trained necessary training courses in this field. Based on Chi-Square Statistical Test, the degree of the outbreak of shoulder pain among workers of the two groups did not show any significant difference ($P_{value} \geq 0.12$).

According to the results shown in Table 3, 91 participants in the study were suffering from neck pain that which, 47 patients (51/6%) required a change in their work, and 44 patients (57/3%) required a slight change in Job conditions. Based on statistical analysis had a significant association between neck pain and Rula score ($P_{value} \leq 0.00$). 117 participants in this study were suffering from back pain that which 43 patients (36/8%) required a change in their work, 67 patients (57/3) required a slight change, 7 patients (6%) required Need to more job modification. Based on statistical analysis had no significant association between low back pain and Rula score ($P_{value} \leq 0.46$). 82 participants in this study were suffering from shoulder pain, that which, 43 patients (52/4%) required a change in their Job, 38 Persons (46/3%) Require a slight change, 1Person (2/1%) Require large changes in work. Based on statistical analysis was performed,

a significant association between shoulder pain and Rula score ($P_{value} \leq 0.00$). 94 participants in this study were suffering from, hand and wrist pain, that which, 41 patients (43/6%) had changes in their job, 50 Persons (53/2%); require a slight change, 3 Persons (3/2%) Require large changes in work. Based on Statistical analysis had no significant correlation between wrist pain and Rula score ($P_{value} \leq 0.43$).

Table 4 showed the distribution of frequency of musculoskeletal disorders among participants based on RULA score (Left-Hand Body Organ).

Table 3: Distribution of Frequency of Musculoskeletal Disorders among Participants of Study Based on RULA Score (Right-Hand Body Organ)

Type of Musculoskeletal Disorder RULA Score	Neck Pain		Low Back Pain		Shoulder Pain		Wrist and Hand Pain	
	Without Pain	With Pain	Without Pain	With Pain	Without Pain	With Pain	Without Pain	With Pain
No need to change	0	0	0	0	0	0	0	0
Need to change	81	47	86	43	86	43	88	41
Partial changes	154	44	129	67	159	38	144	50
Serious changes	14	0	7	7	13	1	11	3
Grand Total	249	91	222	0	258	82	243	94

Table 4: Distribution of Frequency of Musculoskeletal Disorders among Participants of Study Based on RULA Score (Left-Hand Body Organ)

Type of Musculoskeletal Disorder RULA Score	Neck Pain		Low Back Pain		Shoulder Pain		Wrist and Hand Pain	
	Without Pain	With Pain	Without Pain	With Pain	Without Pain	With Pain	Without Pain	With Pain
No need to change	1	0	1	0	1	0	1	0
Need to change	83	44	84	44	88	40	91	37
Partial changes	141	25	114	50	138	27	126	36
Serious changes	24	22	23	23	31	15	25	21
Grand Total	249	91	222	117	258	82	243	94

The results shows 91 participants in the study were suffering from neck pain, That which,44 patients (37/6%) required a change in their work, and 50 patients (42/7%) required a slight change in job conditions,22person (24/2%) require large changes in work . Based on statistical analysis had a significant association between neck pain and Rula score. ($P_{valiue} \leq 0.00$).117 participants in this study were suffering from back pain, that which 44 patients (37/6%) required a changes in their work, 50 patients (42/7%) required a slight change, 23 patients (19/7%) require large change in work. Based on statistical analysis had no significant association between low back pain and Rula score (($P_{value} \leq 0.07$). 82 participants in this study were suffering from shoulder pain, that which, 40 patients (48/8%) required a change in their job, 27 Persons (32/9%) Require a slight change, 15 Persons (18/3%) Require large change in work. Based on Statistical analysis, a significant association between shoulder pain and Rula score ($P_{value} \leq 0.01$). 94 participants in this study were suffering from, hand and wrist pain that which, 37 patients (39/4%) had changes in their job, 36 Persons (38/3%), Require a slight change21 Person (22/3%) Require large changes in work. Based on Statistical analysis had a significant correlation between wrist pain and Rula score ($P_{value} \leq 0.02$).

DISCUSSION

Based on the results of this study, 108 (28.5%) workers working in packaging unit complained of severe pain and discomfort in their neck, 93 persons (23.7%) in their shoulder, 109 persons (27.9%) in their hand and wrist and 134 persons (33.2%) complained of severe pain in their back. The average age of participants with or without feeling pain in their neck, hand and wrist did not show any significant difference with each other ($P_{value} \geq 0.084$). Only the average age of participant with back pain was lower than other workers that difference was significant ($P_{valiue} \leq 0.023$) in the same direction, the average work experience among workers with neck, shoulder and back pain was more than other participants ($P_{value} \leq 0.001$) but this difference was not significant among participants with hand and wrist pain ($P_{value} \geq 0.43$).

It should be noted that the results of these studies are consistent with the results of studies conducted by Choobineh on workers of tire manufacturing company and results of demographic specifications and age of workers and their employment date with musculoskeletal disorders [10].

Guo *et al* investigated the prevalence of musculoskeletal disorder among Workers in Taiwan. They showed that 18,942 (84.3%) participated, and 37.0% (standard error=0.4%) had MSD. Female workers had a significantly higher overall prevalence than male workers (39.5% vs. 35.2%, $p<0.05$). Education and age also had

significant associations with MSD (p<0.001 in both genders) [11].

In this study, frequency of pain in neck, shoulder, hand and wrist among of women showed more than men that this was significantly different ($P_{value}\leq$ 0.00) and gender factor has a significant relationship with the mentioned disorders, so that this difference was insignificant with regard to the back pain ($P_{value} \geq 0.28$). It should be noted that the results of these studies are consistent with the studies conducted on computer users using RULA method [12].

In this study, outbreak of musculoskeletal disorders among women showed more than men, but in a study made on 97 dentists, neck pain among of men was more than women that details of which are inconsistent with the results of this study [13].

The degree of outbreak of pain in neck, back, shoulder, hand and wrist did not show any significant difference among of workers who had been trained for musculoskeletal disorders and other workers ($P_{value}\geq 0.28$), so that these results are inconsistent with the studies conducted on computer users and training them and correction of working positions and consequently, reduction of musculoskeletal disorders. Derek R. Smith *et al.* showed that 12-month period-prevalence of MSD at anybody site was 85.5%. MSD was most commonly reported at the shoulder (71.9%), followed by the lower back (71.3%), neck (54.7%), and upper back (33.9%) [14]..

In this study, there are significant correlation between neck pain and Rula scores on the left and right body of workers, which requires modifications in physical work conditions ($P_{value} \leq$ 0.00).

There was no significant correlation between back pain and Rula scores on the left and right body of workers, although there was required some slight modifications. ($P_{value}\geq 0.46$).

In this study significant correlation between shoulder pain and Rula scores on the left and right body of workers, ($P_{value}\leq$ 0.01). There have required some slight modifications.

In the present study significant correlation were between, hand and wrist pain and Rula scores on the left and right body of workers, which need for change is physical work conditions ($P_{value}\leq$ 0.00).

Conclusion

This study shows that the majority of low back pain in pharmaceutical packaging workers related to variables such as age, work experience and other underlying causes and poor ergonomics at work that the Rula test was approve this result.

The Neck, shoulder, arm and wrist pain of drug package workers due to poor ergonomic working environment and appropriate modifications are needed. Neck, shoulders and wrists pain in female workers were higher than male workers may be due to inappropriate anthropometry and workplace ergonomic conditions. In this study, left wrist pain due to repeated packing more than work left wrist pain.

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