Exposure Level of Ergonomic Risk Factors in Grocery Retail Industries

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Abstract: Generally, grocery retail work requires manual material handling tasks that Involve Ergonomic Risk Factors (ERFs) such as posture, repetition and movements. The aim of this study was to examine the level of Ergonomic Risk Factors (ERFs) among material handlers in grocery retail industries. This study was conducted by using two different types of tools which were Workplace Ergonomic Risk Assessment (WERA) and Rapid Entire Body Assessment (REBA) as a direction observation method. For WERA method, results showed most of them experienced high exposure level for leg and contact stress while for REBA method, results showed most of them experienced medium exposure level for upper arm and trunk. From the research conducted, MSDs and ERFs do related as it showed that musculoskeletal disorders may arise if the workers ignored the safety in ergonomic risk factors. Hence, some ergonomic improvements are needed in order to prevent workers from developing MSDs.

Key words: Musculoskeletal disorders, ergonomic risk factors, material handlers, grocery retail industries, WERA method, Malaysia

INTRODUCTION

Material handlers handle thousands of items each day to stock shelves, check groceries, decorate bakery items and prepare meat products (OSHA., 2004). In a study it was mentioned that the workers deal with too much physical work, heavy lifting, non-stop bending and twisting and bad work posture. These tasks involve several ergonomic risk factors which include force, repetition, awkward posture and static postures. Other studies also claimed that repetition, overload, awkward positions or some combinations are also some factors related to injuries of the human body (Rahman *et al.*, 2010, 2011). Usually, workers in supermarket usually perform lifting tasks in a period of time. This action directly contributes to the intensity of low back pain (Violante *et al.*, 2005).

In another work, meat cutter workers has been involve in awkward postures for a long period of time due to limit work space and hand tool design. These risk factors such as awkward postures, repetitive movements and forceful exertions must be identified immediately in order to prevent injury and plus to avoid decreased in productivity and quality of work (Mukhopadhyay and Khan, 2015).

In addition it was found that Latino poultry-processing workers have also acquire MSD due to awkward, repetitive postures (Grzywacz *et al.*, 2007, 2012) and working overtime (Schulz *et al.*, 2013). On the contrary, workers in wall plastering job in the construction industry also, acquired MSD due to high repetitive task in awkward work (Rahman *et al.*, 2012). The objectives of this study were to examine the level of ergonomic risk factor using Workplace Ergonomic Risk Assessment (WERA) and Rapid Entire Body Assessment (REBA) method as an observational method.

MATERIALS AND METHODS

Subjects and task descriptions: About 60 material handlers were subjected from five different grocery retail industries. In this research, the workers task which involves lifting, lowering, reaching, carrying, pushing and pulling was evaluated and the exposure level of ERFs is to be examined. Basically, direct observation method was used. The subjects were observed in their normal work conditions such as their postures, repetitive movements and forceful exertions and later were studied. The data from these observation were then used for postural analysis in assessing risk factors by using WERA and REBA method (Fig. 1 and 2).

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Fig. 1: Bending that involves awkward posture and awkward lifting

Fig. 2: Squatting and kneeling for a period of time, plus experience hand-arm vibration when pulling manual forklift

Workplace Ergonomic Risk Assessment (WERA): Workplace Ergonomic Risk Assessment (WERA) was developed to provide a method of screening the working task quickly for exposure to the physical risk factor associated with Work-related Musculoskeletal Disorder (WMSDs) (Rahman *et al.*, 2011). The WERA assessment consists six physical risk factors which were posture, repetition, forceful, vibration, contact stress and task duration.

In addition it also involves five main body regions which were shoulder, wrist, back, neck and leg. In this assessment, evaluation of the worker's work are based on scoring system and action levels and not to

mention, guidance is also provided to the level of risk and need for action to conduct more detailed assessments.

Rapid Entire Body Assessment (REBA): Dr. Sue Hignett and Dr. Lynn McAtamney, ergonomists from University of Nottingham in England developed the Rapid Entire Body Assessment (REBA). Basically, REBA was a postural targeting technique for estimating the risks of work-related entire body disorders (Hignett and McAtamney, 2000).

The assessment was on single page of worksheet and the evaluation was based on the required or selected body posture, forceful exertions, type of movement or action, repetition and coupling. In the REBA worksheet, the following body regions which were wrists, forearms, elbows, shoulders, neck, trunk, back, legs and knees will be evaluated based on a score.

Data collection: In this investigation, demographic data and a simple questionnaire has been distributed among the subjects as they help to determine the problems and symptoms for the workers. The data have been acquired direct observation using Workplace Ergonomic Risk Assessment (WERA) and Rapid Entire Body Assessment (REBA). The evaluation of ergonomic risk factors were based on the scoring system and exposure risk level.

Data analysis: Results of scoring system and exposure level were analyzed as mean, standard deviation and action level. The data collected through Workplace Ergonomic Risk Assessment (WERA) and Rapid Entire Body Assessment (REBA) were carried out using Statistical Package for the Social Science (SPSS) Software Version 22.0.

RESULTS AND DISCUSSION

Demographic data: It was observed that, the number of men working in grocery industries was more than women with a percentage of 76.7-23.4%. Mostly, the ages of workers working there were between 21-40 years old with a percentage of 96.7% which were quite young for material handler jobs while the age more than 41 was only 3.34%. The mean ages was 29.8 (SD = 5.25). This explains the high weekly working hours that was more than 51 h a week with a percentage of 70.0% whereas only 30.0% for working hours between 40-50 h a week. The mean of weekly working hours was 55.4 (SD = 4.07). Moreover, mostly their total years of working experience percentage was 93.3% which is between 1-5 years. Only 6.67% was

occupied by workers working with an experience above 6 years. The mean of total years of working experience is 2.76 (SD = 1.81) (Table 1).

Number of self-reported symptoms: Basically, men (n = 46) and women (n = 16) have different prevalence of musculoskeletal symptoms on different body region. The highest symptom affected to males was the lower back with a percentage of 89.1%, followed by upper back (67.4%) and neck (54.3%). While the lowest was the elbows with a percentage of 6.53%. As for females, the highest symptom affected was the lower back with a percentage of 85.7%, followed by upper back (71.4%), neck, shoulder and ankles/feet (50%). While the lowest was the elbows where none of them were affected (Fig. 3).

Exposure level participants for wera physical risk factors: The exposure level of participants for WERA physical risk factors were presented in Table 2. It is found out that contact stress relation with tool handle and posture had the highest mean score of 4.93 (SD = 0.84), followed by the leg relation with posture and duration had

a mean of 4.22 (SD = 0.88) which puts them at high exposure level. The lowest mean score was the vibration relation with posture with a mean of 3.15 (SD = 0.76) which put it in a medium exposure level.

Most of workers experienced high exposure level on contact stress and leg with a mean of 4.93 (SD = 0.84) and 4.22 (SD = 0.88) respectively. While the rest, shoulder, wrist, back, neck, forceful, vibration and task duration experienced medium exposure level with a mean of 3.88 (SD = 0.69), 3.53 (SD = 0.75), 3.88 (SD = 1.03), 3.58 (SD = 0.85), 3.27 (SD = 0.80), 3.15 (SD = 0.76) and 3.5 (SD = 0.62), respectively.

WERA final score: In summary, the highest risk level for WERA physical risk factors was the medium risk level with a percentage of (85.0%) which the task need further investigation and required changes, followed by low risk level (11.7%) and high risk level (3.3%) (Table 3).

Section A scores for neck, trunk and leg analysis: In Section A, the trunk had the highest troubled, followed by the legs and neck with a mean score of 2.73 (SD = 0.92), 1.85 (0.68) and 1.77 (SD = 0.46) respectively. The mean for the overall score in part. A was 4.48 (SD = 1.6103) (Table 4).

Section B scores for arm and wrist analysis: While in Section B, upper arm had the highest troubled with a mean score of 4.02 (SD = 0.54). As for the lower arm and wrists they had the same mean score which were 1.98 (SD = 0.29). The mean for the overall score in part B was 7.12 (SD = 0.92) (Table 5).

Reba final score: Overall, the mean REBA grand score was 8.27 (SD = 1.45) where the worker's postures were at high risk and need to be investigated and implemented changes (Table 6).

Table 1: Demographic data (n = 60)

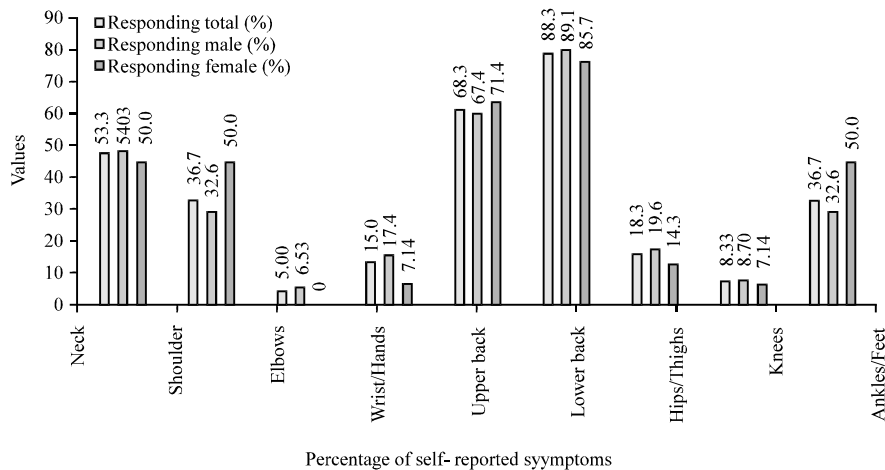| Characteristics	N	Percentage	Mean	SD
Gender				
Male	46	76.7	-	-
Female	14	23.4		
Age				
≥20	0	0	29.8	5.25
21-40	58	96.7		
≥41	2	3.34		
Working experience (Year)				
1-5	56	93.3	2.76	1.81
≥6	4	6.67		
Weekly working time (h)				
40-50	18	30.0	55.4	4.07
≥51	42	70.0		

Fig. 3: Percentage of self-reported symptoms

Table 2: Exposure level participants for WERA physical risk factors

Physical risk factors	Score		Exposure levels
	Mean	SD	
Shoulder	3.88	0.69	Medium
Wrist	3.53	0.75	Medium
Back	3.88	1.03	Medium
Neck	3.58	0.85	Medium
Leg	4.22	0.88	High
Forceful	3.27	0.80	Medium
Vibration	3.15	0.76	Medium
Contact stress	4.93	0.84	High
Task duration	3.47	0.62	Medium

Table 3: WERA final score

Final scores	Risk levels	Action	N	Percentage
18-27	Low	Task is acceptable	7	11.7
28-44	Medium	Task need further investigation and required changes	51	85.0
45-54	High	Task is not accepted, immediately change	2	3.3

Table 4: Section a scores for neck, trunk and leg analysis

Risk factors	Score mean	Score SD
Neck	1.77	0.46
Trunk	2.73	0.92
Legs	1.85	0.68
Posture A	4.38	1.65
Force/load	0.10	0.30
Final score part A	4.48	1.61

Table 5: Section B scores for arm and wrist analysis

Risk factors	Score mean	Score SD
Upper Arm	4.02	0.54
Lower Arm	1.98	0.29
Wrists	1.98	0.29
Posture B	6.12	0.92
Coupling	1.00	0.00
Final score part B	7.12	0.92

Table 6: REBA final score

Risk factors	Score mean	Score SD
Part A	4.48	1.61
Part B	7.12	0.92
REBA final score	8.27	1.45

This research aimed to identify the exposure of ergonomic risk factors among material handlers in grocery retail industries. By using WERA method, the highest score in exposure level was contact stress and leg. The reason contact stress has the highest score in exposure level was because that mostly the workers work with their bare hands. Material handler's tasks involve manual lifting, lowering, carrying, pushing and pulling loads (Deros *et al.*, 2015). The effects of local contact stress can be made worse if the hard object contacts an area with minimal protective tissue such as the wrist, palm or fingers (Trinkoff *et al.*, 2003). Other example is when pressure was applied repeatedly or held for a long time.

In addition, workers who work at such duration were exposed to leg pain (Messing *et al.*, 2006). A researcher explained that kneeling at high degree flexion which puts the workers in an uncomfortable position can affect the leg regions (Chung *et al.*, 2003). Basically, maintaining more than 2 can effect in almost any joint of the body and vary depending on body location (IOWA State University, 2013). Usually, back and leg pain were because of squatting and bending, especially, doing these actions for a period of time (OSHA., 2004). Besides that back pain injuries are faced by manufacturing industries due to mostly from also the same movement task which is manual handling task (Kadikon and Rahman, 2016).

In terms of REBA method, the trunk has the highest score in exposure level. The trunk shows the highest was most probably due to angle of trunk position where most workers bend their body up to 60°, especially when dealing with lifting objects on the floor (Clarke, 2003). In addition, the workers must deal with awkward posture while working, especially when they have to tilt the body to collect goods from the floor which high usage involvement of the upper limbs (Lasota, 2014). Trunk, upper extremities and lower extremities were the most common injured cases with a percentage of 35.0-30.0 and 22.0%, respectively. Besides that, leg was mostly categorized in risk level 3 with a percentage of 53.7% which puts them in low risk and some changes might be needed (Kee and Karwowski, 2007).

A researcher conducted a study and found out that the REBA final score of the workers were 11.0 where their actions were completely inappropriate and risk level was very high plus shall implemented changes (Lasota, 2014). This was because most of the worker's trunk body was bent forward up to or more 60°, especially when picking up goods from the pallets. A researcher predicted that trunk flexion of 40° forward can cause low back pain (Bovenzi *et al.*, 2006). To make matter worse, the workers have to tilt their neck forward at over 20° which could affect the neck (Lasota, 2014). Moreover, the lower limbs were improper due to the standing nature of the work while the upper limbs were regularly raised.

CONCLUSION

The objective of the study has been achieved. Most of the workers experienced high exposure level mainly from leg and contact stress physical risk factors. In addition, the trunk and upper arm showed that most of them experienced these risk factors which put them into the medium to high risk. This should be investigated and implemented changes.

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