

## **Analysis of Rapid Entire Body Assessment (REBA) & Nordic Body Map (NBM) Methods to Reduce Low Back Pain (LBP) In The Stamping and Tooling Company**

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### **Abstract:**

**Background:** A company engaged in stamping and tooling, has a dies manufacturing process where there are several processes, one of which is handwork by operator in the finishing department. During the handwork process, operator is standing and resting by using one hand with his head down. The working positions feel uncomfortable because dies are underneath so the body has to. This position can cause the operator to experience complaints in the waist (low back pain). The purpose of this study was to identify the body and see the factors that influence low back pain complaints in order to provide posture improvement. An analyzed using the Nordic Body Map (NBM) and the Rapid Entire Body Assessment (REBA) methods.

**Materials and Methods:** The method used in this research are Nordic Body Map (NBM) and the Rapid Entire Body Assessment (REBA) methods. Data collection is used to obtain data with actual techniques in direct observations such as interviews and questionnaires about physical complaints with four operator in the finishing area and observing the operator's posture observations using videos and photos on when the operator is working..

**Results:** The results of this analysis are an individual score of 71-73, which is a high risk level for musculoskeletal disorders (MSDs) from each operator, and it was found that 7 out of 28 complaints of skeletal muscle complaints had a very high level of complaints, and also a very high level of risk in body posture, with Final score 12.

**Conclusion:** After analyzing the data gathered, the recommendation given in the form of a steger tool, which could changed the operator's posture while working, so as to reduce the risk of Low Back Pain (LBP). Analysis was carried out by illustrating the operator's posture if improvements were made when working using the Rapid Entire Body Assessment (REBA) method, and the final Rapid Entire Body Assessment (REBA) score was 5, which is a moderate risk level.

**Key Word:** Nordic Body Map (NBM); Rapid Entire Body Assessment (REBA); Body Posture; Low Back Pain (LBP).

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### **I. Introduction**

In a work system, humans play a very important role, because they have to plan, design, control and evaluate the work system at hand (Susanti et al., 2015). A good and correct work position is a position that does not cause pain during or after work, so it does not interfere with work processes and does not need to spend unnecessary efforts at work. With ergonomics, work systems in various lines of company operations are designed in such a way as to pay attention to worker variations in terms of abilities and limitations (physical, psychological, and socio-technical) (Susanti et al., 2015).

A company engaged in stamping and tooling, has a tooling department. Quality stamping products are produced from good tooling products, especially dies, which are molding tools from panels, which are the company's main product. Dies manufacturing goes through several stages of the process, one of which is hand work by the operator. The process of making hand work or it can be said that the manual process carried out by the operator consists of the sanding process, manual grinding, and manual hardening on the die surface. The hand work process can take 60 minutes - 120 minutes for one die in one shift. During the hand work process, the operator is standing and bent on one hand and the head is bowed. This work position will feel uncomfortable because the dies are underneath so that the body has to bend over. This position can cause the operator to experience complaints at the waist (low back pain). With this case, the authors analyzed the operator's work posture using the Rapid Entire Body Assessment (REBA) and Nordic Body Map (NBM) methods.

In this paper, the author will discuss the problem of Low Back Pain (LBP) complaints to four operators

of work activities that can cause these complaints. This study aims to find out how the operator's work attitude and what factors influence the occurrence of low back pain. Furthermore, we can find out how to reduce the occurrence of physical complaints during the hand work process by providing suggestions for posture improvement.

## **II. Material And Methods**

### **Musculoskeletal Disorders (MSDs)**

Musculoskeletal complaints are complaints in the parts of the skeletal muscles that a person feels from very mild complaints to very pain. If the muscles receive static loads repeatedly and for a long time, it can cause complaints in the form of damage to joints, ligaments and tendons. Complaints to the damage are usually termed complaints of musculoskeletal disorders (MSDs) or injuries to the musculoskeletal system (Tarwaka, 2004). Several factors can cause skeletal muscle complaints:

1. Excessive stretching of muscles (over exertion), is often complained of by workers where their work activities require great exertion such as lifting, pushing, pulling and holding heavy loads.
2. Repetitive activities, work that is carried out continuously such as hoeing, chopping large logs, lifting and carrying etc.
3. The work attitude is unnatural, causing the position of the body parts to move away from their natural position, for example a raised movement, the back is too bent, the head is raised, etc.

### **Low Back Pain (LBP)**

Low back pain (LBP) is pain that is felt in the lower back whose source is the spine in the spinal area (lower back), muscles, nerves, or other structures around the area. Low back pain (LBP) can be caused by diseases or disorders that originate from outside the lower back, such as disease or abnormalities in the testicles or ovaries (Suma'mur 2009). According to Suma'mur (2009), Low back pain (LBP) is related to risk factors such as age, obesity (overweight), smoking habits or lack of physical fitness, besides that Suma'mur (2009) also said that in general, the job of lifting, carrying, pulling or pushing heavy loads or those performed in an unnatural / forced body position are more prone to experiencing complaints of Low back pain (LBP).

### **Rapid Entire Body Assessment (REBA)**

Rapid Entire Body Assessment or REBA developed by Dr. Sue Hignett and Dr. Lynn Mc Atamney who is an ergonomist from the University of Nottingham (University or Nottingham's Institute of Occupational Ergonomics). Rapid Entire Body Assessment (REBA) is a method in the field of ergonomics that is used to rapidly assess a worker on the posture of the neck, back, arms, wrists, and feet. This method is also equipped with coupling factors, external loads, and work activities. Assessments using REBA do not take a long time to complete and do a general scoring on a list of activities which indicates the need for risk reduction caused by the operator's work posture (Hignett & Atamney, 2000).

In this method, body segments are divided into two groups, namely group A and group B. Group A consists of the back (torso), neck and legs, while group B consists of the upper arms, forearms, and wrists. The determination of the REBA score, which indicates the risk level of the work posture, starts from determining the A score for group A postures plus the load score and the B score for group B postures plus the coupling score. The two scores (score A and score B) were used to determine the C score. The Rapid Entire Body Assessment (REBA) score is obtained by adding the activity score to the C score. From the Rapid Entire Body Assessment (REBA) score it can be seen the level of risk of injury that exists.

The stages of development using the Rapid Entire Body Assessment (REBA) method include:

- a. Retrieval of worker posture data using video or photo assistance.
- b. The angles of the worker's body parts are determined by the following rules.
- c. Calculation of the REBA value for the posture in question.

REBA score classification:

- Class I (score 1) = No risk
- Class II (score 2-3) = Low risk
- Class III (score 4-7) = moderate risk
- Class IV (score 8-10) = High risk
- Class V (score 11-15) = Very high risk (Hignett & Atamney, 2000).

### **Nordic Body Map (NBM)**

Using the Nordic Body Map (NBM) method, it can be seen which muscle parts are experiencing complaints, ranging from discomfort (mild pain) to extreme pain. By looking at and analyzing the types and levels of skeletal muscle complaints felt by workers. The Nordic Body Map (NBM) questionnaire covers 28 parts of the skeletal muscles on both the right and left sides of the body. Starting from the upper limbs, namely

the neck muscles to the muscles in the legs, through this questionnaire, it will be possible to find out which parts of the muscles are experiencing disturbances in the form of pain or high-level complaints (very painful complaints) (Tarwaka, 2004) This can be done by looking at the total percentage score for each part of the skeletal muscle and the risk level category

**Procedure Methodology**

**Types of research**

Based on its type, this research includes descriptive and quantitative research which has the main characteristic of not requiring a hypothesis that provides an objective explanation, and evaluation as a consideration for the current incident data, as well as calculation processing to determine the proposed solution.

**Type of Data & Information**

This research uses data and information in the form of primary and secondary data. Primary data is data obtained through direct observation and measurement of the object of research related to the complaints of Low Back Pain (LBP). Secondary data is data that is already available from other parties, such as information from companies.

**Method of collecting data**

At this stage, data collection was carried out using two types of methods, namely primary and secondary data. Primary data, this method is used to obtain data with actual techniques in direct observations such as interviews or questionnaires about physical complaints with four finishing section operators in the finishing area on October 02, 2020 and observing the operator's posture observations using videos and photos on when the operator is working. Secondary data, the method used to obtain data indirectly, such as studying literature, journals, and books as supporting references related to Low back pain (LBP) complaints.

**Data Processing and Analysis Methods**

In this study, the Nordic Body Map (NBM) questionnaire was used to obtain the results of interviews with operators, then the results of the questionnaire were processed into data showing the results of Low Back Pain (LBP) complaints. After distributing the questionnaires, the operator's work posture data processing is carried out at work, namely by marking a straight line along with the angles of the photos that have been taken. From the data that has been processed, it is followed by analyzing the data by scoring the work posture using the Rapid Entire Body Assessment (REBA) method.

**III. Result And Discussion**

The work performed by the finishing operator caused several complaints in each part of the skeletal muscle and resulted in a high risk of low back pain for each finishing operator. As we could see on table 1. By using Nordic Body Map (NBM) method, it can also be seen what part of the skeletal muscle is experiencing complaints, of the 28 complaints there are 7 complaints with a very painful level as seen on table 2.

**Table 1 Risk Level of Pain Complaints in Finishing Operators**

| No | Name   | Total Individual Score | Risk Level | Countermeasure                   |
|----|--------|------------------------|------------|----------------------------------|
| 1  | Heri   | 71                     | High       | Immediate all action is required |
| 2  | Tomo   | 72                     | High       |                                  |
| 3  | Dhimas | 71                     | High       |                                  |
| 4  | Teguh  | 73                     | High       |                                  |

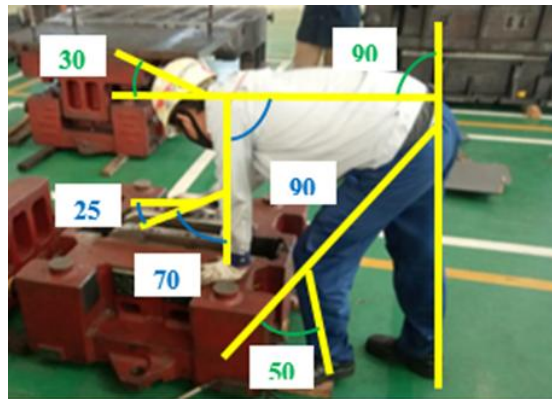
**Table 2 Percentage of Very Pain Complaints**

| No | Type of Complaint         | Percentage (%) |
|----|---------------------------|----------------|
| 1  | Pain in the left shoulder | 100%           |
| 2  | Pain in the back          | 100%           |
| 3  | Pain in the buttocks      | 100%           |
| 4  | Pain in the right leg     | 88%            |
| 5  | Back pain                 | 81%            |
| 6  | Pain in the left hand     | 75%            |
| 7  | Pain in the right calf    | 75%            |

**Results of the Rapid Entire Body Assessment (REBA)**

After knowing the risk level results from using the Nordic Body Map (NBM) method, then analyzing the risk level results using the Rapid Entire Body Assessment (REBA) method to determine the level of risk for posture during work. Figure 1 and Table 3 are the posture of the finishing operator who has been given a posture scale. From the results of data processing, the finishing operator has a very high level of low back pain risk and requires immediate change action, it can be seen from the final results of Rapid Entire Body Assessment (REBA) scoring in Table 4.

**Figure 1** Scale of operator's posture in finishing part



**Table 3** Data on the Posture Scale of Finishing Operators

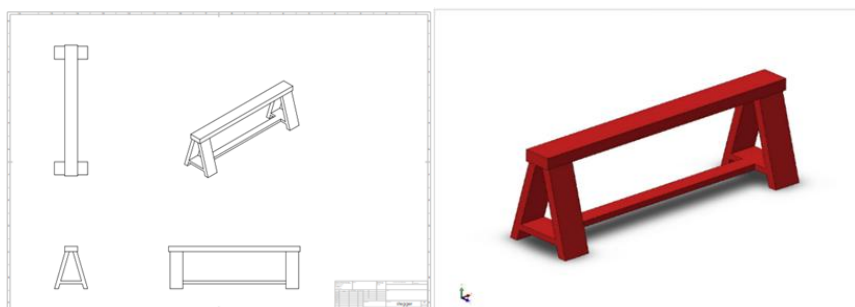
| Group | Parts of body | Angle |
|-------|---------------|-------|
| A     | Torso         | 90°   |
|       | Neck          | 30°   |
|       | Feet          | 50°   |
| B     | Upper arm     | 90°   |
|       | Forearm       | 70°   |
|       | Wrist         | 25°   |

**Table 4** Rapid Entire Body Assessment (REBA) Score Before Improvement

| Information                                 | Score                               |
|---|-------------------------------------|
| Score A                                     | 7                                   |
| Score B                                     | 5                                   |
| Score C                                     | 10                                  |
| Assess muscle activity                      | 2                                   |
| Final REBA score (C score + activity score) | 12                                  |
| Risk level                                  | Very High                           |
| Action                                      | Changes need to be made immediately |

**Proposed Improvement**

From the description of the problem above, it can be concluded that the finishing operator has the risk of low back pain (LBP) and it is necessary to immediately improve body posture when doing work, namely by adding tools at the time of finishing work. The auxiliary tool used is in the form of an iron steger, its use is as a holder for dies that are going through the finishing stage, so that the height of the dies will be almost parallel to the operator's waist while working. Figure 2 is a steger image that will be used.

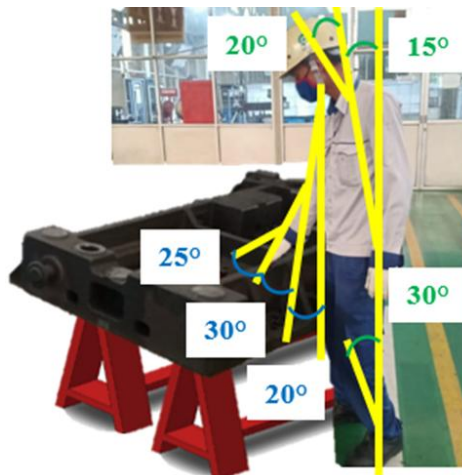


**Figure 2** Iron Steger

With its main function as a support and as a load bearer, using this tool will affect posture while working, furthermore the operator does not need to bend excessively and will stand upright without bending his legs. The steger used is made of 5 mm thick sheet material, therefore it can withstand loads of up to 200 tons. The use of steger is to place 1 die on top of 2 aligned steger, as in Figure 3.

**Assessment of Body Posture When Improved**

In Figure 3 and Table 5 is an illustration if a work posture is corrected using a steger tool, with a steger height of 500 mm and a die height between 400-550 mm, and also an illustration of the scale of the posture in the finishing section operator.



**Figure 3** Illustration of Body Posture When Improved Work Posture

**Table 5** Illustrative Data on the Scale of the Finishing Operators' Posture

| Group | Parts of body | Angle |
|-------|---------------|-------|
| A     | Torso         | 15°   |
|       | Neck          | 20°   |
|       | Feet          | 30°   |
| B     | Upper arm     | 20°   |
|       | Forearm       | 30°   |
|       | Wrist         | 25°   |

Then from the results of the Rapid Entire Body Assessment (REBA) method score, it is determined what level of risk experienced by workers. The following is a table for determining the final Rapid Entire Body Assessment (REBA) score and the level of risk and determining actions for improvement in Table 6.

**Table 6** Rapid Entire Body Assessment (REBA) Score After Improvement

| Information                                 | Nilai                   |
|---|-------------------------|
| Score A                                     | 3                       |
| Score B                                     | 4                       |
| Score C                                     | 3                       |
| Assess muscle activity                      | 2                       |
| Final REBA score (C score + activity score) | 5                       |
| Risk level                                  | Middle                  |
| Action                                      | Changes need to be made |

From the results of the illustration of body posture, if repair is done with tools then the data is processed using the Rapid Entire Body Assessment (REBA) method, resulting in that the work done by the finishing department operator has a moderate level of risk.

**IV. Conclusion**

Based on the results and discussion of this study, the conclusions of the researchers as follows.

1. The results of the analysis of the Nordic Body Map (NBM) was found that there were 7 out of 28 complaints of the skeletal muscle that had a level of complaints of extreme pain method obtained an individual score of 71-73, namely the high risk level of musculoskeletal disorders (MSDs) for each operator. The result of

analysis using the Rapid Entire Body Assessment (REBA) method is a very high level of risk, with the final Rapid Entire Body Assessment (REBA) score reaching 12.

2. Bad posture while working requires immediate corrective action because it can cause an increase in complaints of musculoskeletal disorders other than low back pain. The suggestion given is in the form of a steger tool, to be used to support the dies therefore that the dies are positioned higher, closer to the hip height, and can change the operator's posture while working.

3. Analysis was carried out by illustrating the operator's posture if improvements were made when working using the Rapid Entire Body Assessment (REBA) method, and the final Rapid Entire Body Assessment (REBA) score was 5, which is a moderate risk level.

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