ERGONOMIC RISK ASSESSMENT OF WORKERS IN GARMENT INDUSTRY

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ABSTRACT

The work-related musculoskeletal disorders is a crucial health issue in labor-intensive industries. Despite of the developments in workshop practices and technology, garment industry is among the most labor-intensive industries. The purpose of this study is ergonomic risk assessment of workers in garment industry. For this reason, working environment and physical workloads of workers are investigated in a factory that manufactures baby towels, bathrobes and sleeping bags. Rapid Entire Body Assessment (REBA) method is used to calculate physical workloads of workers for thirteen different operations. The evaluation of the results show that inadequately ergonomic working conditions set off serious physical disorders in garment industry.

Key words: garment industry, risk assessment, ergonomics, REBA

INTRODUCTION

The productivity of labor-intensive garment industry is highly influenced by efficient use of human resource. Operations management based solutions for extension of human resources' utilization levels may seem to increase productivity at first sight. However, heavy workloads and inadequately ergonomic working conditions can negatively influence health of the workers since the tasks in garment industry includes repetitive motions. Monotonous body postures during these motions negatively affect workers by causing work-related musculoskeletal disorders. Although companies may gain high efficiency by increasing utilization levels of workers, crucial health problems can occur in the long period if ergonomic conditions are not seriously taken into account. Furthermore, these problems not only cause work-related musculoskeletal disorders that result in high medical expenses for the company, but also employers will have to continue making a payment for the employees due to occupational health regulations. Therefore, employers must consider adequately safe and ergonomic conditions in the design of proper working environments.

The garment industry is usually accepted as a safe place for working compared to other industries. In this industry, the major risks generally do not arise from direct dangerous hazards, instead, the real risk is hidden in indirect hazards that affect over time due to repetitive jobs. The problems often begin as minor pains, but then they can turn into incapacitating disorders that affect daily life standards of the workers (Saravanan, 2011). Ergonomics aims to prevent these type of problems by controlling the risk factors such as vibration, repetition, working environment, force and posture prior to occurrence of disorders. Therefore, the number of ergonomics risk assessment studies in this industry is significantly increased in the recent decade (Gade, et al., 2015; Keawduangdee, et al., 2012; Koruca, 2011; Metgud, et al., 2008; Mungan & Yetiş, 2009; Parimalam, et al., 2006; Reinhold, et al., 2006; Sealetsa & Thatcher, 2011; Tompa, et al., 2013; Wu, et al., 2015).

In this study, risk assessment of garment industry workers is addressed with ergonomics aspects. A systematic ergonomics improvement regarding these risks that prevent workers from musculoskeletal disorders and help improvement to performance and productivity of workers. Rapid Entire

Body Assessment (REBA) method is used to evaluate operations and to determine the physical workload in a garment factory.
This paper is structured as follows. Section 2 introduces the methods for physical workload evaluation methods including REBA. Section 3 includes ergonomic risk assessment for thirteen different operations taken from a garment factory. Finally, Section 4 concludes the paper and present future research directions.

MATERIAL AND METHOD

Work-related musculoskeletal disorders cause expensive health care problems which result in the loss of income and productivity. Risk assessment of physical workloads may help to prevent development of disorders. Demand of repeating activities, workplace and environmental conditions affect the measurement process of physical workloads (Fallentin, et al., 2000).

Common methodological tools used to assess physical workload are JSI - the job strain index (Steven Moore & Garg, 1995), NIOSH - the National Institute for Occupational Safety and Health lifting equation (Waters, et al., 1993), REBA - the rapid entire body assessment (Hignett & McAtamney, 2000), RULA - the rapid upper limp assessment (McAtamney & Nigel Corlett, 1993); MAC - the manual handling assessment charts (Monnington, et al., 2003), OCRA - The concise exposure index (Occhipinti, 1998), OWAS - Ovako Working posture Assessment. System (Karhu, et al., 1977) and QEC - Quick Exposure Check (Li & Buckle, 1999). See David (2005) and Roman-Liu (2014) for detailed comparison of common physical workload assessment tools.

In this study, REBA method enables to analyze repetitive motions and various postures of workers. REBA is an observational methodology used to investigate risk levels of various postures by using aggregate position of the body (Hignett & McAtamney, 2000). Application of a basic REBA method is given as follows: observation of the worker, ergonomic analysis of workplace and working environment, calculation of neck, trunk and leg analysis scores as Score A, calculation of arm and wrist analysis as Score B, calculation of Score C by combining of Score A and Score B and calculating final REBA score between 1 and 15. Final REBA score allows to assess the risk level of the postures and determine actions required for the improvement of working conditions (Table 1) (Hignett & McAtamney, 2000; Polat, et al., 2015).

Table 1: Required actions for REBA scores

REBA Score	Risk Level	Action
1	Negligible	None necessary
2-3	Low	May be necessary
4-7	Medium	Necessary
8-10	High	Necessary soon
11-15	Very High	Necessary now

RESULTS AND DISCUSSIONS

In the content of this study, ergonomic risk assessment related to working postures of workers in garment industry are investigated in a factory that manufactures baby towels, bathrobes and sleeping bags. In this content, firstly, the data of work-related health problems that is logged by workplace doctor is examined. The data show that there is a significant increase in musculoskeletal disorders for the workers working in sewing, cutting, packaging, warehouse and packaging departments in the recent year. Thirteen problematic working areas are selected according to the suggestions of workplace doctor and experienced workers for investigation.

Then, the working environments are investigated and surveys are conducted. Additionally, video and photos from different angels are recorded in order to analyze working postures of the workers from these areas.

The assessment application from packaging department is explained in detail as an example of the process examined in the factory. There is a dynamic working environment in this department since the final operations including quality control, ironing, bagging and boxing of all products are executed. Boxing unit in this department is one of the selected problematic areas. In this unit, employees are not working in stable conditions, on the contrary, they have to walk between boxing areas and bagging bands, carry the products from the bands and bend down to place them to boxes. The noise in this section is reported as 65 decibels and the dust level is found to be lower compared to sewing and cutting departments. Although, lighting, temperature, humidity and thermal comfort levels are also in acceptable levels, working postures of the workers have to be analyzed with a risk assessment method before drawing a conclusion. Figure 1 shows the worker that is under REBA study as an example from this unit. See Hignett and McAtamney (2000) for the details of REBA scores calculation.

Figure 1: Boxing unit of packaging department

In order to determine Score A, trunk, neck and leg positions during the operations are analyzed. Truck position is scored as 4, neck position is scored as 2 and leg positions are scored as 3. These scores are used to calculate posture Score A as in Table 2. Posture Score A is found to be 7 for this worker. Since Force/Load score is 0, final Score A is determined as 7.

Table 2: Calculation of Score A

Table A		Neck score											
		1				2				3			
		Legs score				Legs score				Legs score			
		1	2	3	4	1	2	3	4	1	2	3	4
Trunk score	1	1	2	3	4	1	2	3	4	3	3	5	6
	2	2	3	4	5	3	4	5	6	4	5	6	7
	3	2	4	5	6	4	5	6	7	5	6	7	8
	4	3	5	6	7	5	6	7	8	6	7	8	9
	5	4	6	7	8	6	7	8	9	7	8	9	9

Then, upper arm, lower arm and wrist positions are investigated and scored according to Table 3. By using these sub-scores, posture score B is found to be 4. Since there is no additional coupling score, final Score B is calculated as 7.

Table 3: Calculation of Score B

Table B		Lower arm score					
		1			2		
		Wrist score			Wrist score		
		1	2	3	1	2	3
Upper arm score	1	1	2	2	1	2	3
	2	1	2	3	2	3	4
	3	3	4	5	4	5	5
	4	4	5	5	5	6	7
	5	6	7	8	7	8	8
	6	7	8	8	8	9	9

In order to calculate Score C, Score A and Score B are combined by using Table 4. Score C is calculated as 8 by using this table. Final REBA score is determined by using Score C and activity score is demonstrated in Figure 2.

Table 4: Calculation of Score C

Table C		Score B											
		1	2	3	4	5	6	7	8	9	10	11	12
Score A	1	1	1	1	2	3	3	4	5	6	7	7	7
	2	1	2	2	3	4	4	5	6	6	7	7	8
	3	2	3	3	3	4	5	6	7	7	8	8	8
	4	3	4	4	4	5	6	7	8	8	9	9	9
	5	4	4	4	5	6	7	8	8	9	9	9	9
	6	6	6	6	7	8	8	9	9	10	10	10	10
	7	7	7	7	8	9	9	9	10	10	11	11	11
	8	8	8	8	9	10	10	10	10	10	11	11	11
	9	9	9	9	10	10	10	11	11	11	12	12	12
	10	10	10	10	11	11	11	11	12	12	12	12	12
	11	11	11	11	11	12	12	12	12	12	12	12	12
	12	12	12	12	12	12	12	12	12	12	12	12	12

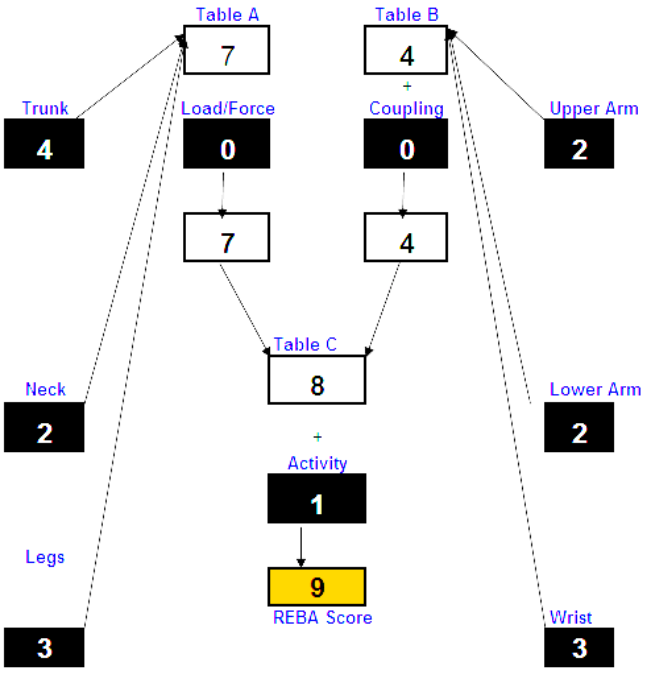

Figure 2: REBA assessment worksheet

Since the boxing operation is repeated more than four times in a minute, an additional activity score 1 is added and final REBA score is determined as 9 for this operation.
According to Table 1. this score points out high risk level. In this case, the management have to immediately investigate and implement improvements in order to prevent and reduce musculoskeletal disorders.

In short, 13 selected areas of saving, cutting, packaging and warehouse departments are analyzed and risk assessments are investigated by using REBA method. According to the results, the working environments, except sewing department, are generally found to be in acceptable levels. In sewing department, the noise is reported as 75 decibels in average that may cause problems to workers in long periods. Moreover, the dust levels are also reported as very high in this department compared to other departments, except cutting department. Analysis of REBA scores show that two of the areas are in low risk level, nine of them is in medium level, two of them is in high level and the finally the warehouse department indicates a very high level risk of injury. Especially high risk level areas require ergonomic implementations to reduce the risk factors that can be done via communication, eliminating excessive force and awkward posture requirements, ergonomic design factors, proper work techniques, job rotations, rest or stretch breaks, training and education.

CONCLUSIONS

Occupational health and safety practices require field observations which can be performed with the help of feedbacks received from workers and health statistics. In this study, the working environment and postures of garment workers are investigated in a textile factory. The ergonomic risk assessment of thirteen critical areas are analyzed by REBA method. The evaluation of the results show that almost quarter of the selected areas include high or very high risk levels which require immediate changes. The operations in these areas could cause serious physical disorders in a short period of time. Risk assessments can protect workers from significant work related musculoskeletal disorders and injuries which could be eliminated by ergonomic improvements. Future research studies may include comparison of alternative assessment methodologies such as OWAS and implementation of improvement suggestions with before/after analyzes.

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