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Determination of the Risk Level of Work Posture by REBA and RULA Methods among Workers of Assembly Lines of a Cosmetics Manufacturing Factory

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ABSTRACT

Background: Although the expansion of innovation in the industry has led to an increase in the fast of works, production and productivity, it has also imposed an increase in the incidence of musculoskeletal disorders. So, the aim of this study was determination the risk level of work posture by REBA and RULA method among workers of assembly line of a cosmetic manufacturing factory.
Methods: This study descriptive was carried out among the assembly line workers of a cosmetic manufacturing factory in 2016. Six tasks (including 28 work postures) were selected due to the most risk of inappropriate work posture factor. 18 postures were evaluated by REBA method and 10 postures by RULA method.
Results: The results showed that the highest REBA score (score10) in the hair color manufacturing section and the highest RULA score (score 7) related to the oxidant and powder parts. The minimum score obtained by the REBA and RULA method was 5 and 4 (minimum 2 corrective action level), respectively.
Conclusion: To prevent musculoskeletal disorders and reduce the staff posture score in pouring materials into the mixer or reservoir of manufacturing hair color, oxidant and powder sections, corrective actions such as the use of a pump system for transferring materials to the reservoir and the use of an footrest to avoid lifting the load to a height above the shoulder are recommended.

1. Introduction

The increasing use of modern technologies in the industry has led to an increase in the fast of work and an increase in production and productivity, but some complications such as fatigue, neuropsychological stress and an increase in the incidence of musculoskeletal disorders have been imposed to human [1].

Work-related musculoskeletal disorders (WMSDS) are including the main causes of workers' discomfort and disability, increased payouts and reduced productivity in industrialized and developing countries, which typically cause widespread involvement in waist, cervical spine and upper limbs (shoulder, elbow, wrists, and fingers) [2, 3].

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Musculoskeletal disorders are including the most common occupational diseases and one of the main causes of absenteeism [4]. In the United States, about one million people sick leave for musculoskeletal disorders treatment every year. The economic impact of work-related musculoskeletal disorders in 2001 year is estimated at more than 54 billion dollars [5].

According to the reports of OSHA organization, 42% all of the occupational diseases are related to awkward posture and musculoskeletal system [6].

According to the report of National Institute of Occupational Health and Safety of the United States, musculoskeletal disorders have devoted themselves to the second rank in terms of importance, frequency, severity and probability of progression among work-related illnesses [7]. The creation of work-related musculoskeletal disorders is due to excessive biomechanical loads and to individual work patterns [8]. These disorders will be created in any place with excessive force, physical inappropriate condition, frequent repetition of movements and low resting time [9].

Operators who work on assembly lines are including those who require a particular physical condition for a long time. Therefore, because of the pressure induced by these conditions to the musculoskeletal system of these individuals, probably there is a health risk and a feeling of pain and discomfort in various parts of the musculoskeletal system [10].

Although today, with more work done by mechanized machines, the workload on assembly line workers is reduced, the risk of musculoskeletal disorders and cumulative damages is also increased, as mechanized assembly lines increase the speed of the work and the more concentration of forces over small limbs [11].

Musculoskeletal disorders, unlike many of the work-related illnesses that originate from contact with a dangerous substance, is a multifactorial phenomenon which all of the effective factors and risk factors are in four groups include genetic factors, morphology, psychosocial and biomechanical factors [12]. Including the most important biomechanical risk factors in incidence of these disorders, can be refer to force, posture, repetitive movements and duration of work [13, 14].

From the important work-related risk factors in incidence of these disorders is work posture (body position while doing the job) which several methods hav2e been proposed to evaluate it. From the presented ergonomic evaluation techniques, the observational methods based on the pen and paper have special merits because no need to specialized equipment and tools as well as the rapid assessment in the short time are of the important features of the two methods Rapid Upper Limb Assessment (RULA) and Rapid Entire Body Assessment (REBA) [14-16].

The Operators are working in assembling lines in the cosmetics industries are including those who require a particular body position for a long time. Therefore, due to the pressure induced by these positions to musculoskeletal system of these people, there is a health risk and a feeling of pain and discomfort in different parts of the musculoskeletal system [5, 10].

The aim of this study was to determination of the risk level of work posture by REBA and RULA methods among workers of assembly lines of a cosmetics manufacturing factory.

2. Materials and Methods

There were 6 production and manufacturing lines in the cosmetics factory: making oxidant (with 5 workers), packing oxidants (with 5 workers), crating powder (with 1 worker), powder packing (with 5 workers), making hair color (with 2 workers) and packing the hair color (with 5 workers). In order to identify jobs and related- subtasks was helped from supervisors, officials and employed workers in the relevant section.

In this descriptive study, 6 tasks were studied, which led to a total of 28 work postures in 50 parts of the manufactory. These tasks include carrying, lifting, packing and handling packages. Then analysis of each task was performed using observational method (filming). The REBA and RULA methods were used to assess the risk of musculoskeletal disorders in relation to the risk factors of each posture. In the REBA method, different parts of the body are put in the two groups A and B for analysis, respectively the position of the waist, neck and legs with a total of 60 combined posture and the position of the arms, forearms and wrists with a total of 36 combined postures. Then to A score, add force/load score and to B score add coupling score and finally to C score obtained from A, B, add activity score and therefore generating a single score that represents the level of MSD risk (Table 1).

In the RULA method, regions of the body are also divided into two groups: A (arm, forearm, wrists, and wrist rotation) and B (neck, trunk and foot). After the

scores of A and B were obtained, the score of work load and the score of using muscle are calculated separately for both groups [14].

Table 1: Final REBA score

Score	Level of MSD Risk
1	Negligible risk, no action required
2-3	Low risk, change may be needed
4-7	Medium risk, further investigation, change soon
8-10	High risk, investigate and implement change
11+	Very high risk, implement change

That way the scores C and D and ultimately the final score are obtained respectively (Table 2). A total of 18 work postures were studied in REBA method and 10 postures were evaluated by RULA method. According to the specific corrective action level of both methods, corrective priorities were determined for 28 postures.

In the tasks that were more work sitting, used from RULA method and in the tasks that were more load handling activities and gripping the load, used from REBA method.

Table 2: Final RUAL score

Score	Action level	Description
1 or 2	1	Acceptable
3 or 4	2	Investigate further
5 or 6	3	Investigate further and change soon
7	4	Investigate and change immediately

3. Results and Discussion

The results obtained from the evaluation by REBA, RULA and corrective action level for each of the tasks are presented in Tables 1 and 2. According to Table 3, the most tasks performed in the packaging of hair color and oxidant obtained the average level of risk, and the tasks of making and packing powder had a high risk level.

The results of Table 4 show that the highest level of corrective actions are in the tasks performed in the manufacture sections of powder and oxidants, respectively, and the smallest them are in the manufacture and packaging sections of hair color, packaging of powder and oxidant.

According to Table 1, the evaluation of each task in the REBA method shows that the highest score (9 and 7) is related to the sub-task or the posture of lifting bags from the ground and removing cartons from the table and the ground in the section of production and packaging of oxidants due to excessive bending in and inappropriate grip when lifting the load. Increasing the score in these sub-tasks can be due bending over 20 degrees along with rotation to the sides in the neck region (sore 3), bending 20-60 degrees along with twist or bending over 60 degrees in region of the trunk (score 4 or 3), and bending between 20-45 degree along with up or abduction in the upper arm region (score 3 or 2).

The highest score in the powder packing task is to remove the carton from the table with its opening and adhering operation (score 9), as well as in the task of making and packing the hair color in the sub tasks of pouring the materials into the mixer (score 10) and removing the carton from the ground and opening it (score 9), due to excessive bending in the neck, trunk, and deviations in different parts of the hand. Obtaining a score of 9 or 10 in these sub-tasks can be due bending over 20 degrees with rotation to the sides in the neck region, bending over 60 degrees in the trunk region and locate upper arm in position of 45-90 degrees or 20-45 along with abduction or it. A study done by Marjan Eidzadeh et al in 2015 is in line with this study in terms of the final score of the REBA method in similar tasks in a date-packing plant [17].

Table 2 shows that the highest final score (score 7) of the RULA method is related to the task of making oxidants and powders in sub-tasks of pouring material into the tank, pouring the raw materials into the mixer and pouring potassium and ammonium, and irozil and paraffin in the mill and add it to the mixer. High score in the above tasks can be due to bending over 20 degrees or bending 10-20 degrees along with twist and bending to the sides in the neck region and bending 20-60 degrees in truck, deviation 15 degrees in wrist region and bending 20-45 in upper arm. Inappropriate postures and thereupon increased local pressure on the muscles of the body, as well as lifting the load at a height above the shoulder in each of the tasks are the reasons for the highest score in mentioned subtasks which are in line with the study of Seraji and et al. in 2007 in terms of the corresponding remedial action in some of the tasks [18]. Also corresponds with Deepak SHARAN et al.'s findings, by selecting 9 tasks (36 subtasks) for evaluation, in a cosmetic company (2014)

Table 3: Results of evaluation by REBA method

Task or work posture	Working posture	Final score REBA	Risk level	Corrective action
Making oxidant	Lifting bags from the ground	9	High	Urgently needed
	Cleaning the Tanks	5	Medium	Is essential
Packing oxidants	Picking up cartons from the ground and opening It	7	Medium	Is essential
	To place the bottle inside the carton	5	Medium	Is essential
	Carton arranging in the pallet	6	Medium	Is essential
	Removing cartons from the table	7	Medium	Is essential
Creating powder	Crushing potassium and ammonium with a rod	8	High	Is urgently needed
	Putting cartons on the pallet	5	Medium	Is essential
Powder packaging	Putting bottles in cartons	8	High	Is urgently needed
	Removing cartons from the table and inserting it into the adhesive part	9	High	Urgently needed
	Removing cartons from the ground and opening It	9	High	Urgently needed
Making hair color	Washing the tanks	5	Medium	Is essential
	Pouring material into the mixer	10	High	Is Urgently needed
Packing the hair color	Removing a tube box from the table	6	Medium	Is essential
	Putting the box on the color machine	5	Medium	Is essential
	Removing cartons from the inside of the carton and placing it inside the device	5	Medium	Is essential
	Removing the carton from the ground and opening it	9	High	Is Urgently needed
	Picking cartons on the pallet	6	Medium	Is essential

Table 4: The results of the RULA assessment

Task	Working posture	Final score RULA	Action level	Description
Making oxidant	Pouring material into the reservoir	70	4	Investigations and changes are required as soon as possible
	Pouring material into the reservoir with pump	4	2	More inspections and some changes are needed
The oxidation package	Placing the bottle on the roll as sitting	5	3	Ergonomic examinations and changes are needed
Making powder	Pouring raw materials into the mixer	7	4	Investigations and changes are required soon
	Pouring Potassium, Ammonium and Paraffin Inside the Mill and Adding it to the Mixer	7	4	Investigations and Changes are Required Soon
	Emptying the Powder in the Bucket and Pouring into the Barrel	4	2	More Inspections and some Changes are Needed
Powder Packing	Removing the Bottle from the Table andPutting it under the Filler	4	2	More Inspections and some Changes are Needed
	Removing the Bottle from Filler and Putting the Bottle on the Roll	6	3	Ergonomic Examinations and Changes are Needed
Making Hair Color	Pumping Material into Tanks	4	2	More Inspections and some Changes are Needed
Hair Color Packaging	Hair Color Putting Inside the Carton	4	2	More Inspections and some Changes are Needed

4. Conclusion

Based on the obtained results, it was found that the risk level of the Work-related musculoskeletal disorders (WMSDS) based on REBA and RULA methods showed that the working environment conditions are damaging. The REBA and RULA scores were high in subtasks of manufacturing sections of the hair color, oxidants and powder in the pouring of materials into the mixer or reservoir. Corrective actions, such as the use of a pump system, are recommended for the transfer of materials into the tank and the use of an underfoot with an appropriate cross-section to avoid lifting the load to a height above the shoulder and so that preventing musculoskeletal disorders and reducing the posture score of workers in the parts. Also, putting up cartons in an appropriate height from the ground level can prevent from bending more than in truck region.

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