

REBA and RULA Evaluation no Cashier: A Case Study

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Abstract

Employee performances can lead to a better work quality in Small Medium Enterprise (SME) industry which could be enhanced by interventions of ergonomics. Ergonomics aims at ensuring a good fit between the workers and their work, thus maximizing the worker's comfort, safety and health, productivity and efficiency. This study aims to design an ergonomic workstation for cashiers at mini mart. Mini mart is one of a business under Small Medium Enterprise (SME). Postural analysis tools which are Rapid Upper Limb Assessment (RULA) and Rapid Entire Body Assessment (REBA) were used to determine and evaluate the risks that related to ergonomic risks. Plus, Nordic questionnaire was conducted in order to analyze the most painful and uncomfortable body parts of the cashiers. The common ergonomic risks and occupational problems of workers in SME industry is Musculoskeletal Disorders (MSDs). Both RULA and REBA score was exceeding the recommended score which RULA score more than 5 and REBA score more than 7. The posture of workers need to be investigate soon to minimize the ergonomic risks. An ergonomic workbench is suggested for workers to reduce the ergonomic risk and can boost the productivity of workers.

Keywords

RULA, REBA ,workbench, workers and ergonomic.

1. Introduction

Ergonomics deals with the application of information about human behavior, capabilities and limitations to the design of systems, machines, tools, tasks or jobs and environments for productive, safe and effective human practice (Nag 2019). The objective of ergonomics is to ensure a good fit between the workers and their job, thus maximizing workers comfort, safety and health, productivity and efficiency. Derived from the Greek words 'ergon', which means work and 'nomos', which means laws, ergonomics literally means the laws of the work (Ehrensberger- Dow and Jääskeläinen 2019).

Ergonomics risks are one of the topic that need to be justified in industries because it was often to be heard as favorites diseases among workers. One of it is Musculoskeletal Disorder (MSD) which includes pain, stiffness, joint noises, weakness and decreased range of motion. Inflammation may cause pain, warmth, tenderness, impaired function, swelling and sometimes redness of the overlying skin (Alexandra 2019). Most of MSD happened because of repetitiveness in a single work, excessive vibration and performing work in awkward posture for a long time.

Most of Small and Medium Industries (SME) companies in Malaysia were not aware with ergonomics on their workers and their jobs (Siong et al. 2018). There were many risks that could happen if ergonomics is not being implemented. Based on United States Department of Labor, there were thousands of reports and illness that were reported in a year. By reviewing the injury reports, it can be concluding that ergonomics were not being implemented by workers during their work.

In Malaysia, ergonomics so far had a little impact because for certain managers in company, ergonomics is not considered with performance, but rather with occupational safety and health and legislation (Loo 2012). It is true that Department of Safety and Health (DOSH) Malaysia had come with many ideas on how to overcome problems that

related to ergonomics, but the employer need to understand that their workers are related to the productivity and performance of the industry.

Besides, most of SME's companies in Malaysia do not have any specific officer safety and health to deal with problems related to ergonomics. One of the purposes to have a specific safety and health officer is to identify the factor of ergonomics risks and evaluating it with a proper technique.

1.1 Objectives

The objectives of this study is to identify the problems that related with ergonomics for cashiers in Small Medium Enterprise (SME). This study also intended to identify ergonomic risks among cashiers in Small Medium Enterprise (SME) industries.

2. Literature Review

2.1 Ergonomic

In early 1900's, human power and motion were being largely depended in the production of industry and in order to improve worker productivity, ergonomics concept was being developed (Nag 2019). A method that became popular in the era was scientific management that could be improved worker efficiency during their jobs.

The scientific study of human work is commonly known as ergonomics (Gainer 2018). Association between "labor" and "health", in other words, the kinds of "health problems" caused by "working" was often reported even in the age of ancient Egypt and the Greek and Roman period. It can be said that the age of development, promoted by the Industrial Revolution that started in the 18th century, demanded magnification of the relationship between labor and health.

Following World War II, the focus of concern expanded to include both worker safety and productivity. Research began in a variety of areas, such as muscle strength required for manual tasks, compressive low back disk force when lifting, cardiovascular response when exercising heavy work and perceived maximum load that can be carried, pushed or pulled (Budnick 2017).

Information fields surrounding human actions and characteristics (i.e., decision-making mechanism, organizational design, human understanding of design) have become known as cognitive ergonomics or human factors. Knowledge areas involving physical aspects of the workplace and human skills such as lifting force, vibration and reach were known as industrial ergonomics or ergonomics (Matsuda et. al 2016).

At this time the broad focus of the group and the duality of name continues. Contributors to concepts related to ergonomics / human factors include industrial engineers, industrial psychologists, occupational medical doctors, industrial hygienists and safety engineers (Stack et.al 2016). Architects, occupational therapists, physical therapists, occupational medicine nurses and insurance loss control specialists are professions using information on ergonomics / human factors.

2.2 Ergonomic Risk

In industry, there were a lot of risks that could happen among the workers. One of the factors is the position of body of the worker during performing their work. In addition, the common factors of ergonomics risks are repetitiveness of work, huge application of force, handle heavy loads, static posture during work and awkward posture for a long time (Otto and Battaia 2017).

Workplaces with high ergonomic risks are assembly systems that have fast paced work because of one-sided strain due to repetitiveness of work (Schneider and Irastorza 2010). One of the illnesses that commonly happened to workers is Musculoskeletal Disorder (MSD) which includes pain, stiffness, joint noises, weakness and decreased range of motion. Inflammation may cause pain, warmth, tenderness, impaired function, swelling and sometimes redness of the overlying skin (Alexandra 2019). Inflammation can result from many different MSD, such as infections and autoimmune disorders.

workers that did not performing ergonomics during their works can cause themselves to Carpal Tunnel Syndrome (CTS) which a medical condition due to compression of the nerve as it travels through the carpal tunnel. The main

symptoms are pain, numbness and tingling in the thumb, index finger, middle finger and the thumb side of the ring finger.

2.3 RULA

RULA was developed by expert of University of Nottingham which the aim of the establishment is to investigate the exposure of worker to risk factors associated with work related to upper limb disorder. The assessment is straight forward and can be used with a minimum of training (Polat and Kalayci 2016). In other words, RULA Assessment Tool was established to evaluate the exposure of individual workers to ergonomic risk factors associated with upper extremity MSD. The RULA ergonomic assessment tool considers postural load requirements of job on the neck, trunk and upper ends.

RULA scoring is divided into six sections which are neck, trunk, leg, wrists, lower arm and upper arm. As shown in Figure 1, wrists, lower arm and upper arm will be grouped into table A to get a new score. Then, from neck, legs and trunk scores, it will be grouped into table B to get another score. From those new scores, it will be grouped again in a new table C with addition on force, workload and coupling score. From table C, final score will be obtained and the final score will be referred into the results section. There were 4 of results which are acceptable posture (score 1 to 2), further investigation and change may be needed (score 3-4), further investigation and change soon (score 5 to 6) and investigate and change immediately (score 7).

Most of ergonomists know that there are certain risk factors that must be consider when assessing risk for given tasks which are force frequency of work, duration of work and posture. RULA is feasibly best applied to jobs and tasks that did not involve in repetitiveness and deal with a great force (Budnick 2012). For example, RULA is the best ways to evaluate jobs by static postures such as seated office work and standing during quality check. Moreover, RULA is applied to a single job in time and for asymmetric postures, RULA must be applied to all side of the body that include separately. In other words, RULA is very useful in the ergonomics, with proper training of application and interpretation (Figure 1).

RULA Employee Assessment Worksheet
Complete this worksheet following the step-by-step procedure below. Keep a copy in the employee's personnel folder for future reference.

A. Arm & Wrist Analysis

Step 1: Locate Upper Arm Position
Step 1: Adjust... Final Upper Arm Score = 4

Step 2: Locate Lower Arm Position
Step 2: Adjust... Final Lower Arm Score = 3

Step 3: Locate Wrist Position
Step 3: Adjust... Final Wrist Score = 3

Step 4: Wrist Twist
Wrist Twist Score = 1

Step 5: Look-up Posture Score in Table A
Posture Score A = 5

Step 6: Add Muscle Use Score
Muscle Use Score = 0

Step 7: Add Force/load Score
Force/load Score = 0

Step 8: Find Row in Table C
Final Wrist & Arm Score = 5

SCORES

Table A

Upper Arm	Wrist			
	Wrist Twist 1	Wrist Twist 2	Wrist Twist 3	Wrist Twist 4
1	1	2	2	2
2	2	2	2	3
3	2	3	3	3
4	2	3	3	3
5	3	3	3	3
6	3	3	3	3
7	3	3	3	3
8	3	3	3	3
9	3	3	3	3
10	3	3	3	3
11	3	3	3	3
12	3	3	3	3
13	3	3	3	3
14	3	3	3	3
15	3	3	3	3
16	3	3	3	3
17	3	3	3	3
18	3	3	3	3
19	3	3	3	3
20	3	3	3	3
21	3	3	3	3
22	3	3	3	3
23	3	3	3	3
24	3	3	3	3
25	3	3	3	3
26	3	3	3	3
27	3	3	3	3
28	3	3	3	3
29	3	3	3	3
30	3	3	3	3

Table B

Neck	Trunk Posture Score					
	1	2	3	4	5	6
1	1	1	1	1	1	1
2	1	1	1	1	1	1
3	1	1	1	1	1	1
4	1	1	1	1	1	1
5	1	1	1	1	1	1
6	1	1	1	1	1	1
7	1	1	1	1	1	1
8	1	1	1	1	1	1
9	1	1	1	1	1	1
10	1	1	1	1	1	1
11	1	1	1	1	1	1
12	1	1	1	1	1	1
13	1	1	1	1	1	1
14	1	1	1	1	1	1
15	1	1	1	1	1	1
16	1	1	1	1	1	1
17	1	1	1	1	1	1
18	1	1	1	1	1	1
19	1	1	1	1	1	1
20	1	1	1	1	1	1
21	1	1	1	1	1	1
22	1	1	1	1	1	1
23	1	1	1	1	1	1
24	1	1	1	1	1	1
25	1	1	1	1	1	1
26	1	1	1	1	1	1
27	1	1	1	1	1	1
28	1	1	1	1	1	1
29	1	1	1	1	1	1
30	1	1	1	1	1	1

Table C

1	Final Score						
	1	2	3	4	5	6	7
1	1	2	3	3	4	5	6
2	2	2	3	4	4	5	5
3	3	3	3	4	4	5	6
4	3	3	3	4	4	5	6
5	4	4	4	4	5	6	7
6	4	4	4	4	5	6	7
7	4	4	4	4	5	6	7
8	4	4	4	4	5	6	7
9	4	4	4	4	5	6	7
10	4	4	4	4	5	6	7
11	4	4	4	4	5	6	7
12	4	4	4	4	5	6	7
13	4	4	4	4	5	6	7
14	4	4	4	4	5	6	7
15	4	4	4	4	5	6	7
16	4	4	4	4	5	6	7
17	4	4	4	4	5	6	7
18	4	4	4	4	5	6	7
19	4	4	4	4	5	6	7
20	4	4	4	4	5	6	7
21	4	4	4	4	5	6	7
22	4	4	4	4	5	6	7
23	4	4	4	4	5	6	7
24	4	4	4	4	5	6	7
25	4	4	4	4	5	6	7
26	4	4	4	4	5	6	7
27	4	4	4	4	5	6	7
28	4	4	4	4	5	6	7
29	4	4	4	4	5	6	7
30	4	4	4	4	5	6	7

Final Score 7

B. Neck, Trunk & Leg Analysis

Step 9: Locate Neck Position
Final Neck Score = 4

Step 10: Locate Trunk Position
Final Trunk Score = 3

Step 11: Legs
Final Leg Score = 2

Step 12: Look-up Posture Score in Table B
Posture B Score = 7

Step 13: Add Muscle Use Score
Muscle Use Score = 0

Step 14: Add Force/load Score
Force/load Score = 0

Step 15: Find Column in Table C
Final Neck, Trunk & Leg Score = 7

Figure 1. RULA Assessment Form

2.4 REBA

Rapid Entire Body Assessment (REBA) is an ergonomic assessment tool to evaluate the whole body postural and risks that related with the job. REBA assessment gives a systematic and quick assessment of the complete body postural risks to a worker. First, REBA has been created to evaluate the type of unpredictable working postures found industry and give a rapid assessment (Hignett and McAtamney 2000). Rather than RULA, REBA can evaluate whole body posture while REBA is focusing on neck, trunk and upper ends.

REBA scoring is divided into six sections which are neck, trunk, leg, wrists, lower arm and upper arm. From neck, legs and trunk scores, it will be grouped into table A to get another score. Then, from wrists, lower arm and upper arm will be grouped into table B to get a new score. From those new scores, it will be grouped again in a new table C with addition on force, workload and coupling score. From table C, final score will be obtained and the final score will be referred into the results section. There were 5 of results which are negligible posture (score 1), low risks and change may be needed (score 2-3), further investigation and change soon (score 4 to 7), investigate and change immediately (score 8 to 10) and very high risks and implement changes (score 11).

From the REBA worksheet in Figure 2, the analysis in every postural is very clear and specific. It divides the body into segments to be coded individually with reference to movement planes. It provides a scoring system for muscle activity caused by static, rapid changing in each minute, rapid large range change or unstable base postures (Essays 2018). REBA works by observing positions of individual body segments. The more abnormalities from the neutral posture, the higher the score of each body part. There are two groups that are combined; group A includes trunk, neck and legs and group B upper and lower arms and legs. The posture combinations are transformed to a general postural score. Additionally, load handed, coupling with the local handled and physical activity are observed and scored. These scores are total up to have one score for each observation and then compared to tables stating risk on five levels (negligible – very high) and actions needed (none – necessary now) (Figure 2).

REBA Employee Assessment Worksheet

Based on Technical note: Rapid Entire Body Assessment (REBA), Hignett, McAtamney, Applied Ergonomics 31 (2000) 201-205

A. Neck, Trunk and Leg Analysis

Step 1: Locate Neck Position

Step 1a: Adjust...
If neck is twisted: +1
If neck is side bending: +1

Step 2: Locate Trunk Position

Step 2a: Adjust...
If trunk is twisted: +1
If trunk is side bending: +1

Step 3: Legs

Step 4: Look-up Posture Score in Table A
Using values from steps 1-3 above, locate score in Table A

Step 5: Add Force/Load Score
If load < 11 lbs: +0
If load 11 to 22 lbs: +1
If load > 22 lbs: +2
Adjust: If block or rapid build up of force: add +1

Step 6: Score A, Find Row in Table C
Add values from steps 4 & 5 to obtain Score A. Find Row in Table C.

Scoring:
1 = negligible risk
2 or 3 = low risk, change may be needed
4 to 7 = medium risk, further investigation, change soon
8 to 10 = high risk, investigate and implement change
11+ = very high risk, implement change

SCORES

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

		Lower Arm		
Table B		1	2	
Wrist	1	2	3	1
Upper Arm Score	1	2	3	2
	2	3	4	3
	3	4	5	4
	4	5	6	5
	5	6	7	6
	6	7	8	7
	7	8	9	8

		Table C											
Score A (score from Table A + load/force score)		Score B (table B value + coupling score)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	1	1	1	2	3	3	4	5	6	7	7	7	7
2	1	2	2	3	4	4	5	6	7	8	8	8	8
3	2	3	3	4	5	6	7	7	8	9	9	9	9
4	3	4	4	5	6	7	8	8	9	10	10	10	10
5	4	5	5	6	7	8	8	9	10	11	11	11	11
6	5	6	6	7	8	9	9	10	11	12	12	12	12
7	6	7	7	8	9	10	10	11	12	13	13	13	13
8	7	8	8	9	10	11	11	12	13	14	14	14	14
9	8	9	9	10	11	12	12	13	14	15	15	15	15
10	9	10	10	11	12	13	13	14	15	16	16	16	16
11	10	11	11	12	13	14	14	15	16	17	17	17	17
12	11	12	12	13	14	15	15	16	17	18	18	18	18

Step 7: Locate Upper Arm Position:

Step 7a: Adjust...
If shoulder is raised: +1
If upper arm is abducted: +1
If arm is supported or person is leaning: -1

Step 8: Locate Lower Arm Position:

Step 9: Locate Wrist Position:

Step 9a: Adjust...
If wrist is bent from midline or twisted: Add +1

Step 10: Look-up Posture Score in Table B
Using values from steps 7-9 above, locate score in Table B

Step 11: Add Coupling Score
Well fitting Handle and mid range power: grip: +0
Acceptable but not ideal hand hold or coupling acceptable with another body part: +1
Hand hold not acceptable but possible: +2
No handles, awkward, unsafe with any body part: Unacceptable: +3

Step 12: Score B, Find Column in Table C
Add values from steps 10 & 11 to obtain Score B. Find column in Table C and match with Score A in row from step 6 to obtain Table C Score.

Step 13: Activity Score
+1 1 or more body parts are held for longer than 1 minute (static)
+1 Repeated small range motions (more than 16 per minute)
+1 Action causes rapid large range changes in postures or unstable base

Final REBA Score

Task name: _____ Reviewer: _____ Date: ____/____/____

This tool is provided without warranty. The author has provided this tool as a simple means for applying the concepts provided in REBA. © 2004 Wm. Connelly, Inc. provided by Practical Ergonomics rtinker@ergosmart.com (816) 444-1667

Figure 2. REBA Assessment Form

2.5 Nordic Questionnaire

The purpose of Nordic questionnaire is to develop and produce a standardized questionnaire procedure allowing comparison of low back, neck, shoulder and general complaints for use in ergonomics studies (Joanne 2007). Nordic questionnaire was a method of investigation that needs to be held by questioner and subjects of study. The purpose of applying Nordic questionnaire in this study was to investigate the cashiers' health condition during their work.

As shown in Figure 2, the general Nordic questionnaire is divided into 3 parts. First, the workers are known as subject. The subject needs to answer the entire questionnaire for all 3 parts. The first part asks about the subject's illness for the past 12 months that includes neck, shoulders, elbows, wrists, upper back, lower back, hips, thighs, buttocks, knees and ankles. The second part needs the subject to answer whether they had been injured their body in past 7 days. Lastly, the third part of the Nordic questionnaire asks whether the subject had been prevented from carrying out normal activities because of their body illness in the past 12 months. From this questionnaire, the health condition of workers could be obtained easily.

3. Methods

Several methods were now available for assessing the exposure to risk factors associated with MSDs to identify the potential risks involved in ergonomic jobs. RULA, REBA and Nordic questionnaire were the method of data collection in this study. All of those methods are easy to understand and user friendly even there is no cost at all to perform the methods. Furthermore, those methods are commonly used in evaluating ergonomics in any industries because the methods are including all aspects that need to be evaluated in ergonomics study. All of those methods preparation need to be done before evaluating the subject of the study which is four cashiers from four different companies.

Rapid Upper Limb Assessment (RULA) was recognized to evaluate the exposure of individual workers to ergonomic risk factors associated with upper extremity Musculoskeletal Disorder (MSD). The RULA ergonomic assessment tool considers postural load requirements of job on the neck, trunk and upper ends. In RULA, the postural scoring is divided into six sections which are neck, trunk, leg, wrists, lower arm and upper arm. From wrists, lower arm and upper arm will be grouped into table A to get a new score. Then, from neck, legs and trunk scores, it will be grouped into table B to get another score. From those new scores, it will be grouped again in a new table C with addition on force, workload and coupling score. From table C, final score will be obtained and the final score will be referred into the results section. There were 4 of results which are acceptable posture (score 1 to 2), further investigation and change may be needed (score 3-4), further investigation and change soon (score 5 to 6) and investigate and change immediately (score 7).

Rapid Entire Body Assessment (REBA) gives a systematic and quick assessment of the complete body postural risks to a worker. Apart from RULA, REBA had assessed and considers the entire body posture while RULA only focusing on upper limb body posture. REBA scoring is divided into six sections which are neck, trunk, leg, wrists, lower arm and upper arm. From neck, legs and trunk scores, it will be grouped into table A to get another score. Then, from wrists, lower arm and upper arm will be grouped into table B to get a new score. From those new scores, it will be grouped again in a new table C with addition on force, workload and coupling score. From table C, final score will be obtained and the final score will be referred into the results section. There were 5 of results which are negligible posture (score 1), low risks and change may be needed (score 2-3), further investigation and change soon (score 4 to 7), investigate and change immediately (score 8 to 10) and very high risks and implement changes (score 11).

Nordic questionnaire was a method of investigation that needs to be held by questioner and subjects of study. The purpose of applying Nordic questionnaire in this study was to investigate the cashiers' health condition during their work. The questionnaire was questioning about the cashiers' condition for the past 12 months and the second part was for the last 7 days. The next sections that being questioned in the Nordic was the prevention and cures that being implement by the cashiers themselves and the action by companies.

Then, the score from the RULA and REBA need to be processed until the final score is obtained whether the risks that struck the operators is high or low. Apart from that, the final score will determine the whether the jobs performed is negligible or need to have implement change.

4. Results and Discussion

4.1 RULA

Several pictures were captured during the cashiers performing their jobs. Observation was one of the methods performed during taking the pictures and data from the cashiers. Next, the pictures or the data were analyzed to ensure the RULA scoring forms complete. The scorings were given based on the cashier's activities and work posture during their work (Figure 3).

One of the most commonly used for ergonomics risks assessment tools are Rapid Upper Limb Assessment (RULA). In this study, RULA was used as ergonomics tools to assess the posture of the cashiers. Figure 3 shows the results of RULA for the four cashiers. The posture that assessed using RULA is focusing on upper limbs mainly arms and wrist. From the observations that had been conducted, there were several work activities that had been highlighted. The work activities were:

- Prolonged standing – 4 hours of continuous standing
- Standing bent forward – 30 to 45 degree • Standing bent to the side – 10 to 30 degree
- Standing with body twist – 45 to 90 degree
- Reaching far products – 50 to 60 cm
- Lifting heavy products – 5 kg to 10 kg

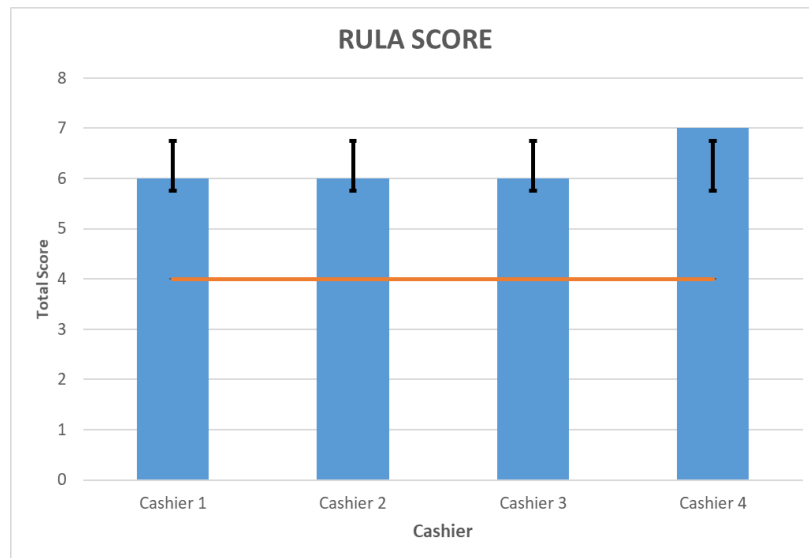


Figure 3. RULA Score

As shown in Figure 3 above, it shows that cashier 4 has the highest final score for RULA which was 7. Meanwhile, the rest of the cashiers have the same RULA final score which was 6. The standard deviation is 0.5 and mean is 6.25. The data shows that 68% scores are between 5.75 and 6.75, while 95% scores are between 11.5 and 13.5. RULA score more than 4 indicates that the posture needs to be investigated soon and the cashier has a medium risk for MSDs. The difference between cashier 4 and others is the work activities. All of the cashiers are undergoing prolonged standing, standing bent forward, standing bent to side, standing with body twist and reaching far products. For cashier 4, she needs to lift heavy products compared to other cashiers that did not need to lift heavy products.

4.2 REBA

As for REBA assessment, the same pictures were captured during the cashiers performing their jobs were evaluated. Observation was one of the methods performed during taking the pictures and data from the cashiers. Next, the pictures or the data were analyzed to ensure the REBA scoring forms complete. REBA scoring was evaluated by using examples shown in Figure 2. The scorings were given based on the cashier's activities and work posture during their work.

Next, the most commonly used for ergonomics risks assessment tools is Rapid Entire Body Assessment (REBA). In this study, REBA was used as ergonomics tools to assess the posture of the cashiers. Figure 4 shows the results of REBA for the four cashiers. The posture that assessed using REBA is focusing on the whole body and limbs motions. From the observations that had been conducted, there were several work activities that had been highlighted. The work activities were:

- Prolonged standing – 4 hours of continuous standing
- Standing bent forward – 30 to 45 degree.
- Standing bent to the side – 10 to 30 degree
- Standing with body twist – 45 to 90 degree
- Reaching far products – 50 to 60 cm
- Lifting heavy products – 5 kg to 10 kg

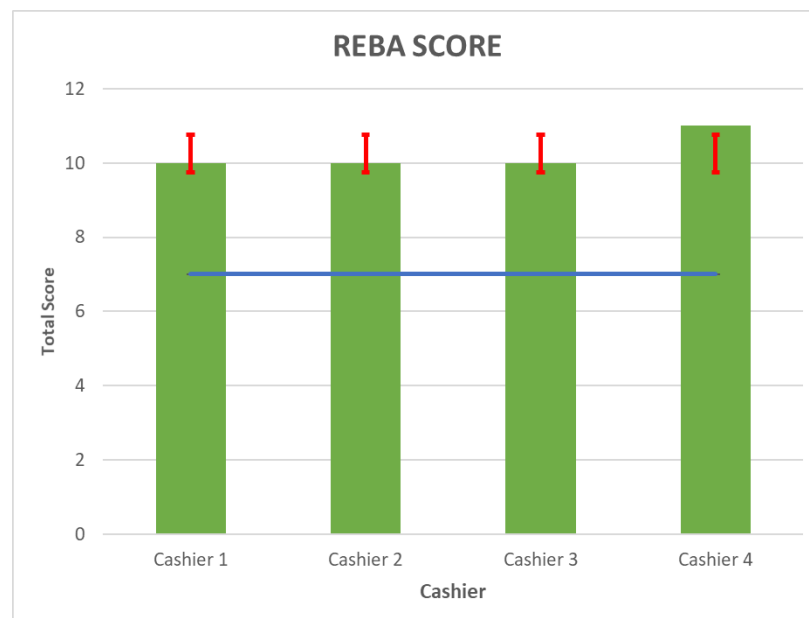


Figure 4. REBA Score

Figure 4 above shows that cashier 4 has the highest final score for REBA which is 11 per 15 respectively. Meanwhile, the rest of the cashiers have the same REBA final score which was 10 per 15. REBA score more than 7 indicates that the cashier might experience medium risk getting the MSDs. REBA score mean is 10.25 and standard deviation is 0.5. The data shows that 68% scores are between 9.75 and 10.75. The difference between cashier 4 and others is the work activities. All of the cashiers are undergoing prolonged standing, standing bent forward, standing bent to side, standing with body twist and reaching far products. As for cashier 4, she needs to lift heavy products compares to other cashiers that did not need to lift heavy products.

4.3 Nordic Questionnaire

The Nordic questionnaire in this study was to investigate the cashiers' health condition during their work. The questionnaire was questioning about the cashiers' condition for the past 12 months and the second part was for the last 7 days. The next sections that being questioned in the Nordic was the prevention and cures that being implement by the cashiers themselves and the action by companies.

The aim of using Nordic questionnaire in this study was to develop and test a standardized questionnaire methodology that would allow comparison for use in this ergonomics study of low back, neck, shoulder and general complaints. In addition, Nordic questionnaire was conducted to the 4 cashiers that being observed. The purpose of conducting the Nordic questionnaire were to determine the most painful and uncomfortable body parts of the cashiers in the past 12

months and last 7 days of working. Plus, from the combination of Nordic questionnaire, RULA and REBA, the cause of the injuries or troubles can be obtained (Figure 5).

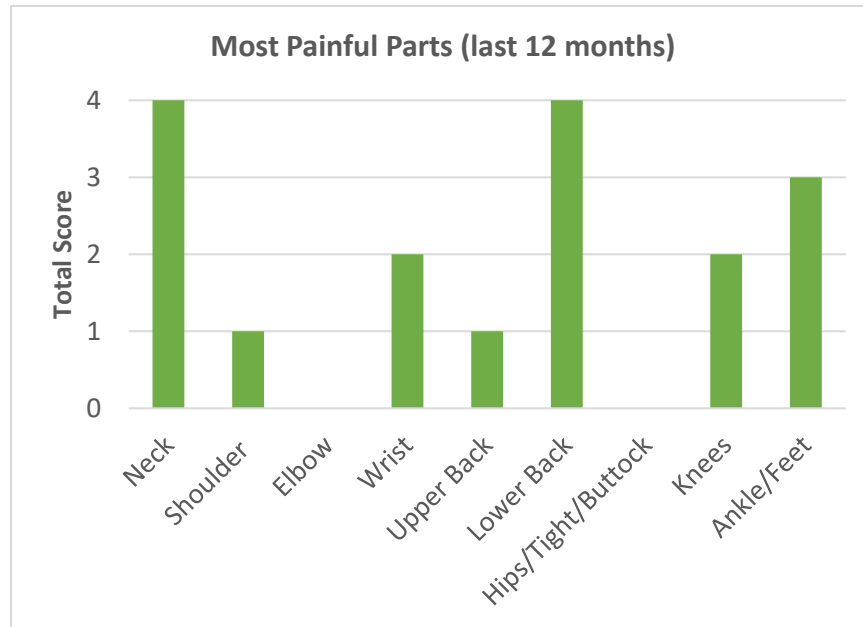


Figure 5. Score for Most Painful Part (last 12 month)

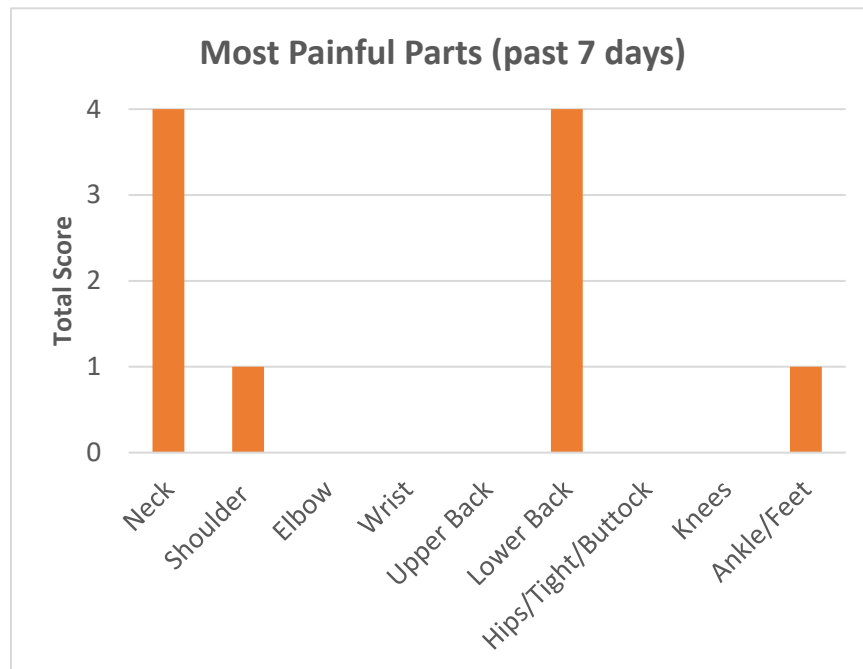


Figure 6. Score for Most Painful Part (past 7 Days)

As shown in Figure 6, it shows the most painful parts for the last 12 months that being experienced by the cashiers. Neck and lower back has the highest score for the most painful parts for the last 12 months followed by ankles/feet that had score 3. It shows that the most painful parts that being experienced by the cashiers for the last 12 months were neck and lower back. Plus, ankles/feet also one of the most painful parts experienced by the cashiers as it was voted by 3 persons. From Figure 6, it shows that the most painful parts that being experienced by the cashiers for the past 7

days were neck and lower back. Besides, shoulders and ankles/feet were both voted by 1 person. After analyzing the results of Nordic questionnaire, the most painful parts that being experienced by the four cashiers for both period of time were neck, lower back and ankles or feet can lead into ergonomics risks. Example of Musculoskeletal Disorder (MSD) that could be faced by the cashiers were stiffness, muscle strain, vertebral osteomyelitis and spinal fracture.

5. Conclusion

Small Medium Enterprise (SME) is an important industry in Malaysia's economy. In order to improve the quality and productivity of workers, a specific solution is needed for adjusting the existing work environment at the workstation. From this study, a significant observation and analysis found that the cashiers were working in uncomfortable conditions and uncomfortable postures, as the study has found. This is because of a lack of education and understanding of ergonomics in small medium-scale industry.

Several methods had been done to analyze the working condition of the four cashiers from four different companies. The methods include Rapid Upper Limb Assessment, Rapid Entire Body Assessment, Nordic questionnaire, anthropometry data and workspace envelope. This study had come out with a new ergonomic workbench for cashiers. The purpose was to eliminate or minimize the possibilities of getting ergonomics risks or injuries. Example of Musculoskeletal Disorder (MSD) that could be faced by the cashiers are stiffness, muscle strain, vertebral osteomyelitis and slip discs. From this study, the problems that related with ergonomics for the cashiers had been identified. Several methods were implemented to discover and analyzed the problems. A new workbench design also had been created in order to reduce those problems faced by the cashiers. Ergonomics risks can be reduced by implementing ergonomic workbench for workers that could lead to the highest productivity in SME.

The new workbench design needs to be fabricated and tested by the cashiers. This could help in finding the flaws of the workbench if it is being tested. Besides that, more workers should be observed and analyzed for their working posture for the further studies. It is because the more the respondents in the study, the more information will be obtained.

Limitation this study is the anthropometry data and working envelope measurements. These two data should be considered to obtain more information on the workstation on the suitability with the cashiers. Besides that, the workstation can be design efficiently when the anthropometry and working envelope data taken into account.

Next, all industry should aware with ergonomics risks. The company should give proper briefing and training to improve the workers' awareness on ergonomics risks. Implementing ergonomic procedure helps to reduce the risk of developing Musculoskeletal Disorders (MSDs). A good culture of safety increases productivity, morale for workers and retention for workers. Strong integration in ergonomics prevents injury, and increases productivity. With these recommendations, the ergonomics risks in SME industry can be reduced.

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