



Analysis of Employee Work Posture with the Quick Exposure Check (QEC) and Rapid Entire Body Assessment (REBA) Method (Case Study: CV. Wijaya Mandiri Label)

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A B S T R A C T

CV Wijaya Mandiri Label is a company engaged in offset printing label printing. The products produced from the company can vary according to customer demand. The printing industry generally still uses work activities in the form of manual material handling which includes lifting, pushing, and pulling to move an object. This research aims to identify the level of potential risk of injury to employee work postures. In this study, the methods uses were Quick Exposure Check (QEC) and Rapid Entire Body Assessment (REBA). The QEC method is used as an initial identification of potential ergonomic problems and the risk of injury at workstations where the exposure level is 83% (very high risk) and 82.7% (very high risk). So that further research is needed by assessing work postures using the REBA method with REBA score 11 (very high) and REBA score 9 (high). The proposed improvements are in the form of manual scissor lift table and an adjustable work desk following the anthropometry of workers. From these tools can reduce the risk level REBA score from 11 to 7 (medium) and REBA score from 9 to 5 (medium) which is known from the simulation results of using tools using 3D software.

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1. INTRODUCTION

The creation of ergonomics of the work process on work postures will create safe and comfortable conditions for workers and can also increase efficiency in the physical, mental, and productivity conditions of these workers in carrying out their daily activities. Industries in developing countries still often ignore posture analysis methods where the work process still involves humans completely is a major problem

in companies that can lead to musculoskeletal disorders (MSDs) due to repetitive processes and poor work postures. By triggering this, to maximize worker performance and productivity, several different factors that can have an impact on these aspects, one of them is the physical condition of the employees. CV. Wijaya Mandiri Label located in Sidoarjo is a company engaged in offset printing label printing. At CV. Wijaya Mandiri Label has a

total of 10 employees in the production department and has a working time that lasts for 9 hours per day. From the results of preliminary observations at CV. Wijaya Mandiri Label, it was found that the work posture of employees was less ergonomic, namely in the workers of the printing transfer section and in the packaging section workers.

Based on previous research, it explains that the QEC method is a method for assessing occupational risks associated with muscle disorders in the workplace (Yuslistyari & Adhadin, 2018). Assessment of the QEC method is carried out in 2 aspects through questionnaires, namely through observers and workers (Fragastia & Ramadhan, 2022). The QEC method assesses back, shoulder/arm, wrist, and neck impairments and their combination with the risk factors of duration, repetition, static and dynamic work and effort required quickly (Ramdhani & Noor, 2018). Likewise with the type of work, the determination of exposure score also distinguishes 2 types of differences, namely static work and manual handling work (Bastuti & Zulziar, 2020). The REBA method is a method in the area of ergonomics that is used to quickly examine the posture of an employee's neck, back, arms, wrists, and legs (Rahmawati & Utami, 2020). This method also defines further factors that are vital to the final evaluation of posture, such as the load or force, the type of grip, and muscle activity performed by the worker (Anthony, 2020).

Based on previous research, it shows that the QEC method and the REBA method are methods that can be used in work posture assessments that can be done quickly. In the assessment of work posture using the REBA method, there is a different perspective on the assessment of each part of the body compared to the QEC method, where in the difference in perspective the REBA method has a more complete assessment of body parts compared to the QEC method. Nevertheless, this study was conducted with these two methods to provide a more comprehensive approach to assessing work postures and to identify risks more accurately.

2. LITERATURE REVIEW

2.1. Nordic body map

Nordic Body Map is one of the subjective assessment methods to assess the severity of musculoskeletal disorders of individuals in the workgroup. The NBM application uses a questionnaire worksheet in the form of a body map that shows which parts of the body from 27 parts of the skeletal muscles are experiencing discomfort or complaints of pain. The use of the NBM questionnaire is something that is commonly used in a study on ergonomic issues that aims to determine the work discomfort experienced by the relevant workers in the field (Atmojo, 2020).

2.2. Anthropometry

Anthropometrics is to collect numerical data regarding the human body's structure, size, shape, and bulk as well as its use for purposes of design or problem-solving. (Purbasari, 2019). Anthropometric measurements are used extensively as ergonomic considerations when designing products and working systems that require human interaction (Aras, Rahmatika, & Putra, 2019).

2.3. Percentile concept

The percentile is a value indicating the percentage of individuals whose dimensions are in line with or below this value. The 95th percentile would indicate 95% of the population is at or below that size, while the 5th percentile would indicate 5% of the population is at or above that size (Anwardi; Harpito; M. Rasyid Ridha, 2018). There are several percentile values that are often used in Table 1.

Table 1. Percentile calculations

Percentile	Calculations
1 ST	$\bar{X} - 2,325$
2,5 TH	$\bar{X} - 1,96$
5 TH	$\bar{X} - 1,645$
10 TH	$\bar{X} - 1,28$
50 TH	\bar{X}
90 TH	$\bar{X} + 1,28$
95 TH	$\bar{X} + 1,645$
97,5 TH	$\bar{X} + 1,96$
99 TH	$\bar{X} + 2,325$

(Source : Anwardi, 2018)

2.4. Quick exposure check

Quick Exposure Check (QEC) is one of the load posture measurement methods introduced by Li & Buckle in 1999. QEC is a method used to determine the risk of musculoskeletal disorder injuries that focus on the upper body, namely the back, neck, arms/shoulders, and wrists (Yuslistyari & Adhadin, 2018). The procedure in applying QEC has 3 stages as follows: (1) Identifying risks through questionnaires by observers and workers used to analyze the condition of a workstation. (2) Calculating the exposure score from the answers to questionnaires conducted by observers and workers. (3) After getting the exposure level of each part, add all the values and calculate the exposure level to find out the QEC action level. The action level of the QEC total exposure level is shown in Table 2.

Table 2. Action level QEC

Total Exposure Level	Actions
<40%	Secure
40 – 49%	Further research needed
50 – 69%	Further research needed and changes are needed
>70%	Further research needed and changes as soon as possible

(Source: Bastuti, 2020)

2.5. Rapid entire body assessment

The REBA method assesses ergonomic risk factors on the whole body in use, such factors as: static, dynamic, speed of change, or unstable postures, the lifting that is being done, and how often, workplace modifications, equipment, training or worker behavior (Hunusalela, Perdana, & Dewanti, 2021). Therefore, this method can be useful for risk prevention and can be used to warn that there are improper working conditions in a workplace (Dewanti, Surya, & Tiara, 2020). The procedure in applying REBA has 5 stages as follows: (1) Observe the work and document it in pictures or videos. (2) Select the work postures to be evaluated and assessed. (3) Measuring the angle of each body part in the work posture. (4) Giving REBA values based on the measured angles. (5) Interpreting the final REBA results on the REBA action level. The action level of the REBA score is shown in Table 3.

Table 3. Action level REBA

Action Level	REBA Score	Risk Level	Actions
0	1	Negligible	Unnecessary
1	2 – 3	Low	May be necessary
2	4 – 7	Medium	Necessary
3	8 – 10	High	Needs to be immediate
4	11 – 15	Very High	Necessary right now

(Source: Anthony, 2020)

3. RESEARCH METHOD

This research was performed by taking a case study at CV. Wijaya Mandiri Label. Data collection was carried out only in the offset printing station production section. This study used the Quick Exposure Check (QEC) and Rapid Entire Body Assessment (REBA) methods. The research steps to solve the problem can be seen in the Fig. 1.

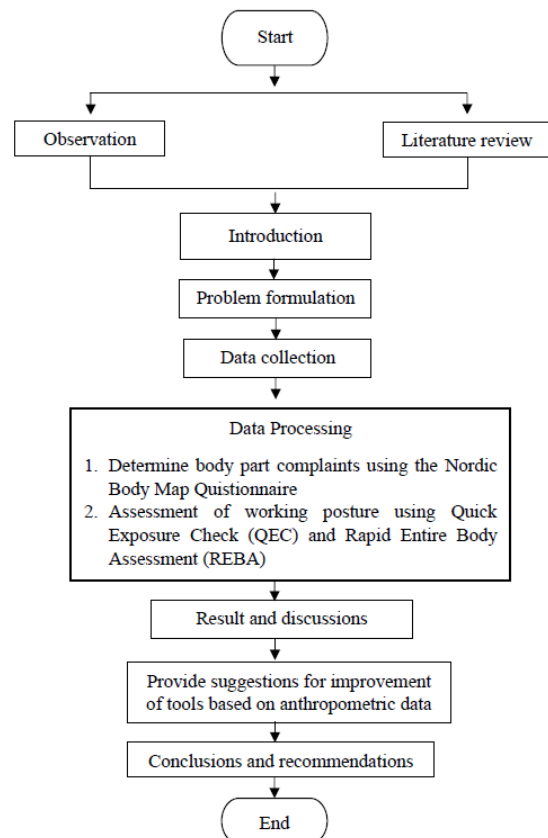


Fig. 1. Research flowchart

4. RESULT AND DISCUSSION

4.1. Nordic Body Map Questionnaire

Based on the results of the NBM questionnaire that has been filled in by ten workers as

respondents, several types of complaints on the body parts of workers are obtained in the form of percentages as in Table 4.

Table 4. Percentage of Body Part Complaints

No	Body Parts	Percentage of Total Complaints
1	Left shoulder	30%
2	Right shoulder	30%
3	Right upper arm	20%
4	Left lower arm	20%
5	Right lower arm	20%
6	Waist	10%
7	Back	10%
8	Left upper arm	10%

(Source: processed data)

From the results of the questionnaire in Table 4. it can be concluded that the percentage of most workers who complain of pain in the body parts is the left shoulder and right shoulder. This can be caused by the existence of non-ergonomic work postures which result in the level of shoulder performance more than other parts of the body. It can also be caused by the work of carrying loads, bending and pulling, or pushing loads manually.

4.2. Work posture assessment with QEC and REBA method

Work posture assessments were carried out on two workers in different work activities, namely in the activity of moving printouts in Fig. 2. and packaging in Fig. 3. Calculation of work posture assessment using ErgoFellow software.



Fig. 2. Working posture of moving printouts (Source: processed data)



Fig. 3. Working posture of packaging (Source: processed data)

Workers in the activity of moving printouts produce an exposure level of 83% which is included in the very high category and an action is obtained, namely the need for further research and immediate changes. Then workers in packaging activities produce an exposure level of 82.7% which is included in the very high category and an action is obtained, namely the need for further research and immediate changes. Based on the results of the QEC which obtained corrective actions in the form of the need for further research and changes as soon as possible, further work posture assessments were carried out using the REBA method. Workers in the activity of moving printouts results obtained a final REBA score of 11 which is included in the very high category and requires corrective action at this time. Then workers in packaging activities obtained a final REBA score of 9 which is included in the high category and requires immediate corrective action.

4.3. Suggestion for Improvement of Tools

Based on the results of the work posture assessment above, where both methods get results in the very high category, changes or corrective actions are needed at this time. The corrective action is in the form of designing tools for both activities that are expected to reduce the level of risk from the previous

results. The tools designed consider the size of the tool based on anthropometric data from workers at the printing and packaging transfer workstation with an ergonomic shape. Anthropometric data and percentile determination on the size of workers can be seen in Tables 5 and 6.

Table 5. Measurement data for moving printouts activity

Anthropometry Data	Dimension	Percentile	Size
Fingertips to toes	Tool height	5%	52 cm
Forearm length	Tool width	5%	42 cm
Shoulder width length	Tool length	5%	39 cm

(Source: processed data)

Table 6. Measurement data for packaging activity

Anthropometry Data	Dimension	Percentile	Size
Elbow tip of the toe	Tool height	5%	91 cm
The length of the forward stretch of the hand	Tool width	5%	67 cm
Elbow span length	Tool length	5%	73 cm

(Source: processed data)

Based on the data above, all the dimensions of the tools are using a 5% percentile. From these results it can be seen that the design of the tool is designed for a population of 5% to be able to use the tool with a good range, and in a population of 95% can also use the tool with a sufficient range.

The design of aids that will be used in the activity of moving printouts and packaging results according to the anthropometric data of the workers can be seen in Fig. 4 and Fig. 5.



Fig. 4. Manual scissor lift table for moving printouts activity (Source: processed data)

In the picture above, a tool for moving printouts activity is obtained, namely a manual scissor lift table with a hydraulic system that can adjust the height of the board according to the anthropometric data of workers who have been determined to help the work posture of moving printouts activity workers with more ergonomic.



Fig. 5. Adjustable work desk for packaging activity (Source: processed data)

In the picture above, a tool for packaging activity is obtained, namely an adjustable work desk that can adjust the desk height according to the anthropometric data of workers who have been determined by electric power which

can make workers' postures more ergonomic.

The next stage is to simulate to find out the difference in work posture and REBA risk value before and after using the tool can be seen in Fig. 6 and Fig. 7.

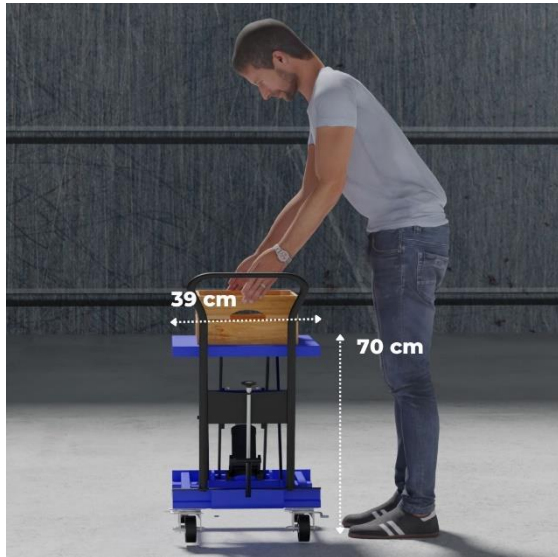


Fig. 6. Simulation of manual scissor lift table usage (Source: processed data)

In the simulation of the use of a manual scissor lift table, the final REBA assessment is 7 which is lower than the final REBA assessment of the initial work posture of 11 so that it can reduce the risk value of the initial work posture on moving printouts activity.

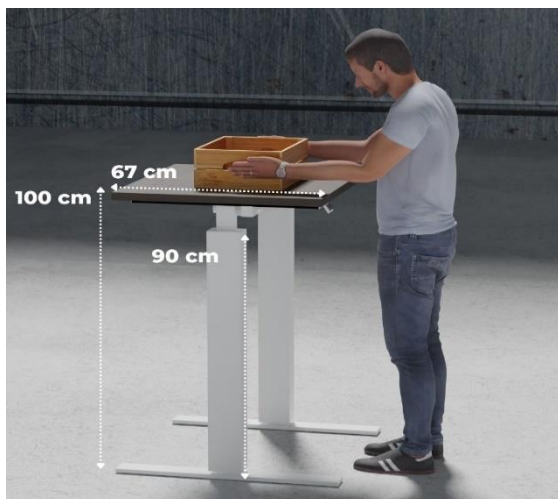


Fig. 7. Simulation of adjustable work desk usage (Source: processed data)

In the simulation of using an adjustable work desk, the final REBA assessment is 5 which is

lower than the final REBA assessment of the initial work posture of 9 so that it can reduce the risk value of the initial work posture in the packaging activity.

5. CONCLUSION

Based on the study results, the conclusion is that after simulating the use of assistive devices in the moving printouts activity, namely the manual scissor lift table, it can reduce the risk of worker injury through the final REBA value of 11 with a very high-risk level to the final REBA value of 7 with a medium risk level. Then after the simulation of the use of assistive devices in packaging activity, namely the adjustable work desk, it can reduce the risk of worker injury through the final REBA value of 9 with a high risk level to the final REBA value of 5 with a medium risk level. For further research, it is hoped that further analysis can be carried out on the design of tools ranging from material costs to production costs.

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