Work Posture analysis Using the Rapid Entire Body Method Assessment (REBA) to Reduce the Risk of Injury in Line I Employees Upper Production PT. XYZ

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A B S T R A C T

This research aim to solve the problem of ergonomic standart in the process of making an upper shoes by implementing Rapid Entire Body Assessment (REBA). This method is suitable to solve job body posture problem of the worker of PT XYZ based in Sidoarjo. PT XYZ is an international company and one of the expantion company from Denmark, they produce high quality shoes with more than 7000 workers. There are several plaint from the worker that they had a featigue in some part of te body. REBA assess the score from the top of the body to the bottom of the body and giving report are report of the posture risk. By using this method, the solution can be found with giving the right posture of the worker body while working their duty. The result of the research are confirmed to reduce the risk of musculoskeletal disorders (MSDs) the posture need an improvement by changing the moves of trunk, upper arm, and wrist. Reba score are known in 6 and it's increasing to 3 after the improvement.

1. INTRODUCTION

In the current era, safety, health and comfort of workers are prioritized at work because comfort at work can influence the level of productivity of the work itself (Purnama et al., 2020). Ergonomics risk factors are attitudes or work environment that can causes the position of body parts to move in an uncomfortable manner can cause various problems in a job, both problems health and work accident problems. Therefore, in order for a job does not pose a dangerous risk, there needs to be an assessment of ergonomic risk. Ergonomic risk assessment can be used for Identify complaints or skeletal muscle disorders that may occur for carrying out material handling activities manually, with using different ergonomic risk assessment methods (Wijaya et al., 2018). The operator's working posture is a point key in analyzing the effectiveness of a job. Besides being usable to assess the effectiveness of a job, if the operator's working posture is bad and continues continuously for a long time it can cause One of the injuries is Musculoskeletal Disorders (MSDs) (Susihono & Prasetyo, 2012). Work-Related Musculoskeletal Disorders (WMSDs) are caused by work activities often done and done repeatedly, or work that performed with

unnatural postures (Tarwaka, 2014). In determining whether there are musculoskeletal complaints for all parts of the body in workers, ergonomic researchers often use the Rapid Entire Body Assessment (REBA) method. Rapid Entire Body Assessment (REBA) was developed to assess work postures found in the health care industry and other service industries. The data collected is in the form of body posture, the amount of force/load used, the type of movement, repetitive motion and grip. The final results of the REBA score can provide an indication of the level of risk and where countermeasures must be taken. The REBA method is proposed to assess risky body postures with work related musculoskeletal disorders (WRMSDs) (Higgnet & Mcatamney, 2000).

PT. XYZ here is an international shoe company and one form of company expansion from a shoe company originating from Denmark but stands and has its own company policy. PT. XYZ itself has around ± 7000 employees with several factories or factories. We can describe how busy the atmosphere in the factory is during the production process, therefore in this study I want to know how the standard ergonomics of worker movement there, of course I will focus on Line I Upper to focus on the upper shoe production process which contains 40 employee. Several complaints are reported from the company health center that the workers in this station experience a body sore during work. To solve these problems the Rapid method is used Entire Body Assessment (REBA). The use of the REBA method was chosen because it can provides a more detailed assessment of the worker's body posture whole. This method can help evaluate the body posture and give the company body posture suggestion. The REBA method assesses upper and lower body posture bottom which forms a certain angle starting from the neck, back, arms the top, forearm, wrist to the leg operator. The REBA method can also provide a score where the score is shows how big the risk of the work posture is and its importance action that needs to be taken. The data source will also collect with Nordic Body Map Form which have 28 question that the workers have to fill.

2. LITERATURE REVIEW

The term "ergonomics" comes from the Latin words ergon (work) and nomos (natural law) and can be defined as the study of human aspects in the environment which are reviewed in terms of anatomy, physiology, psychology, engineering, management and design (Nurmianto, 2004). Work posture is a determining point in analyzing the performance of a work activity. If the condition of the operator's working body is appropriate and ergonomic, of course the benefits obtained by the worker will be maximum. However, if the operator's working attitude is less comfortable, the operator will quickly feel tired. If the operator gets tired easily, the operator's work performance will automatically decrease and not be as desired (Susihono & Prasetyo, 2012). When working, the posture is designed to be natural so that it can reduce the incidence of musculoskeletal injuries. Good work posture is largely determined by the movement of the body's organs while working (Wijaya & Muhsin, 2018). Workers will be more comfortable working if they have favorable working conditions (Haekal et al., 2020)

Musculoskeletal Disorders (MSDs) are injuries and system disorders soft tissue (muscles, tendons, ligaments, nerves, joints, blood vessels) (Lubis et al., 2021). If the muscles experience interference with daily activities such as doing work, it can be disrupted because muscle strength is an important part of the organs of the human body so that the body can move. The onset of pain in these muscles can result in lowering one's work productivity. In addition, excessive muscle contraction coupled with giving a load that is too heavy for a long enough duration will certainly raise the risk of MSDs complaints (Tjahayuningtyas, 2019). MSDs usually begin with complaints of intense and tight pain during work (Akbar et al., 2023). REBA (Rapid Entire Body Assessment) is a method in the field ergonomics used to quickly assess the posture of the neck, back, arms, the wrists and ankles of a worker. (OHSCO, 2008). Rapid Body Assessment (REBA) is a body posture assessment method developed in 2000 by Dr. Sue Hignett and Dr. Lynn Mc Atamney is an ergonomist from a university in Nottingham. REBA can be used if in a work activity using the whole body (neck, back, legs, arms, wrists), static/dynamic

posture, rapidly changing or unstable, work that handles loads/no loads continuously or not. In addition, the assessment using this method also pays attention to the grip factor, the weight of the object being lifted and the determination of worker activity (Stanton et al., 2005). Several research have been conducted to improve the worker posture using this method. For example Pratiwi et al. (2014) conducted research using RULA and REBA in pottery making in Yogyakarta. Retrieval of body posture data carried out in the formation process because almost 80% of the time It is necessary for craftsmen to complete their work with attitude work that varies greatly depending on the product to be made. Data collection includes recording craftsmen's activities, posture selection different jobs, then take angle measurements for each parts of body. The research results show that in the RULA method, Postures 3 and 8 get a score of 7, which means they are in good condition dangerous and requires immediate change, with the REBA method The results obtained were posture 2 with a score of 7 which means the risk of injury high so corrective action needs to be taken immediately. Antoher

research, Restuputri (2017) conducted research using the and method REBA for the prevention of musculoskeletal disorders at CV. Wijaya Kusuma. Causes of musculoskeletal disorder complaints in workers CV production. Wijaya Kusuma is on the work posture of the workforce at the entire production process when producing mini sanitary ware that shows high REBA score, there are 6 work postures with a "medium" risk level affected by MSDs and there are 4 work postures with a "high" risk of being affected MSDs. The solution is to improve working posture while standing and sitting producing mini sanitary ware, from the proposed improvements a score is obtained REBA of the proposed improvement in standing work posture is 1 which has the risk level can be ignored and suggestions for improving sitting working posture are proposed A REBA score of 3 was obtained which has a low risk level. Based on previous studies, it can be seen that REBA is a method that can be used to improve workers work posture and reduce injury
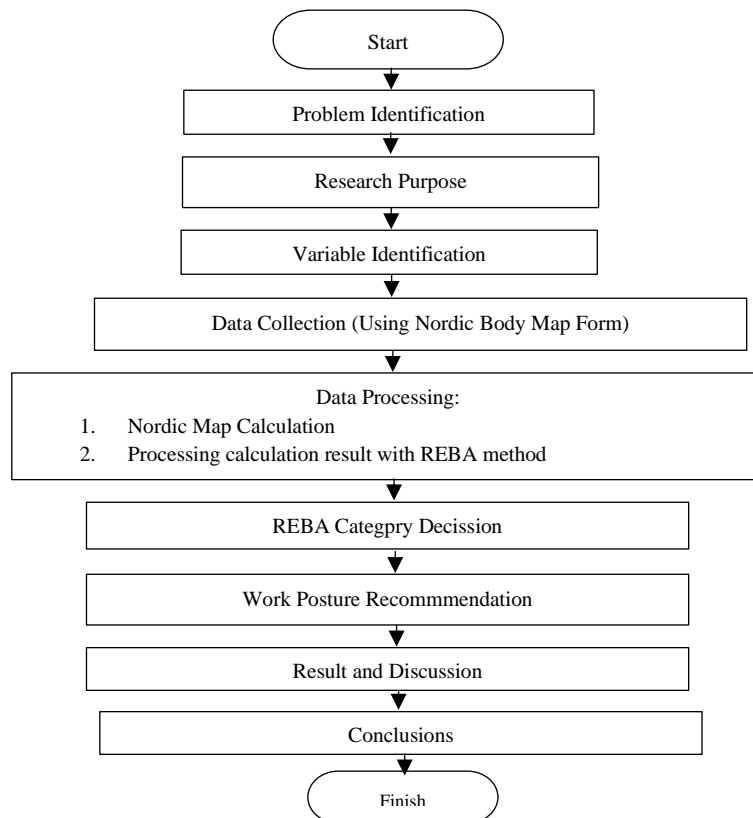
3. RESEARCH METHOD

Figure 1. Research flowchart

REBA (Rapid Entire Body Assessment) is a method in the field ergonomics used to quickly assess the posture of the neck, back, arms, the wrists and ankles of a worker. REBA has close similarities the RULA (Rapid Upper Limb Assessment) method, but the REBA method is not as good RULA method which shows the analysis on the advantages that are needed and for movement on repetitive jobs created, REBA is more general, in the sum of one of the new systems in the analysis included dynamic and static factors, the form of loading, the interaction of individual loading, and a new concept related to consideration with the title "The Gravity Attended" to prioritize the position of the most superior. The first step is giving Nordic Body Map Form to the workers. The Nordic Body Map Form was created to find out the complaints experienced by employees while doing work. The Nordic Body Map questionnaire contains 28 complaints of pain in all parts of the body.

Table 1. Nordic body map form result

No	Workers Name	Age	Work Period	Number of Complaint	Complaint Type
1	Lidya Septiyanti	30	5-10 Years	13	1, 5, 6, 8, 12, 13, 15, 16, 19, 21, 23, 25, 27
2	Sri Widayanti	40	>10 Years	12	0, 5, 6, 8, 10, 12, 13, 15, 21, 22, 23, 25, 27
3	Lala Kumala	28	4 Years	11	1, 2, 3, 4, 8, 11, 13, 15, 24, 25, 27
4	Farah Syahdina	32	5 Years	11	1, 5, 13, 14, 15, 16, 19, 21, 23, 25, 26
5	Lina Fatuliya	45	>10 Years	15	0, 1, 2, 5, 8, 10, 12, 19, 20, 21, 23, 24, 25, 26, 27
6	Wiwik Siti Aminah	40	>10 Years	10	6, 8, 12, 13, 15, 19, 21, 22, 23, 27
7	Khumaidah Khorirotul	34	8 Years	13	1, 3, 5, 8, 10, 11, 12, 13, 14, 19, 23, 25, 26
8	Sita Fatimah	28	5 Years	10	3, 4, 5, 8, 12, 13, 21, 22, 24, 27
9	Hana Zubaida	30	6 Years	10	0, 1, 2, 3, 13, 15, 16, 21, 23, 27
10	Yayuk Lailatul Syahidah	42	>10 Years	11	1, 3, 5, 8, 11, 12, 19, 21, 25, 26, 27

Each complaint contained in the Nordic Body Map questionnaire is calculated by adding up similar complaints, and then a percentage is made from all employees in the Line I Upper section. After that, the percentage is made of all employees of the Line I Upper section. percentage of questionnaires collected from of the 10 upper employees, 28 body parts complained of experiencing conditions quite sick, sick, to very sick. The most common complaints felt by Line I Upper employees after work are:

a. 3 employees complained of pain with a percentage of 30% felt in the body parts:
- Pain at the bottom of the neck
- Pain in the right calf
- Pain in right leg

b. Complaints of illness as many as 2 employees with a percentage of 20% felt in parts of the body:
- Pain in the right knee
- Pain in the back

c. Minor complaints as many as 7 employees with a percentage of 70% felt in any part of the body:
- Pain in right ankle
- Pain in left forearm

The percentage of complaints that are often experienced by 10 employees Line I Upper is pain in the lower part of the neck, this can be caused by an unnatural working posture.

4. RESULT AND DISCUSSION
REBA Manual Calculation

In this stage, every posture of the workers body will counted and give the score. In the REBA Group A Sewing Process Scoring, we can see that the neck forms an angle of >20° with a slight bow, where this posture gets a REBA score of 2. The torso forms an angle of about 20° to 60°, where this posture gets a REBA score of 3. Both legs are well supported by sitting, where this posture gets a REBA score of 1. There is no supported load, this condition does not receive REBA scoring. (Table 2) The total score obtained in the group A table is 4 and because there is no load value, the total score obtained in the group A table is 4.

In the REBA Group B Sewing Process Scoring, we can see that The upper arms move to form an angle of 20°-45° where this posture gets a REBA score of 2. The forearms move by forming an angle of 0°-100° where this posture gets a REBA score of 2. The wrist moves at an angle of >15° with the wrist sideways, where this posture gets a REBA scoring of 3. The grip score performed by employee A is a grip that is in the good category, where this point does not receive a REBA score. (Table 3) The total score obtained in the group B table is 4 and because there is a coupling value of 0, the total score obtained in the group B table is 4.

The final value for the work posture of employees in the upper production work process contained in table 4.6 above is 4 with an activity value of 2 added due to repetition of a small part of the activity more than 4 times for 1 minute, so the final value is 6. Based on this score, the risk level of Employee work posture is categorized as a medium risk level, which means it requires inspection and change as can be seen in Table 4

Table 2. REBA Group A upper sewing process result

A		Neck												
		1				2				3				
	Feet	1	2	3	4	1	2	3	4	1	2	3	4
	1	1	2	3	4	1	2	3	4	3	3	5	6
	2	2	3	4	5	3	4	5	6	4	5	6	7
Body Trunk	3	2	4	5	6	4	5	6	7	5	6	7	8
	4	3	5	6	7	5	6	7	8	6	7	8	9
	5	4	6	7	8	6	7	8	9	7	8	9	9

Table 3. REBA Group B upper sewing process result

B		Forearm					
		1			2		
	Wrist	1	2	3	1	2	3
	1	1	2	2	1	2	3
	2	1	2	3	2	3	4
Upper arm	3	3	4	5	4	5	5
	4	4	5	5	5	6	7
	5	6	7	8	7	8	8
	6	7	8	8	8	9	9

Table 4. REBA Group A and B upper sewing process result

Group A Score	Group B 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
2	1	2	2	3	4	4	5	6	6	7	7	8
3	2	3	3	3	4	5	6	7	7	8	8	8
4	3	4	4	4	5	6	7	8	8	9	9	9
5	4	4	4	5	6	7	8	8	9	9	9	9

REBA Calculation using ErgoFellow Software

Calculations can also be done using Ergofellow software. After carrying out the process in the Ergofellow software, the final REBA score was 6. This value is the same as the calculation carried out manually (Figure 1).

Improvement of Work Posture

Based on the results of observations and analysis results that have been carried out on the working posture of Line I Upper employees, recommendations for improvement have been obtained to reduce the risk value of working posture by adopting good and correct working positions. The position of the neck (neck) forming an angle of >20° can be changed to form an angle between 0°-20° and get a score of 1. The angle of the position of the torso (trunk) needs attention because it has an angle of 20°-60° with a score of 3. Proposed improvement is to change the angle of the trunk to 0°-20° or even straight so that a score of 1 is obtained. Upper arm position needs attention because it forms an angle of 20°-45° with a score of 2. Proposed improvements include changing the working position if possible by straightening the upper arm with minimal movement to 0°-20° and not bending it so that a score of 1 is obtained. The position of the wrist forms an angle of >15° and sideways with a score of 4. The proposed improvement is to change the position of the wrist to form an angle of 0°-15° without any additional position so that a score of 2 is obtained. For suggestions for improving work posture in this process, a REBA score of 2 is obtained, which is lower than the initial work posture of 6, so that the risk value of the initial work posture can be reduced (Figure 3).
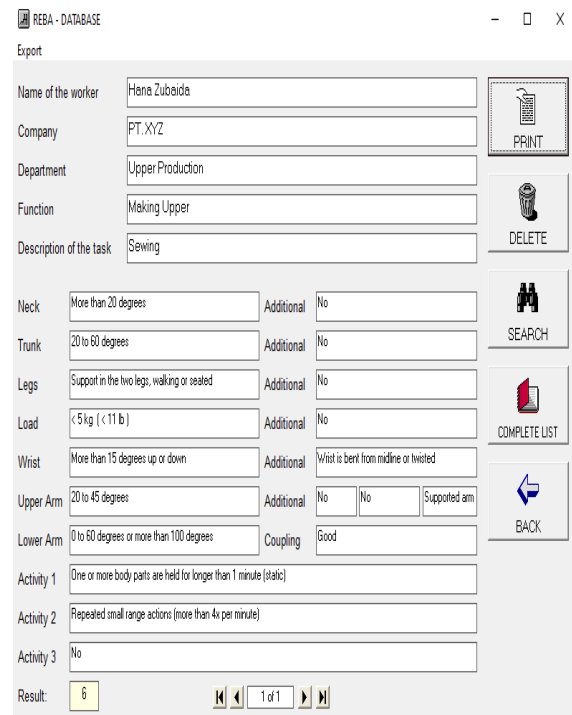

Figure 2. Result using ErgoFellow software

Figure 3. Line 1 upper worker's posture suggestion

Compared to previous study, the result of this study show the score obtained after improving working posture in this case study can decrease significantly. The results of the improvements also help companies to increase worker effectiveness and reduce the risk of worker injury. This can increase the production of upper shoes to be more efficient.

5. CONCLUSION
 Based on data processing from the questionnaire results, the percentage of questionnaires collected from 10 Line I Upper employees showed that there were 28 body parts that complained of being quite sick, sick or very sick. The most common complaints felt by Line I Upper employees after work where 3 employees each with a percentage of 30% experienced complaints of pain in the lower part of the neck, right lower arm, right calf and right foot; as many as 2 employees with a percentage of 20% experienced complaints of pain in the back and right knee; and as many as 7 employees with a percentage of 70% experienced mild complaints on the left forearm and right ankle. Complaints frequently experienced by 10 Line I Upper employees based on percentages refer to pain in the lower part of the neck which can be caused by unnatural working postures, and based on the REBA scoring results carried out manually and using ErgoFellow 3.0 software, the upper production process has value REBA scoring of 6 with a moderate level of risk that requires investigation and improvement. Proposals for improving work postures to reduce the risk level of musculoskeletal disorders (MSDs) in the sewing process, namely by proposing working postures in the trunk position with a movement angle of 0°-20°, in a moving neck position with a range of movement between 0°-20 °, the position of the upper arm moving between 0°-20° and not bending, and the position of the wrist (wrist) moving between 0°-15° without any sideways movement, for suggestions for improving work posture in this upper sewing process get a REBA score of 3 from the previous one with a value of 6 so that the risk level can change to be low from the previous one which had a moderate level of risk.

Researcher also suggest that the companies should provide work aids in the form of support to support employee performance and pay more attention to the environmental atmosphere and placement of employees' work equipment when carrying out work. Research based on human error, K3, Layout Design, and research that considers the physical work environment are suggested for further research to obtain a comprehensive case study in the focus area of ergonomic risk.

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