ORIGINAL ARTICLE

MULTIPLE ERGONOMIC ASSESSMENTS ANALYSIS ON DISTRIBUTION WORKERS AT PRINTING INDUSTRY

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ABSTRACT

Number of accident cases reported to the Malaysian Social Security Organization (SOCSO) which are related to the number of diseases of musculoskeletal system and connective tissue is increasing rapidly since 2013 to 2017 where most of the accident cases reported comes from the manufacturing industry. Work related musculoskeletal disorder (WMSD) often happens among the workers due to manual material handling (MMH) while performing their everyday working task. The workers in printing and publishing industries especially in distribution section are exposed to risk of getting WMSD diseases. This is because every worker in the distribution section needs to perform MMH tasks such as lifting, bending, twisting, pulling, and pushing which involves repetitive motion. The objective of this study is to investigate the prevalence of musculoskeletal disorders diseases among the distribution workers by using multiple ergonomic assessment analysis such as Nordic Discomfort Questionnaire, Quick Exposure Check (QEC) Questionnaire and REBA Analysis. The results from Nordic Discomfort Questionnaire indicates that majority of the workers experienced discomfort on their upper back, lower back, hips and knee. Meanwhile, QEC Questionnaire shows that high exposure risk on the lower back among workers which are in the group age of 31-40 years old. Lastly, REBA Analysis shows that necessary or immediate changes needs to be take on two of the chosen working postures in order to prevent from much serious WMSD developing in future among the workers. Improvement or mitigation related to the design of the workstation might reduce the development of WMSD among the workers and further reduce the risky awkward postures performed by the workers which will indirectly increase the performance of the worker and increase the productivity level of the company.

Keywords: *WMSD, MMH, REBA, Nordic, QEC*

INTRODUCTION

According to Malaysia Social Security Organization (SOSCO, 2017), the number of diseases of musculoskeletal system and connective tissue cases reported in 2017 increases nearly 78% since 2013 as shown in Figure 1. The manufacturing industries showed the highest accident cases reported compared to other industries in 2017 where there are 16589 accidents were reported to SOCSO and the numbers are also increasing since 2013 as referred to Figure 2. Furthermore, it is the same as the number of cases reported due to manual material handling (MMH) activities that occurred in their daily routine such as strenuous movement and over-exertion in lifting, pushing, pulling, handling or throwing objects are also increasing as in Figure 3. Mostly, the accident cases reported were contributed by industries related to printing and publishing. MMH is very synonym in printing industry since the newspaper and magazine bundles need to be handle manually by workers during production, distribution and sales activity. Incorrect MMH activities are possible risks on lower back pain as well as other work-related musculoskeletal disorders (WMSDs) for example, overexertion in MMH activities can affect the workers in long or short-term duration, which very much depends on the intensity of the activity and physical capabilities of the workers (Nag, 2000). The short-term effects might include sprain or muscle fatigue while the long-term effects might include low-back pain and accelerated disc degeneration.

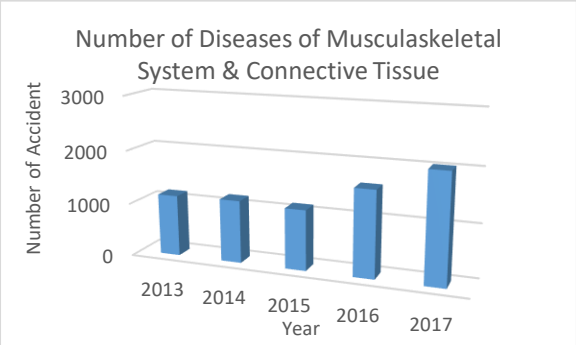

Fig. 1 Number of Diseases of Musculoskeletal System & Connective Tissue Cases Reported

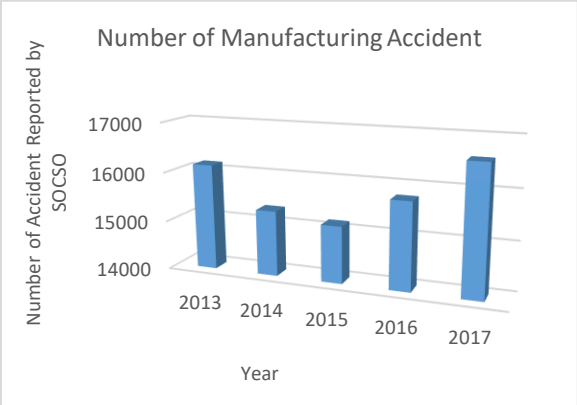

Fig. 2 Number of Accident Cases Occurred in Manufacturing Industry Reported by SOCSO

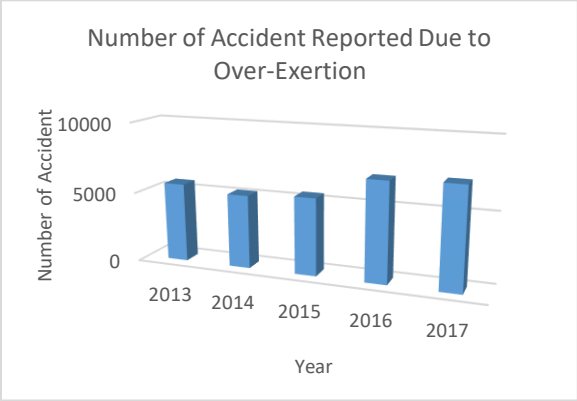

Fig. 3 Number of Accident Cases Reported Due to Over-Exertion

The major problem in many industrialized countries is developed by WMSDs (Hagberg et. al, 1995) and many studies and researches have found yet proved that WMSD is common in the current industry (Kaka et.al, 2016; Karimi et.al, 2016; Yu et.al, 2012; Lu et.al, 2016; Fredriksson et.al, 2001). Another studies state that WMSD is responsible for pain, disability, absenteeism, reduced productivity, and heavy financial costs among workers worldwide plus, serious injuries in the musculoskeletal system can be develop because of the potential of WMSD and if it is to be ignore (Kaka et.al, 2016). The increasing problem of WMSD will affects employee, employer and even the government especially in terms of performance and productivity mostly because of the increase in number of sick leave applied by the employee due to lower back complaints (Bidiawati & Suryani, 2015).

In United Kingdom in year 2009 until 2010, there were just over 560 accidents reported under RIDDOR for the printing industry where MMH leads the chart with highest percentage which is 27% when compared with other accident (HSE, 2016) and MMH task is proven to co-exist with WMSD. Unfortunately there are not many research done on printing industry in Malaysia which are related to MMH and WMSD. Thus, the objective of this study is to investigate the prevalence of WMSD among the distribution workers in a local newspaper company which is responsible for printing and distributing newspaper in West Malaysia using Nordic Discomfort Questionnaire, Quick Exposure Check (QEC) Questionnaire and Rapid Entire Body Assessment (REBA) Analysis.

METHODOLOGY

Participants

The workers consist of 12 males and 1 of them is a foreign worker where all of them are working in the distribution department and aged between 20 until 52 years old. The workers have been working in the company for about 12 years in average and they work for about 25 days per month. This study is focusing on distribution worker since MMH mostly takes place in the distribution department where the workers need to load and unload the newspaper manually from the stacker machine, a machine that arrange the newspaper according to order unit, to the trolleys. They need to load and unload around 30000 pieces of newspaper that weights about 8kg per stacks that comes out from the stacker machine and load it onto the trolley every morning and the working process is as shown in Figure 4. The trolleys' height is about 1.6m and it has 4 compartments with each of it having the same dimension as the newspaper as shown in Figure 5. The types of MMH involve during the activity including bending, lifting, twisting and repetitive motion. Ergonomics assessment tools such as the Nordic questionnaire, QEC and REBA analysis will be used to analyse the MMH activities perform by the distribution workers.

Fig. 5 Working Process of Distribution Workers

Fig. 5 The Trolley Used for Distribution Work

Ergonomic Assessments

Nordic Discomfort Survey

Nordic Musculoskeletal questionnaire are conducted on all the distributions workers where this questionnaire helped to identify areas of the body causing musculoskeletal problems (Hedge et.al, 1999). The questionnaire used is for standing male worker and it consist of 12 body part from head to the foot. The questionnaire focuses on the body parts that the worker frequently felt pain or no pain over the past 4 weeks and most recently. This questionnaire provided useful and reliable information on musculoskeletal symptoms in occupational health practice (Kuorinka, 1987).

Quick Exposure Check (QEC) questionnaire

Quick Exposure Check (QEC) survey is used to assess the changes in exposure to musculoskeletal risk factors of the back, shoulders and arms, hands and wrists, and neck (David et. Al, 2008). It involved the practitioner which was the observer who conducted the assessment and the worker who has direct experience of the MMH tasks. This questionnaire are being carried out on 4 different age groups which are 20-29 years old, 30-39 years old, 40-49 years old and above 50 years old as it is the only reasonable aspect that can differentiate between the workers.

Rapid Entire Body Assessment (REBA) Analysis

Rapid Entire Body Assessment (REBA) analysis is used to identify the risk level and to evaluate the final score of the working posture of the distribution workers (Hignett & McAtamney, 2000). The REBA analysis was choosen because this analysis evaluates the entire posture of the workers. One representative from each age group were chosen to be evaluated using this assessment and there are 5 different postures that are being analyse using this assessment. 4 from 12 workers were chosen to be the candidates for this study, and they represented 4 age groups which are 20-29 years old, 30-39 years old, 40-49 years old and above 50 years old. The candidates performed their working routine and the score are being given based on trunk, neck and legs postures are represented in Table A while upper arms, lower arms and wrist postures represented the score for Table B. Next the score were added together with the load/force and coupling factors to get the score for Table C. Finally score from Table C was added with activity score and the final score for REBA obtained Figure 6.

REBA Score	Risks Level	Action Needed
1	Safe	Not necessary
2-3	Low	Can be necessary
4-7	Medium	It is necessary
8-10	High	It is necessary soon
11-15	Very High	It is urgent

Fig. 6 REBA Score and Its Risk Level Chart

RESULT

Nordic Discomfort Survey

Based on the data obtained, Figure 7 showed the number of workers and the frequency of them experiencing discomforts, pains and aches on certain body parts. It can be seen that majority of the workers experienced discomforts, pains and aches at least 1-2 times since the last week they work. They experienced most of discomforts,pains and aches especially on the neck, upper back, lower back, hips/buttocks and both knees. Furthermore, among all 12 body parts, lower back showed the highest percentage in moderately uncomfortable with 25%, 50% of the workers felt slightly uncomfortable and 25% of them did not experienced any uncomfortable as shown in Figure 8.

Next, both knees, neck, both shoulders, both fingers and thighs showed the second highest percentage in moderately uncomfortable with 8%. However, knees showed the highest percentage in slightly comfortable with 67% when compared to other body parts, while neck only showed 42% and both fingers and thighs only showed 17%. The remaining of the workers did not experienced any uncomfortable and pain on these body parts. Lastly, upper back, upper arms, lower legs and forearm did not give any moderate uncomfortable experiences to the workers. However, on the upper back, the percentage of slightly comfortable is quite high with 50% followed by upper arms, lower legs with 17% and lastly forearm with only 8%. The remaining of the workers did not experienced any uncomfortable and pain on these body parts.

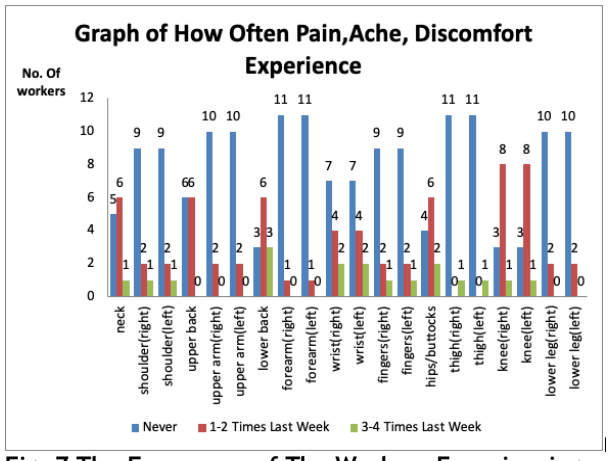

Fig. 7 The Frequency of The Workers Experiencing Pain, Aches and Discomfort on Their Body Part

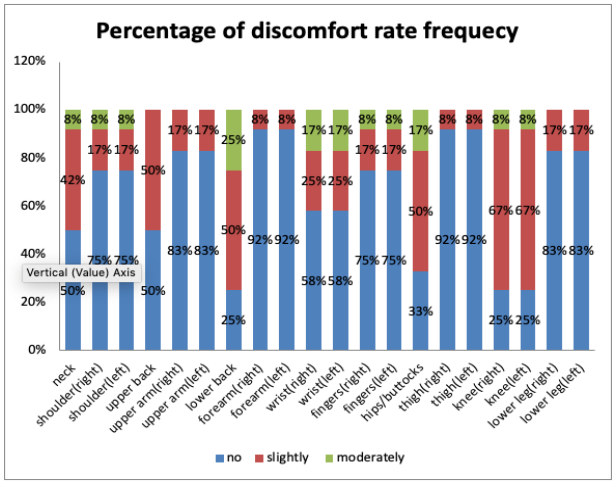

Fig 8. Percentage of Discomfort Rate Frequency on Workers Body Part

Quick Exposure Check (QEC) questionnaire

While conducting the Quick Exposure Check (QEC) Questionnaire, the workers were divided into 5 different age groups which are below 18 years old, 20-29 years old, 30-39 years old, 40-49 years old and above 50 years old. However, there are no workers aged below 18 years old thus there will be only 4 age groups. To identify the exposure level among the workers, Table 2 will be served as a guideline to be compared with the scores which will be obtained later. The result showed the activity transferring the newspaper from the stacker machine to the trolley was giving moderate risk to the workers' body parts which are back, shoulder/arm, wrist/hand and neck and this is applied to all age groups since their task is the same as shown in Figure 9.

Table. 2 QEC Guidelines for Exposure Levels

Exposure Levels for Body Parts				
Score	**Low**	**Moderate**	**High**	**Very High**
Back (Static)	8-15	16-22	23-29	29-40
Back (Moving)	10-20	21-30	31-40	41-56
Shoulder/arm	10-20	21-30	31-40	41-56
Wrist/hand	10-20	21-30	31-40	41-56
Neck	4-6	8-10	12-14	16-18
Exposure Levels for Environment and Organizational Factors				
Driving	1	4	9	-
Vibration	1	4	9	-
Work pace	1	4	9	-
Stress	1	4	9	16

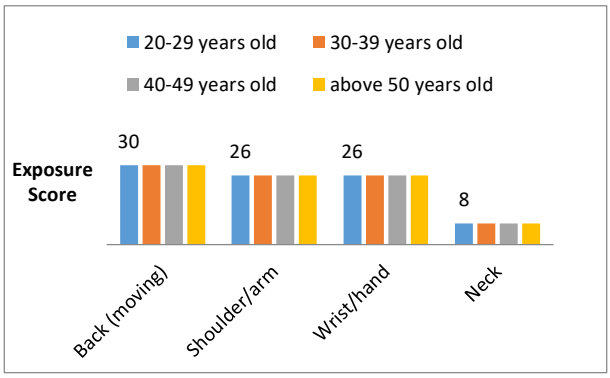

Fig. 9 Exposure Level of Body Parts

Meanwhile, exposure levels for environment and organizational factors, the results are shown in Figure 10. Only work pace showed moderate risk to age group 30-39 years and above 50 years old while the rest showed low risk to all age groups.

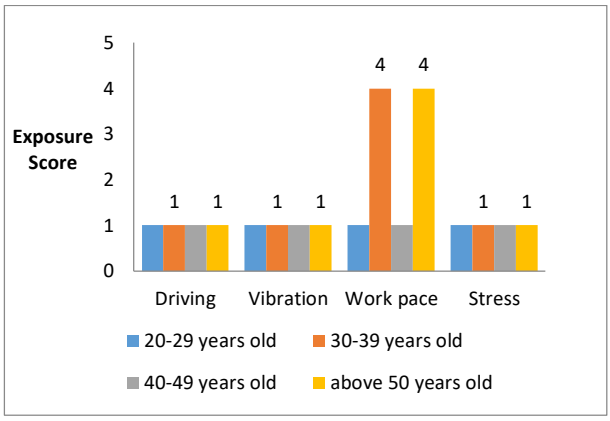

Fig. 10 Exposure Level for Environment and Organizational Factors

Rapid Entire Body Assessment (REBA) Analysis

REBA Analysis was conducted to analyse the risk level and the action needed to be taken for the working flow of MMH performed by the distribution workers. One representative from each age groups, 20-29 years old, 30-39 years old, 40-49 years old and above 50 years old, were chosen to be analysed. After the final REBA score of the working posture was obtained, the risks level and action that needed to be taken according to the REBA score can be determined using the given indicator as shown in Figure 11.

REBA Score	Risks Level	Action Needed
1	Safe	Not necessary
2-3	Low	Can be necessary
4-7	Medium	It is necessary
8-10	High	It is necessary soon
11-15	Very High	It is urgent

Fig. 11 REBA Score and Its Risk Level

The workers were evaluated with 5 different working postures that were chosen including loading postures, that can be separated into another 3 different postures which are loading on the lowest part trolley, loading on waist level and loading on highest part of the trolley. Table 3 shows the summary of the REBA analysis for all age groups and it can be seen that loading postures on lowest level and highest level gives the highest REBA score among the 5 postures. Hence, necessary interventions or changes must be taken especially on these two postures since they give high risk level onto the workers. Intervention such as proper training on MMH or workstation redesigned is highly recommended and might be effective to reduce the risk of these postures. Other postures showed medium risk with necessary action should be taken in order to reduce the risk are very much encouraged.

Table 3. Summary of REBA Analysis

Posture	Activity	Average REBA Score	Risk Level and Action
	Grab and starting to lift the newspaper Body almost neutral	6	Medium, Necessary
	Carrying the load Body twisting	7	Medium, Necessary
	Trunk bend more than 60º to put the load at lowest level Side bending	10	High, Necessary soon
	Body twisting to put the load at the middle.	6	Medium, Necessary
	Body reaching to put the load at highest level.	8	High, Necessary Soon

DISCUSSION

Result obtained, showed that the workers performed MMH every day as their working routine. The MMH that are involved such as lifting, bending, twisting, carrying and repetition movements are risky to the workers which might further exposed the workers with musculoskeletal disorders. Based on REBA analysis done, it is proven that all related postures are giving at least medium risk to the workers and necessary action should be taken to reduce the risk and the most risky posture is during bending when the workers ha to put the newspaper on the lowest part of the trolley. What worsen the condition is the poorly designed workstation that also contributed to the increasing risk of getting musculoskeletal disorder.It is clear that the problems occured is mainly due to the trolleys that is being designed to be too tall where the workers had to reach out to put the 8kg of newspaper at the highest level or bend too low to put the same weight of newspaper when the trolley are empty and the workers had to repeat this for multiple times until they are done. Intervention needs to be implemented so that the workers would have less risks of getting WMSD in near future which might effect the companys productivity rate. Among the ideas that can be considered is by using a portable slider made of roller which is about the height of the workers waist so that they can just push the newspaper stack on the roller and let it fall onto the trolley. This intervention might reduce the act of reaching, twisting and bending postures among the workers.

CONCLUSION

This study showed that most of the workers experienced discomfort on the neck, upper back, lower back, hips/buttock and knees. Moreover, the most frequent body parts that experienced discomfort are on the lower back, wrist, hips/buttock and knees. The results are supported with the Nordic questionnaire, QEC questionnaire and REBA analysis which showed that exposure score for all body parts are moderate, and this is applied to all age groups. Thus, the purpose of this study is achieved because WMSD were proven to exists among the printing industries distribution workers who perform MMH. It is clear that actions needs to be taken immediately on some of the postures performed by the workers while they are doing their routine working flow in order to lower the risk. Further study should and intervention needs to be taken on the design of the workstation of the distribution workers to make it more reliable and easier for the workers to work without the concern of developing WMSD while working and at the same time can avoid hazardous postures that could lead to musculoskeletal disorders.

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