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Implementation of the Rapid Entire Body Assessment (REBA) Method in an Effort to Reduce Musculoskeletal Disorders (MSDs) in the Footwear and Automotive Industry

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Abstract
Background. This paper examines the impact of uncomfortable workplaces on absenteeism and employee complaints in the shoe and automotive industries. The risk of work-related accidents can be caused by several factors, such as unsafe actions resulting from unsuitable work positions for employees.
Aims. This study analyzes the risk of MSDs interference among workers in the Material Inspection and Packing Department of PT X Shoe Company and PT Adyawinsa Stamping Industry (PT ASI).
Method. The methods employed include direct observation in the workplace, visual documentation, in-depth interviews with workers, and measurements using the REBA.
Result. The measurement results indicate that arranging materials on shelves and boxes on pallets has a REBA score that falls in the medium to high category, making it necessary to improve the working position as soon as possible.
Conclusion. Improvement efforts are made to assistive devices, and directions are given to workers to improve their work posture. The results of work improvement using these tools will lead to a safer and more comfortable work environment.
Implementation. This study proposes the application of anti-fatigue mats, improved air circulation, and work posture training to reduce ergonomic risks. With these interventions, employees can work more effectively, improving work comfort, reducing the risk of MSDs, and enhancing worker productivity.

Keywords: REBA, ergonomics, MSDs, working posture, and material inspection.

INTRODUCTION

Due to the impact of increasing industrial competition, companies need to improve the quality and quantity of products produced so that demand for workers will be greater, enabling them to meet the company's targets. The demands on these workers are certainly balanced by the need for safety and health. However, in reality, only a few companies seriously implement effective work systems, and as a result, there are still work accidents and complaints from workers.

Complaints from employees that occur are discomfort in the form of diseases related to MSDs disorders (Fathuroman, 2019).

To realize the disorder of MSDs, research was carried out at PT X and PT ASI. PT X's production is in the form of shoes, and PT ASI is engaged in the manufacture of car spare parts the production of PT X shoes. Problem identification was carried out through observation and interviews with as many as 31 workers. There is 1 question that will be asked of the workers regarding the working conditions and welfare of the workers. Based on the interview, it is evident that there have been delays in delivering products to buyers, indicating that production floor issues are present. From the observation activities carried out, data on the absence of workers in each department were also obtained. Based on this data, *the Material Inspection and Packing Department* has the highest percentage of absences. The reason for further research in these departments was ergonomics-related complaints and constraints (such as aches and pains, fatigue) as well as high absenteeism rates in both departments. At PT X, *material inspection* is the primary task, specifically checking the quality of materials received from *suppliers*. Additionally, the packaging department is responsible for packing the finished shoes into the provided packaging boxes. Measurement of work comfort using REBA.

Production of PT. ASI is a car spare part such as those from Toyota, Honda, Daihatsu, and Suzuki brands. The study's observations yielded complaints, including *myalgia* and *low back pain. Myalgia* is a disorder of MSDs that is indicated by muscle pain in the form of muscle pain and cramps (Tomaszewski, Stepien, and Tomaszewska, 2011). In addition, MSDs disorders can occur in the lower back due to unergonomic working positions (Tarwaka et al., 2005).

LITERATURE REVIEW

Currently, one of the widely used methods to measure the movements of the working position in the legs, arms, wrists, and neck that can cause MSDs (Hignett & McAtamney, 2000). The REBA assessment is divided into three main groups: A, B, and C. Figure 1 illustrates the REBA assessment sheet that will be used in the posture assessment process.

The purpose of using REBA is to provide a simple postural analysis system that can identify musculoskeletal risks associated with various tasks (Middlesworth, 2017). REBA provides a user-friendly tool, as it takes less time and effort. However, REBA does not consider

the duration of the task. REBA provides an assessment of the worst possible posture of the workers. The most suitable method for this study is REBA.

REBA is a quick and easy measurement used to assess various working postures and detect the risk of MSDs. The measurement of the REBA method is carried out on 6 parts, namely the back, chest, legs, wrists, middle arm, and upper arm. The REBA measurements for each part are carried out independently according to the movement at the time of carrying out their activities at a low cost, namely using only cameras, a pen, and paper (Hignett & McAtamney, 2000; Coyle, 2005). Several studies have demonstrated that REBA measurements are suitable for whole-body evaluation and are particularly effective for assessing both static and dynamic work (Hashim et al., 2012). REBA adapts better than RULA for highly varied workstations. This can be attributed to the development of RULA in the context of research related to whole-body movements; hence, RULA is unreliable (Chiasson et al., 2012).

As a result of the unergonomic working position, it will have an impact on MSD interference. MSDs are injuries and disorders that occur in soft tissues, such as tendons, muscles, joints, ligaments, and cartilage, as well as the nervous system, resulting from muscles receiving constant and repetitive loads over a prolonged period (OSHAcademy, 2018).

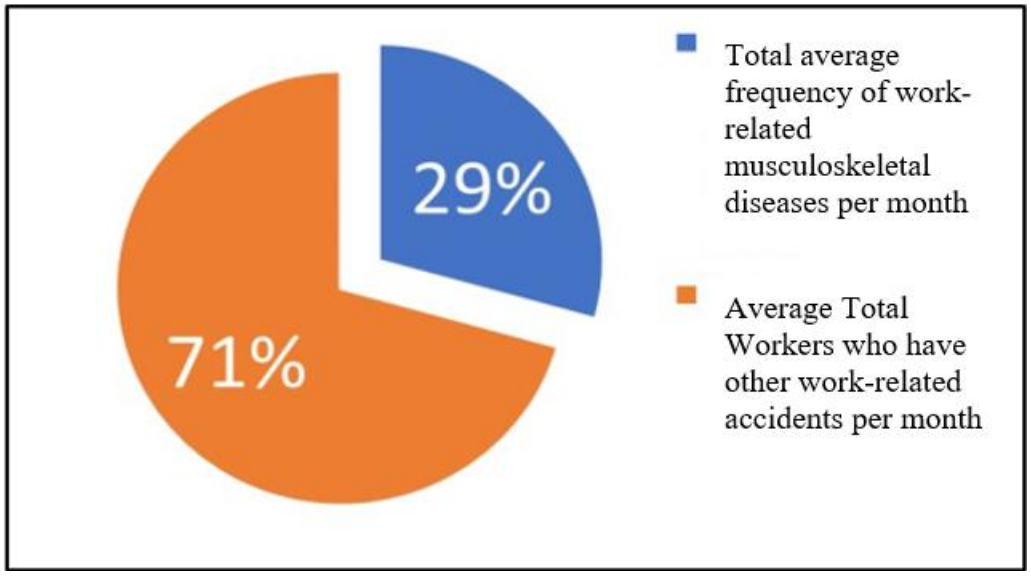

Figure 1. Average MSD Sufferers (OSHAcademy, 2018)

The REBA measurement process is illustrated in Figure 2.

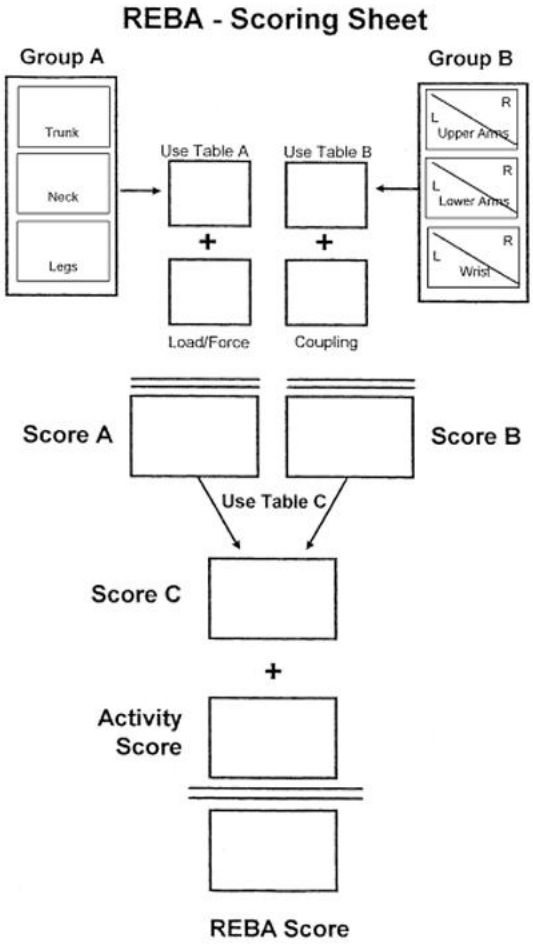

Figure 2 REBA Scoring Sheet

The details of the REBA coding are shown in Figure 3.

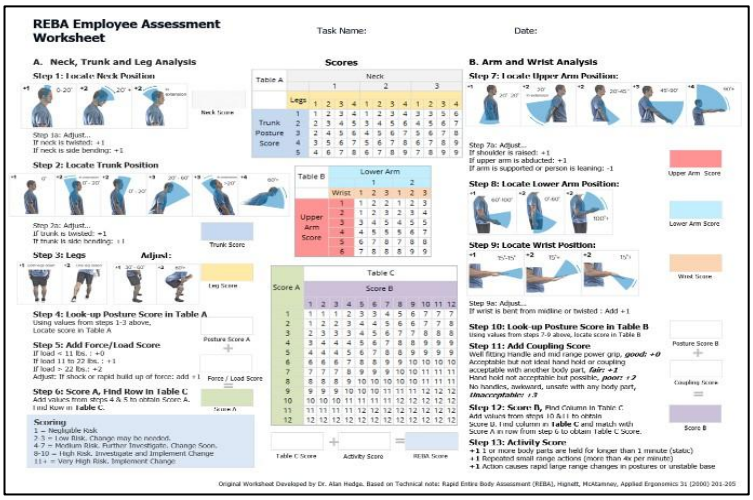

Figure 3. REBA Assessment Sheet (Source: Middlesworth, 2017)

The impact of MSDs disruption on companies is a decreased production level caused by worker injuries, as well as the enormous costs incurred for the healing process of workers. MSDs are a serious medical challenge in a variety of industries in America.

According to Wignjosoebroto (2003), REBA measurements cannot be separated from the science of Anthropometry. Anthropometry is a study that involves measuring the dimensions of the human body, including weight, standing height, arm span, body circumference, leg length, and other relevant measurements. In addition, the research results of Sanders and McCormick (1987), Pheasant and Haslegrave (2015), and Pulat (1992), as cited in Tarwaka et al. (2005), suggest that ergonomic interventions should focus on the field of human anthropometry. This is because ergonomic interventions are always related to the relationship between humans and machines, as well as other supporting devices. The results of the body dimension measurement will then be used in designing various work improvement needs, such as workstation dimensions, work facilities, and products. The application of anthropometry in the design of work systems or products aims to obtain the proper measurements for users who will use the objects and work systems that are designed.

METHOD

The nature of this research is quantitative descriptive, as it is carried out by direct observation of the research object. The purpose of this study is to identify the level of occupational posture risk using the REBA method. The research at PT X was carried out at the Department of

Material Inspection and Packaging. Breast milk is carried out in the Stamping Section. Subjects are workers who perform predominantly standing work activities, lifting weights, or other repetitive physical activities.

Data collection involves direct observation of work postures as workers perform their tasks. Data collection is carried out by cameras to help assess posture. Additionally, detailed interviews were conducted with workers to gather information about physical complaints or difficulties they experienced at work. Anthropometric measurements (such as body height and arm length) are used to support the validity of the working position.

The research instruments used were the REBA assessment sheet (Hignett & McAtamney version), observation aids in the form of cameras, tripods, and stopwatches, and posture observation sheets (to record the position of foot, wrist, arm, body, and head/neck). The research procedure was carried out as follows.

1. Identify critical work activities based on data on absences, worker complaints, and workload.
2. Observation and documentation of work posture when workers perform routine activities.
3. Classification and assessment of job positions using the REBA value table:
    a. Group A assessment (torso, neck, legs)
    b. Group B assessment (wrist, upper and lower arm)
    c. Coupling determination (handle)
    d. Combination of A and B values → C values (total REBA)

The results of the measurement using REBA were then analyzed. A high REBA value will be maintained through continuous ergonomic intervention until a moderate REBA value is achieved (6-8).

DISCUSSION

The results of ergonomic risk measurement using the REBA method in the material inspection and packing department at PT X

REBA measurement is carried out by measuring Part A, namely the torso, neck, legs, Part B, namely the upper arms, lower arms, wrists, Determination of couplings (handles) and finally a combination of A and B values → C values (total REBA) shown by Figure 4.

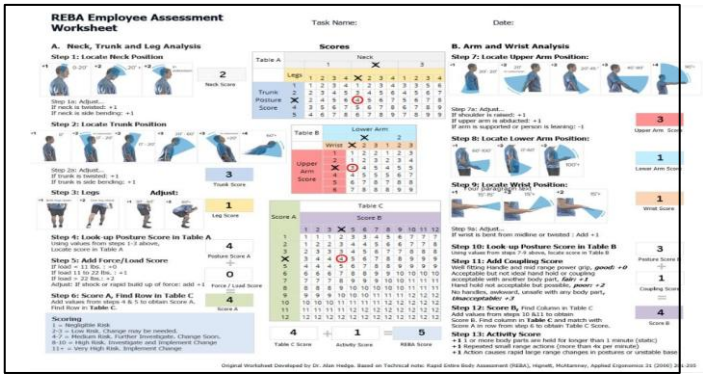

Figure 4. Results of REBA identification in the packing work

The final result of the REBA score was 5, which falls into the medium risk category, requires further investigation, and is expected to *change soon.* This category falls under the medium risk of developing MSDs, for which further investigation is needed to implement ergonomic interventions. The results of interviews with 6 *material inspection workers* revealed that they worked in a comfortable environment and felt satisfied with their current job position, as well as the workplace.

The results of REBA measurements in the *packing* department are shown in Figure 5.

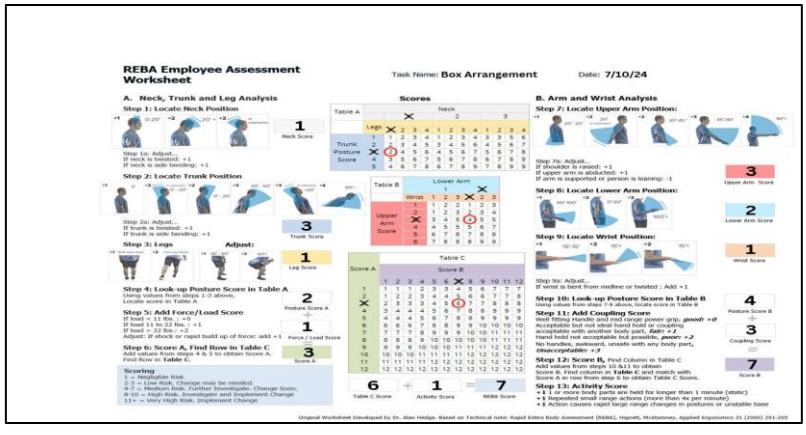

Figure 5. Identification of REBA on Disease Risk

The results of the REBA analysis indicated a moderate risk score (6-8) for the development of MSDs, suggesting that further investigation is necessary to implement

improvements. Additionally, the results of interviews with six packing workers revealed that they worked in a safe and comfortable environment.

Measurement of the REBA method at PT ASI

Process *Packing* is wrapping spare parts to be placed in a box. Process *Packing. It is coated with a thin foam to prevent blisters, then wrapped in a box using power tools, such as an automatic stapler*. Activity Packing consists of three stages: activities *pre-packing*, the activity of moving goods, and the activity of packing with boxes. The first activity is the process of moving finished goods to the station, *Packing* as indicated in Figure 6. Figure 6 is the posture that is used the longest due to distance and is also the most repeated.

Figure 6. Packing Process

Table 1. REBA Value on *Pre-packing* Posture of Goods to the Packing Station

Task	: *Pre-packing process*		**Observation date**	: 24 April 2019	
Sight	:left		**Observer**	: Muhamad Fathurohman	
Group A			**Group B**		
Neck	***Trunk***	***Lego***	***Upper Arm***	***Lower Arm***	***Wrist***
Angle >20°	*Angle 0°*	*angle <30°*	*Angle <20°*	*60°- angle 100°*	*Angle <15°*
no adjustment	*no adjustment*	*Position 1*	*no adjustment*	*no adjustment*	*no adjustment*
2	1	1	1	1	1
Posture Score A	1		***Posture Score B***	1	
Force/Load	<5kg	0	***Coupling***	*Good*	0
Score A	1		***Score B***	1	
Score C					
1					
Activity Score					
2					
Repeated small range actions (more than 4x per minute) (+1)					
1 or more body parts are held longer than a minute (static) (+1)					

REBA Score	*Risk Level*	*Action*
3	*Low*	*may be necessary*

Table 2. Recapitulation of REBA Results on *Pre-Packing Activities* at Packing Stations

Work	Pre-packing process				
Worker	**REBA Score**		**Picture**	**Table**	***Action***
	A	**B**			
A	1	1	3	*Low*	*may be necessary*
B	3	1	3	*Low*	*may be necessary*
C	3	1	3	*Low*	*may be necessary*
D	2	1	2	*Low*	*may be necessary*
Max Score	3	1	3	*Low*	*may be necessary*
Min Score	1	1	2	*Low*	*may be necessary*
Average score	2	1	3	*Low*	*may be necessary*

The second activity is wrapping goods with boxes. This activity was chosen a posture that was used repeatedly where it was used to pack goods in a box using *a stapler (*Figure 7).

Figure 7. Posture Angle in Goods Packing Activities at the Packing Station

According to the results of research by Lastariwati and Khayati (2015) and *the International Labor Organization (2013*), *myalgia* and LBP can be categorized as work-related accidents because they can cause injuries, *loss of time*, and losses for companies in the healing process that takes a certain amount of time. Additionally, there are employee complaints that have

an impact on MSDS disruptions (OSHAcademy, 2018).

Safety is important for all parties and everyone. According to Sujoso (2012), survival means being free from losses caused by insecure conditions, illness, or loss (*free from loss*). Other definitions expressed by ILCI are more functional. The definition is related to injuries, complaints, property damage, and reduced production/process time. Occupational safety is safety related to machinery, equipment, and the work system used by an employee. The purpose of occupational safety is to ensure that all machines, equipment, production processes, and working systems are working correctly. Most of the work is performed in a standing position without access to adequate ergonomic equipment. This causes complaints such as leg, back, and arm pain.

Based on the results of the REBA score, which indicate a moderate to high risk of MSDs, several proposed improvements have been designed to address aspects of work ergonomics, including: the use of an Anti-Fatigue Mat (placed under the feet when standing for a long time); 2. Air Circulation (Exhaust Fan); 3. Work Posture Training and Use of Assistive Devices.

According to OSHAcademy (2018) and Peter Vi (2000), MSDs occur when there is a mismatch between the physical requirements of a job and the physical capacity of the worker, affecting muscles, tissues, blood vessels, ligaments, and joints.

Hignett and McAtamney (2000) and Nurliah (2012) suggest that REBA can be used to measure working positions ergonomically. The measurement results can be obtained with REBA values of good (<4), medium (4–6), high (7–11), and very high (>11). If the REBA value is >11, then ergonomic intervention needs to be carried out immediately.

Table 3. Final Score REBA

Final* REBA *Score	***Risk Level***	***Action***
1	*Negligible Risk*	Not Required
2 to 3	*Low Risk*	May Be Required
4 to 7	*Medium Risk*	Needed
8 to 10	*High Risk*	Urgent Need
Above 11	*Very High Risk*	Required Now

The use of the REBA method offers flexibility, allowing it to assess risk to the entire body, whether static or dynamic. In addition, this method has been tested to validate the reliability and validity of REBA (Budiman & Setyaningrum, 2006; Kurniawati, 2009).

Fathurohman's (2019) research in the automotive industry shows that *welding* stations that move goods at packing stations require immediate repairs, may have a REBA score of 12 (very high risk). The proposed improvements involve enhancing the workstation, work position, and related

aspects to minimize the risk of injury to workers. The evaluation of the posture of the proposed improvement can be said to be successful if the working position is carried out ergonomically, with REBA remeasurement with <6 results.

The challenge of using REBA is that it is a subjective method, lacking detail and precision in covering three important risk factors: strength, repeatability, and posture. Janowitz et al. (2006) explain that some factors (e.g., twisting, bending to the side) are given equal weight regardless of their magnitude (e.g., turning 5° or 20°). According to Coyle (2005), the use of the REBA Method is time-consuming because it requires multiple measurements to obtain valid results. In addition, the measurement results for the 'most common' posture and the high-duty cycle posture were ranked equally (Shanahan et al., 2013). For a comprehensive evaluation of the risk of MSDs in the workplace, it is necessary to employ multiple methods to obtain more accurate results.

Currently, measurement using REBA is one of the most commonly used observational ergonomics assessment tools in various manufacturing industries. Several studies have been reviewed to provide an overview of the development, application, validation, and limitations of this method so far. The study using REBA sought a larger number of respondents and a more complex work environment to assess risk factors for MSD disorders.

CONCLUSION

The results of REBA measurements at PT X show that most of the work activities in the Material Inspection and Packing Department are at moderate to high risk of MSDs. Activities with a high REBA value (≥8) include arranging materials on shelves and organizing boxes on pallets, which require immediate posture improvement. Additionally, REBA-valued activities are undergoing (6-8) visual inspections and label attachment, which still require attention. The results of the study indicate that the current work system is not fully ergonomic and has the potential to compromise workers' long-term health. The results of REBA measurements at PT Industri Otomotif indicate that most activities pose high risks, necessitating significant improvement.

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