

ORIGINAL ARTICLE

INVESTIGATING ERGONOMICS RISKS IN SYNTHETIC GLOVES PACKAGING WORKSTATION

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ABSTRACT

This paper is investigating the ergonomics risks in the workstation of synthetic gloves production floor. These synthetic gloves are used for medical and healthcare purposes. The methods of Ergonomics Risk Assessment (ERA), Rapid Upper Limb Assessment (RULA), Rapid Entire Body Assessment (REBA) and Occupational Repetitive Assessment (OCRA) were applied to identify the problem of workstation and operator. The results show that the initial ERA assessment support for further investigation on static, sustained and repetitive risk while the average score of RULA, REBA and OCRA is 6,7 and 19.4 respectively. These results will be translated into measurable design parameters in the improvement design of synthetic gloves production workstation.

Keywords: *Standing posture, ERA, REBA, OCRA*

INTRODUCTION

Synthetic gloves are used in many applications i.e. healthcare, food processing and services, automotive, construction, chemical industries etc. which is the main usage is for hand protective purposes during conducting the activities. In the past decade, there has been an increase in the use of synthetic gloves especially for the elder people, change in healthcare reforms, the emergence of new healthcare threats and clean room manufacturing, which has led to a steady growth in the industry.

It is difficult to search the existing research regarding ergonomics study in gloves packaging workstation. However, similar studies can be reviewed as study motivation and references such as (Deros et al., 2013; Lasota, 2015; Malhotra, Bhatnagar, & Chauhan, 2018; Md Deros, Senin, & Khamis, 2013; Mossink, 1990). An ergonomics intervention was proposed by (Mossink, 1990) for minimizing the low back pain and pain in arm and shoulder are among operators in tobacco packaging department. Then, a study had been conducted by (Lasota, 2015) relating MSDs in a sequential packaging of furniture packaging and the analysis of risk factors. The main risk factors influenced the negative evaluations were insufficient number of breaks, preventing the staff from getting sufficient rest and a short cycle i.e. less than 15 seconds due to the pace forced by the conveyor belt. Next, a proper workplace layout for food grain packaging production was proposed by (Malhotra et al., 2018) after

studying the ergonomics issues in the packaging workstation. Next, a study conducted by (Deros BM, Khamis NK, Ghani JA, 2013) was to identify risks and body parts that received high number of complaints in regarding to standing workstation in electronic manufactures in Malaysia. The study reported that the common risks for standing working position were awkward posture, contact stress, wrist, and static posture, fatigue, twisting of the spine, bending, too far and not reachable. In addition, three body parts i.e. shoulder ankle or feet and neck received 53% of total complaints in terms of pain and un-comfortableness. Next, (Md Deros et al., 2013) examined female operators' effectiveness at standing workstations during assembling different components and parts for making electronic product. The study found that three major types of MSDs were observed in the standing workstations which were pain at the shoulder region, leg region and upper back region. Based on the existing reviewed studies, there were enough evidences to motivate this study to investigate the initial ergonomics risks among operators in the synthetic gloves packaging workstation in relation to standing posture.

This study emphasizes the repetitive motion and static and sustained posture investigation among operators in glove packaging workstations. This is because the operators in the department work in standing and static posture in their shift hours. In addition, the operators also conducting standing operation with high repetitive hand movement in order to fulfil the high target of glove production.

STATE OF THE ART

Standing workstation becomes normal practice in the production floor nowadays due to its positive impact to the operators' performance and productivity. However, there is a negative implication that standing workstation can cause discomfort to body muscles compared to sitting workstation Deros et al., (2013). Inappropriate workstation design will contribute to static and sustained working posture.

Standing while conducting different operational tasks can be classified based on leg movements such as dynamic (continuous movement), static (less or no leg movement) or combination of both actions (Deros BM, Khamis NK, Ghani JA, 2013). In prolonged standing condition; a stationary position means doing work without much leg movements due to the nature of work. In this type of work, most of worker's body weight is supported by the lower limb and large muscle trunk (Deros BM, Khamis NK, Ghani JA, 2013). Therefore, the musculoskeletal disorder (MSDs) symptom possibly occurs in related body area such as legs.

Investigation tools in ergonomics examines the interaction between human physical, behavioural, psychological, and physiological with his daily or working environment (Jaffar N, Abdul-Tharim AH, Mohd-Kamar IF, 2011). Ergonomics knowledge and practice is becoming more important in the industry 4.0 because it is proven to be an important factor in increasing the production efficiency and productivity (Tee et al., 2017). The work task requirements should not exceed the capacity and limitations of operators to ensure that they are not exposed to working hazards which contributing to safety risk, health issues and decrease the productivity in the industry (Kolgiri, Hiremath, & Bansode, 2016).

In general, there are several factors that contribute to MSD symptoms i.e. awkward posture, static and sustained work posture, forceful exertion, repetitive motion, hands-arm and whole-body vibration. Working environment may also lead to presence of ergonomics risk factors i.e. lighting, extreme temperature, ventilation and noise. MSDs will occur among the workers who are spending more than half of their working hours by doing repetitive motion or task in awkward or static work posture. As a result, they will experience a variety of MSDs symptoms such as pain related to the neck, shoulder, elbows, hands, fingers, hip and knees part (Abdol Rahman, Masood, & Hassan, 2017). Thus, in order to minimize or eliminate the MSDs, Ergonomic Risk Assessment (ERA) (Abdullah, Othman, & Awang, 2017), Rapid Upper Limb Assessment (RULA) (Lasota, 2015), Rapid Entire Body Assessment

(REBA) (Tee et al., 2017) and Occupational Repetitive Action (OCRA) (Lasota, 2015) is the recommended ergonomics tool to investigate the risks, related musculoskeletal parts and other factors that contribute to the MSDs.

METHODS

Participants

Nine operators had been participated in ERA with range age 20 to 40 years; belong to two males and seven females. Three of them had participated in RULA, REBA and OCRA assessment (DOSH Malaysia., 2017) because they had long working experience i.e. 1 to 7 years of working experience.

Operation tasks

Figure 1 illustrates the tasks involved in the glove packaging department i.e. unpacking gloves from the plastic bag, sorting the gloves by right, left or reject/damage, inserting gloves into paper bag, and packed it into the shipping box. The tasks were completed according to the quantity of orders. The working days for the packaging operators were 5 days per week which the production target for every working day were 10 bags with each bag contained 250 pairs of gloves. The operators' working days and hours were:

Monday - Friday: 7 a.m. - 4.40 pm

Break: 1 hour (10 a.m. - 11 a.m.)

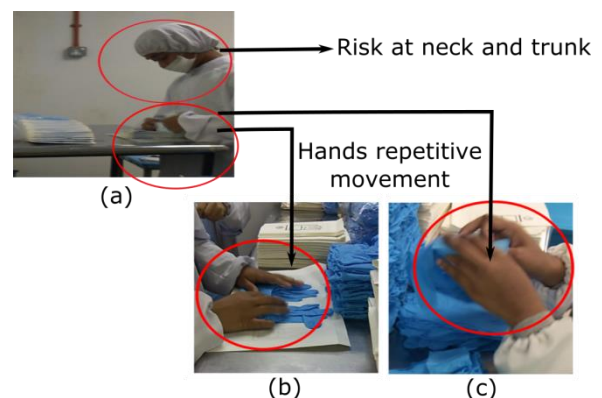


Fig. 1 (a) Standing posture in synthetic workstation (b),(c) Operators conducting repetitive tasks using hands

Experiment

A series of Interview were conducted with the participants during the working hours. Four types of assessment were conducted to identify the ergonomics risks i.e. ERA, RULA, REBA and OCRA (DOSH Malaysia., 2017).

At beginning, this study used proactive approaches of self-assessment, walkthrough and reviewing records. For self-assessment, two types of forms were used. The first one was self-assessment musculoskeletal pain or discomfort survey form and another one was ergonomics and musculoskeletal pain or discomfort complaint form. Then, ERA was conducted based on the participants' feedback forms and answers from interview sessions using video recording and capturing pictures. The observation focused on the participants' movements during standing, their hands movement during completing task and the interaction between participants and their working environment i.e. gloves, boxes, aid tools, working tables and other participants. Then, documents on job safety were reviewed and analysed to identified additional factors that possibly contributing to the ergonomics risks among participants.

Data Analysis

The data from ERA, RULA, REBA and OCRA forms were analysed according to the guidelines from (DOSH Malaysia., 2017). Task analysis and time analysis was conducted to obtain the results from interview answers, video records and pictures (Gulliksen et al., 2016).

RESULTS

Initial ERA Analysis

Table 1 shows the results of initial ERA for participants in synthetic glove packaging workstation. The highest feedback is repetition work posture which three scores for all of the operators. The second and third highest score is two and one respectively which is awkward posture and static and sustained work posture. Table 1 also shows the major musculoskeletal symptoms among participants which are related to neck, shoulder, upper and lower back, and feet area. This result supported by Figure 1 produced from the task analysis and time analysis of video observations among participants while they conducted the operational tasks. Based on the analysis, static and sustained works posture and repetitive work posture are suggested to be investigated in detail using RULA, REBA and OCRA to verify the risk level.

Table 1 Results on initial ERA

Risk factors	Total Score	Minimum requirement for advanced ERA	Result of Initial ERA			Need Advanced ERA? (Yes/No)			Any pain or Discomfort due to risk factors as found in Musculoskeletal Assessment (/) which part of the body			
			1	2	3	1	2	3	1	2	3	
Operator												
Awkward Postures	13	≥6	2	2	2	No	No	No	Neck	/	/	/
Static and Sustained work Posture	3	≥1	1	1	1	Yes	Yes	Yes	Shoulder	/	/	/
						No	No	No	Upper back	/	/	/
Forceful Exertion	7	1	0	0	0	No	No	No	Upper arm	/	/	/
Repetition	5	≥1	3	3	3	No	No	No				
Vibration	4	≥1	0	0	0	No	No	No	Lower back	/	/	/
Lighting	1	1	0	0	0	No	No	No				
Temperature	1	1	0	0	0	No	No	No	Forearm	/	/	/
Ventilation	1	1	0	0	0	No	No	No	Wrist	/	/	/
Noise	2	≥1	0	0	0	No	No	No	Hip/buttocks	/	/	/
									Thigh	/	/	/
									Knee	/	/	/
									Lower leg	/	/	/
									Feet	/	/	/

Advanced ERA

Figure 2 presents the result from RULA assessment. The results show that all participants obtain high scores in the RULA analysis i.e. 6 which indicating very high risk ergonomics in upper body areas e.g. upper arm, wrist and arm, neck and trunk which require urgent workstation improvement.

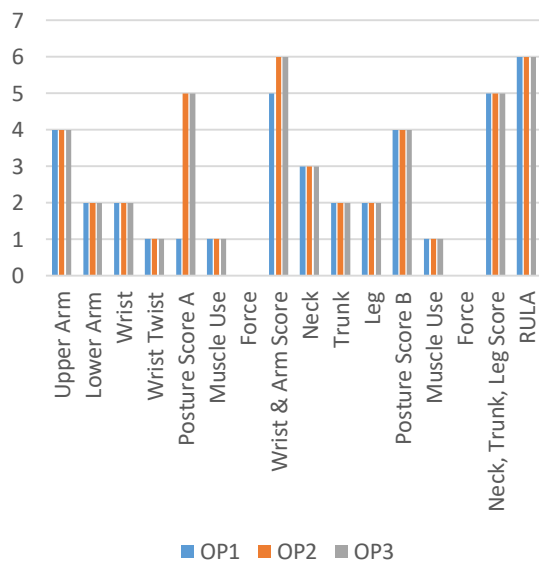


Fig. 2 Results of RULA assessment

Figure 3 illustrates the results from REBA assessment. The results show all participants obtain the high score i.e. 7 which indicating high risk ergonomics in entire body areas e.g. upper arm, wrist and neck which require urgent workstation improvement.

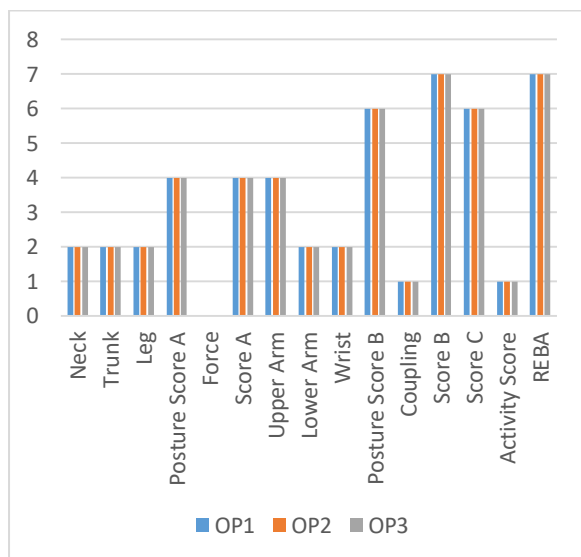


Fig. 3 Results on REBA assessment

Table 2 shows the results of OCRA assessment relating to repetitive works conducted by participants in this study. The results show that all participants obtain medium ergonomics risk which is in the range of 14.1 to 22.5 scores. So that, the work station improvement is suggested to avoid the repetitive risk become severe in future.

Table 2 Results on OCRA assessment

Participants	Result
Op 1	20.6
Op 2	19.6
Op 3	18.1

CONCLUSION

The purpose of this study is to investigate the ergonomics risks in the workstation of synthetic gloves packaging production floor. The ergonomics tools such as initial ERA, RULA, REBA and OCRA was applied in this study to assess the ergonomics risks among nine operators in the packaging department. Task analysis and time analysis based on video records and still pictures were conducted to support the assessment results. The results from initial ERA, RULA, REBA and OCRA assessments supported by task and time analysis provide enough evidences to justify that existing workstations require urgent improvements due to the high level of ergonomics risks in static and sustained working posture and repetitive working posture. In future, the design improvement of glove packaging workstation is recommended to be done to minimize the static, sustained and

repetitive risk among the glove packaging operators.

ACKNOWLEDGEMENTS

This study was supported by University Malaysia Perlis (UniMAP). Thank you to the company that involved in this study (the name is private and confidential). Thank you also to the operators in the glove packaging department that involve in this study.

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