ORIGINAL ARTICLE

INITIAL ERGONOMIC RISK ASSESSMENT ON UNROLLING AND ROLLING FIRE HOSE ACTIVITY AMONG FIREFIGHTERS AT PUTRAJAYA FIRE AND RESCUE STATION

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ABSTRACT

The purpose of this study is to identify the prevalence of Musculoskeletal Disorders (MSDs) for the activity of unrolling and rolling fire hose with manual handling before and after the fire-fighting operation and make an initial assessment to determine the level of ergonomic risk exposure faced by the firefighters in the cause of their work. A total of thirty (30) respondents comprising firefighters at the Putrajaya Fire and Rescue Station were involved in this study. Data were collected through interviews using the Cornell Musculoskeletal Questionnaire (CMQ), individual posture assessment using an Initial Ergonomic Risk Assessment Form as stated in the Workplace Ergonomic Risk Assessment Guidelines 2017, and field observation by recording the videos and pictures with some inputs added from the management. The results of the study revealed that 70% of the respondents suffered discomfort at the shoulder, 70% at the upper arm, 63% at the thigh, 76% at the knee, and 90% at the lower back. This result also shows that the ergonomic risk for that activity is contributing to the discomfort and pain of the firefighters. Preventive measures are needed to avoid problems in the future such as job rotation, fitness program and so on. In conclusion, the current unrolling and rolling fire hose activity among firefighters create various health and safety risks including ergonomic risks. This is because the activity involves manually lifting, lowering and awkward postures which lead to lower back pain. If the activity is not improved and no immediate intervention is implemented, the risk of MSDs will increase. In order to reduce the level of ergonomic risk exposure, top management of Malaysia Fire and Rescue Department is suggested to provide full cooperation and support to the formulated recommended actions.

Keywords: Ergonomic risk assessment; musculoskeletal disorders; unrolling and rolling fire hose activity; Malaysian firefighters

INTRODUCTION

Ergonomics is a combination of the words ergo, a Greek word meaning “work” and nomics, meaning “study”- the study of work (Te-Hsin & Kleiner, 2001). Ergonomics is, therefore a study of human capabilities relating to work demands. Ergonomics studies work, as it relates to the human body and its limits. The most prevalent ergonomic related injuries are musculoskeletal, either from repetition, overload, awkward positions or some combination. Presumably, injuries could be a reason affecting workers performance (Vieira et al., 2007).

A Musculoskeletal Disorder (MSDs) is one of the most common occupational health problems. Besides, MSDs include injuries affecting muscles, tendons, ligaments, joints, nerves, and blood vessels (Christopher & Undoing, 2014). Besides that, MSDs are disorders and injuries that affect the human body’s movement or musculoskeletal systems. It can be defined by impairments of body structures such as muscles, joints, tendons, ligaments, nerves, bones and the localized blood circulation system, caused or aggravated primarily by work itself or by the work environment (Nunes, 2009).

This study was conducted to obtain the necessary information especially in the context of Malaysian firefighters. No official study has been carried out focusing on MSDs symptoms among firefighters in Malaysia and the firefighting operations particularly. In the research context, only a few published studies exist on firefighters’ musculoskeletal disorders and due to the universal nature of firefighting, there is an emerging need for scientific studies on the health effects of the job (Lusa et al., 2015).

According to the observation and verbal feedback from firefighters at Putrajaya Fire and Rescue Station, it was found that unrolling and rolling fire hose task may cause firefighters to be exposed in the risk of an illness related to ergonomic problems such as back pain and fatigue. This work task also commonly takes time and use a lot of firefighter’s energy. There are four (4) steps in unroll and roll fire hose activity which lead to giving impact on firefighter’s ergonomics which are unrolling fire hose, extinguishing the fire, draining out water from the fire hose and rolling fire hose. All these steps are currently done manually with no suitable mechanical tools at this time to help firefighters complete the task.

All these employees are working in the most critical and dangerous area or situation and any decrease in performance, as well as a loss of workdays, will certainly make an impact on the firefighting operations. Ergonomic hazard sometimes can be difficult to trace and detect and it can appear in various forms such as repetitive movement, prolonged sitting, awkward posture and many others (Vieira & Kumar, 2007; Rahman, Aziz, & Yusuff, 2009; Bahardin, & Rahman, 2018). The employees might think that the lower body pain they feel comes from the ageing of the body and awkward postures activity they endured at home. They fail to realize that the factors might come from the way they executing their daily work activities. This might be due to a lack of awareness in the knowledge of the ergonomic hazard (Shamen et al, 2001; Bahardin & Rahman, 2018). Besides, MSDs occur when body is in the wrong postures. Furthermore, the lack of devices to aid the employees can worsen the wrong postures during work (Jaffar et al., 2011; Lop et al., 2017).

The main routine by the firefighters after firefighting operation is to roll the fire hose used. Usually, the hose will be stretched on the ground and firefighters will roll up the hose manually in forwarding bending body position. The impact of the bending body position has revealed that those involved are at a risk for ergonomic-related illnesses such as back pain and fatigue. Bone disease has also been confirmed by the World Health Organization (2013) that back pain occurs to adults between the ages of 35 and 55 years old and the biggest cause is lifting heavy loads during work. Added information, the length of a fire hose used is 100 feet or 30 meters with a net weight of 15 kilograms. However, the fire hose weight will be increased to 18 kilograms when the water pressure is 7 bars and could increase to 25 kilograms and more when the water pressure is 10 bars and above.

Thus, the aim of this study was to determine the prevalence of MSDs and to make an initial assessment of the level of ergonomic risk exposure faced by firefighters in the cause of their work.

METHODS

Respondents were specifically chosen based on their function as a firefighter at Putrajaya Fire and Rescue Station. Data were collected through work area observation, non-structured interview, assessment using Cornell Musculoskeletal Questionnaire (CMQ), individual posture and work method evaluation using checklist and form in the Guidelines of Ergonomic Risk Assessment at Workplace 2017 as well as input from the management. The questionnaire was distributed to participated firefighters on three (3) working shifts with a total of 30 firefighters volunteered to take part in this research as respondents. Respondents were asked to answer all questions as stated in the CMQ and the musculoskeletal discomfort survey section. The CMQ was chosen as the questionnaire for this study because the standardisation in CMQ can help in the analysis and recording of the musculoskeletal symptoms. The next stage is to observe the actual on-site work activity by recording the videos and pictures in order to identify all normal body-posture deviations.

In order to carry out the study, several instruments, materials and facilities were used to obtain the required results such as video audio, camera, checklist and evaluation form from the ERA Guidelines 2017. In addition, the study also uses a laptop, fire hose and Fire Rescue Tender (FRT) at Putrajaya Fire and Rescue Station.

RESULTS

Cornell Musculoskeletal Pain Self-Assessment survey is one of the preferred methods used during the research in order to identify the parts or area of the body which experiencing discomfort or pain. The firefighters are required to answer a set of questions based on symptoms experience involving parts of their body. There are fourteen (14) body parts has been used to identify the discomfort or pain. All the information collected been analysed and showed that five (5) part of the body experienced discomfort with the highest frequency from the activity of unrolling and rolling fire hose.

According to the Guidelines of Ergonomic Risk Assessment 2017 (DOSH, 2017) there are nine (9) ergonomic risk factors stated. Every initial ergonomic risk assessment needs to consider all factors involved and makes judgments or assessment based on the relevant information only. The nine (9) ergonomic risk factors are awkward posture, static and sustained work posture, forceful exertion, repetition, vibration, lighting, temperature, ventilation and noise.

Based on this study, results from the initial ergonomic risk assessment showed that awkward posture is the main factor which contributes to back pain problems as complained by firefighters involved. From Table 1, the results show that 70% of the firefighters feel pain at the shoulder, 70% at the upper arm, 63% at the thigh, 76% at the knee and 90% at the lower back. These are the body areas which recorded the pain experienced by the 30 firefighters from

Putrajaya Fire and Rescue Station. From Table 2, the results of initial ERA also show that awkward postures were score is 6 (YES) but do not need to do advance ERA because each work activities take less than 2 hours per day.

Table 1 Distribution of MSDs Prevalence by Body Parts

Experience Ache/Pain/Discomfort	n	%
Shoulder	21	70%
Upper Arm	21	70%
Thigh	19	63%
Knee	23	76%
Lower Back	27	90%

Table 2 Task Activities and Ergonomic Risk Factors

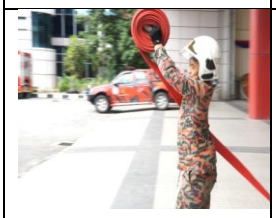
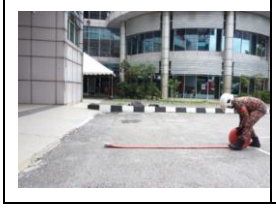
Images	Task Description	Ergonomic Risk Factor
	Unrolling fire hose	Awkward postures by lifting 15 kg fire hose with arms and elbow lifted above shoulders and extended forward create discomfort to shoulders and upper arms.
	Draining of water from the hose	Awkward postures by lifting fire hose from end to end with wrist flexion bend backwards, arms, elbow and shoulder lifted creates discomfort to shoulders and wrist.
 	Rolling fire hose	Awkward postures working in squat position and back bent forward to roll fire hose on the ground manually creates discomfort to thigh, knee and lower back.

Table 3 Results of Initial Ergonomic Risk Assessment (ERA)

A Risk Factors	B Total Score	C Min Requirement for Advanced ERA	D Result of initial ERA	E Any Pain or Discomfort due to risk factors as found in Musculoskeletal Assessment (refer Part 3.1) (Yes/No)	F Need Advanced ERA? (Yes/No)
Awkward Postures	13	≥6	6	*If YES, please tick (/) which part of the body*	NO
Static & Sustained Work Posture	3	≥1	0		NO
Forceful Exertion	7	1	0		NO
Repetition	5	≥1	0		NO
Vibration	4	≥1	0		NO
Lighting	1	1	0		NO
Temperature	1	1	0		NO
Ventilation	1	1	0		NO
Noise	2	≥1	0		NO

Neck	
Shoulder	/
Upper back	
Upper arm	/
Lower back	/
Forearm	
Wrist	
Hand	
Hip/butt ocks	
Thigh	/
Knee	/
Lower leg	
Feet	

From Table 1 and 2, it shows that the most common complaint of discomforts from the firefighters is on the lower back with a percentage of 90%, the knee of 76% and shoulder together with the upper arm of 70%. These MSD complaints are part of health-related complaint arises in firefighting services whose works are mostly dealing with lifting and bending (awkward posture) causing MSDs to occur. The way of work and equipment used also influences MSDs risk for firefighters. To overcome MSDs complaint, it is necessary to prevent and minimize the occurrence of MSDs in firefighters by providing tools that are appropriate to their work, especially for manual handling works that require a large force to lift, lower and awkward postures such as squat and back bent. This is very important because for a continuous work involved with lifting, lowering, squatting and back bent even if it is dynamic but always followed by fatigue which can then become MSDs. There are numbers of ergonomic principles that can be applied to prevent and resolve risks including ergonomic work processes lifting, lowering, squatting and back bent. MSD levels from the lowest to the heavy will interfere with the concentration in work, causing fatigue and ultimately will decrease productivity and work efficiency.

CONCLUSION

In conclusion, the current unrolling and rolling fire hose activity among firefighters in Putrajaya Fire and Rescue Station create various health and safety risks including ergonomic risks. This is because the activity involves manually lifting, lowering and

awkward postures which lead to lower back pain. If the activity is not improved and no immediate intervention is implemented, the risk of MSD will increase for the firefighters. To reduce the level of ergonomic risk exposure, top management of Malaysia Fire and Rescue Department is suggested to provide full cooperation and support to recommended actions formulated. Preventive measures are needed to avoid problems in the future such as job rotation, fitness programs and introduce a mechanical tool to reduce a problem. The significant association between ergonomic risk levels and working performance specified that the higher-level exposure of ergonomic risks will be reducing firefighter's motivation to work and jeopardizing the service quality. Poor working performances will most likely affect both the top management and the firefighters. Therefore, top management and firefighters must embark in determining ways and solutions to find the best ergonomic approach to improve this condition. One of the best suggested is by providing sufficient equipment and tools such as fire hose roller which also can lead the job activity easier and faster.

COMPETING INTERESTS

There is no conflict of interest.

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