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Work Posture Analysis Using REBA and RULA Methods on Production Process at CV Halalan Thoyiban

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Abstract

Achieving optimal results is something that should be considered in industrial activities. One of the factors supporting achieving optimum results is the system of work in the company. Man is one of the elements of such a system of work. Humans have limited physical abilities, so it is necessary to pay attention to the load that can be borne during work. When humans receive excessive loads with the wrong working posture, it can lead to fatigue and musculoskeletal disorder. These conditions will have an impact on workers productivity, so workloads and postures are something to bear in mind. On CV Halalan Thoyiban there is a production process that is done manually and over a long period of time, so there needs to be an analysis of the operator's working posture. Based on the Nordic body map questionnaire, it is known that the worker has been suffering from pain in some parts of his body. The results of the analysis using the REBA and RULA methods showed that the working posture has low risk, medium risk, and very high risk levels.

Keywords: Work Posture, Nordic Body Map, REBA, RULA

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I. INTRODUCTION

The increase in industrial activity must be balanced with the achievement of the results of the work process. A good working system will be created when its elements are well organized, including men, materials, machines and equipment, working methods, and working environment. The man element is the part that will be studied further in this research. Humans have limited physical and cognitive capabilities, therefore, in doing their work, humans must pay attention to the workload that can be accepted during work [1]. It relates to the working posture performed by the worker, in practice often the work posture is regarded as something considered trivial and unnoticed. If the wrong posture is performed continuously, it will cause fatigue and muscle disorder or musculoskeletal disorders (MSDs). If this happens to the workers then the productivity of the operator will be disrupted and the production target is not achieved, therefore the posture of work is something to pay attention to. An understanding of the ideal working posture for the body is important knowledge to be known and understood by all workers at work. So that conditions of the body that can hinder the productivity of the worker towards this production goal can be avoided and a good working system in the company is created.

Some methods that can be used to improve working posture include rapid entire body assessment (REBA) and rapid upper limb assessment (RULA). The improvement of the working posture is expected

to guarantee the comfort and safety of the operators and increase the productivity of the company. CV Halalan Thoyiban is one of the companies that operates in the field of food manufacturing and bread production. In this company, some parts of the production process are still done manually by humans for a long period, so there is a need for analysis of the work posture in this company's production process to find out if the work posture performed by the workers is ideal or not and how high the level of risk is.

A. Work Posture

Work posture is an action taken by a worker while doing his job [2]. When the body posture at work is good and ergonomic, then it can be assured that the result obtained by the worker will be good anyway, but if the work posture of the operator is wrong or not ergonomic then the workers will be easily tired and there can be abnormalities in the shape of the bone [3]. Unergonomic working attitude, excessive muscle movement, and repetitive activity are work factors that can cause MSD complaints [4]. There are three classifications of posture at work, namely sitting work posture, standing working posture, and sitting standing working posture. Sitting and standing position is a better position than just sitting or standing, which provides an advantage where pressure on the waist and spine is 30% lower than standing or sitting constantly [5].

B. Musculoskeletal Disorder (MSDs)

Complaints about the musculoskeletal system are complaints about parts of the skeletal muscle that a person feels ranging from very mild to very painful. When the muscles are loaded statically repeatedly and over long periods, it can cause complaints of damage to the joints, ligaments, and tendons. Complaints of damage are usually classified as musculoskeletal disorders (MSDs) or injuries to the musculoskeletal system [6]. Early symptoms in musculoskeletal disorders cause pain, dizziness, numbness, stiffness, swelling, burning, tremors, and sleep disturbances. MSD complaints if not addressed or dealt with promptly will disrupt concentration in work, cause fatigue, and ultimately reduce productivity.

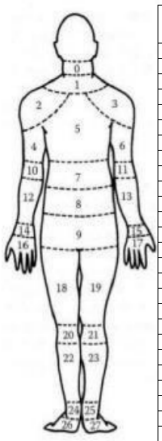
Nordic body map (NBM) is a method that is done by analyzing the body maps shown on each part of the body, this NBM method is a questionnaire given to the worker. 28 body areas can be analyzed on both the right and left sides of the body, starting from the upper limbs of the neck muscles to the lower muscles of the legs. Through the Nordic body map questionnaire, you will be able to identify any parts of the muscle that suffer from discomfort or complaints from the lowest degree (no complaint/no pain) to the highest level (very painful grievances) [4]. Fig. 1 explains the details of the Nordic Body Map.

KUESIONER
NORDIC BODY MAP

IDENTITAS DIRI
(Tulislah identitas saudara atau coret yang tidak perlu)

1. Nama :
2. Umur :
3. Jenis Kelamin : Pria / Wanita*
4. Status : Kawin / Belum Kawin*
5. Jenis Pekerjaan :

Jawablah pertanyaan berikut ini dengan memberikan tanda (√) pada kolom jawaban yang saudara pilih sesuai kondisi/perasaan saudara saat ini.



No.	Jenis Keluhan	Tingkat Keluhan			
		1	2	3	4
0	Sakit/kaku pada leher bagian atas				
1	Sakit/kaku pada leher bagian bawah				
2	Sakit pada bahu kiri				
3	Sakit pada bahu kanan				
4	Sakit pada lengan atas kiri				
5	Sakit pada punggung				
6	Sakit pada lengan atas kanan				
7	Sakit pada pinggang				
8	Sakit pada bokong				
9	Sakit pada pantat				
10	Sakit pada siku kiri				
11	Sakit pada siku kanan				
12	Sakit pada lengan bawah kiri				
13	Sakit pada lengan bawah kanan				
14	Sakit pada pergelangan tangan kiri				
15	Sakit pada pergelangan tangan kanan				
16	Sakit pada tangan kiri				
17	Sakit pada tangan kanan				
18	Sakit pada paha kiri				
19	Sakit pada paha kanan				
20	Sakit pada lutut kiri				
21	Sakit pada lutut kanan				
22	Sakit pada betis kiri				
23	Sakit pada betis kanan				
24	Sakit pada pergelangan kaki kiri				
25	Sakit pada pergelangan kaki kanan				
26	Sakit pada kaki kiri				
27	Sakit pada kaki kanan				

Keterangan : 1: Tidak sakit, 2: Agak sakit, 3: Sakit, 4: Sakit sekali

Fig 1. Nordic Body Map

C. *Rapid Entire Body Assessment (REBA)*

Rapid entire body assessment was developed by Dr. Sue Hignett and Dr. Lynn McAtamney who are ergonomists at the University of Nottingham's Institute of Occupational Ergonomic. Rapid entire body assessment (REBA) is a method developed in the field of ergonomics and can be used quickly to assess the working position or posture of the neck, back, arms, wrists, and legs of the operator. Besides, this method is also influenced by coupling factors, external loads carried by the body, and activity by the worker. Assessment using REBA does not take a long time to complete and perform a general scoring on the list of activities that indicate the need for risk reduction due to the operator working posture [7]. The result of the REBA method is a score that shows the level of risk from work posture and what action is needed to cope with it. Fig. 2 explains the details of the REBA Employee Assessment Worksheet.

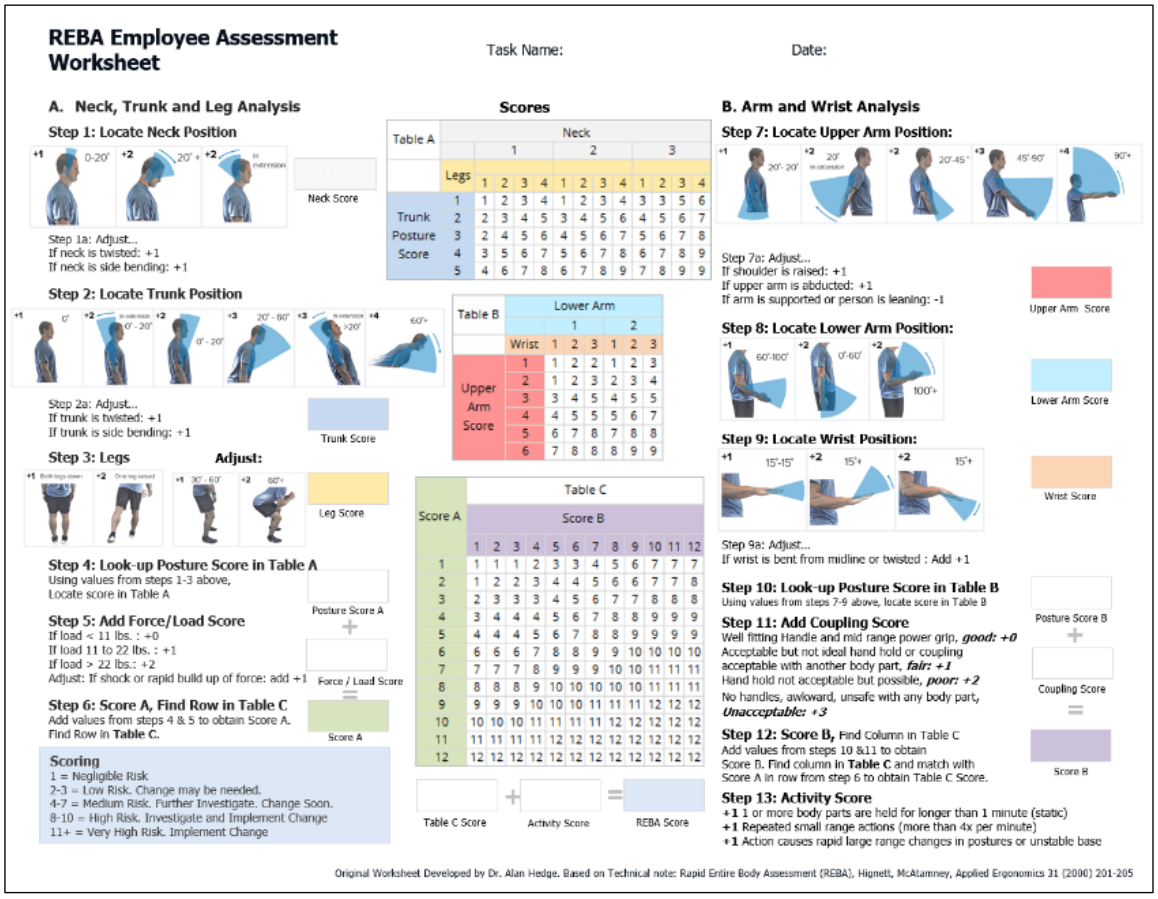


Fig 2. Worksheet REBA

D. *Rapid Upper Limb Assessment (RULA)*

Rapid upper limb assessment (RULA) method was developed by McAtamney & Corlett. RULA method is a quick method of assessing the upper body posture, the input in this method is posture (palm, upper arm, forearm, back, and neck), the loads lifted, the energy used (static/dynamic), and the amount of work. This method provides quick protection in jobs such as risks on work related to upper body or upper limb disorders. Just like REBA method, RULA method also has a final score that shows the level of risk from the working posture and what action is needed to cope with it. Fig 3. explains the details of the RULA Employee Assessment Worksheet.

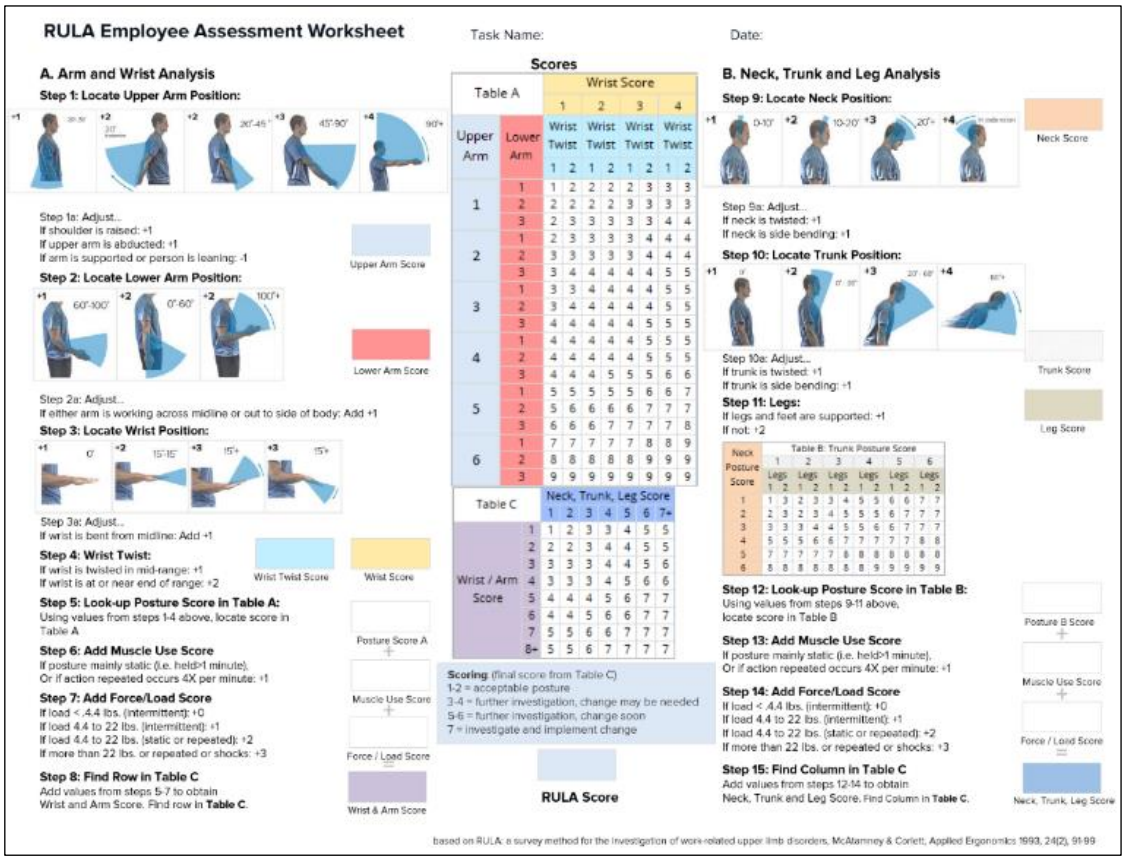


Fig 3. Worksheet RULA

II. RESEARCH METHOD

A. Problem identification

The investigation began with the identification of a problem on CV Halalan Thoyiban, the problem found was a process of work done manually over a long period of time and a complaint about some part of the body felt by the operator.

B. Data collection

Data collection is done by interview and observation. Data collection by interview to obtain data such as company profile, production process, operator data, and complaints experienced by workers. Data collection by observation methods is carried out to obtain load mass data, working duration, and side-visible operator photos.

C. Data processing and analysis

Data processing and analysis using the REBA and RULA methods yields a REBA and RULA final score that indicates the level of risk of the work posture and what action needs to be taken to cope with it.

D. Proposal for improvement

Based on the final results of the REBA and RULA scores, action was taken against the posture of work that requires improvement. This posture improvement was eventually used as a proposal for improvement for the company.

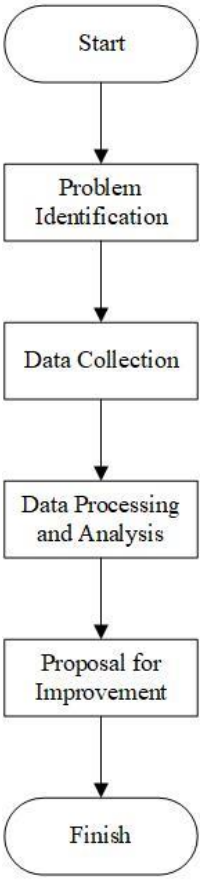


Fig 4. Research Method

I. RESULTS AND DISCUSSION

A. Initial and Improvement Work Posture

The research was carried out on four (4) operators with different tasks consisting of the process of preparing the raw material of the dough (work posture 1), cutting the dough manually (work posture 2), cutting the dough by machine (work posture 3), and filling flavor variants (work posture 4). A picture of the comparison of initial work postures and improvements is in Table I.

Table I. Initial and Improvement Work Posture

Initial work posture of preparing the raw material of the dough	Improvement work posture of preparing the raw material of the dough
	

Initial work posture of cutting the dough manually  	Improvement work posture of cutting the dough manually 
Initial work posture of cutting the dough by machine  	Improvement work posture of cutting the dough by machine 
Initial work posture of filling flavor variants  	Improvement work posture of filling flavor variants 

B. *Nordic Body Map Questionnaire*

Based on the questionnaire results of the nordic body map method, it is known that the operator in the process of preparing the raw material has a pain complaint in the back and waist. The operator in the process of cutting the dough manually has a pain complaint in the upper right arm and waist. The operator in the process of cutting the dough with machine has a pain complaint in the left upper arm, back, right upper arm, and waist. The operator in the process of filling flavor variants has a pain complaint in the upper right arm and waist.

C. *REBA*

Data of the initial and improvement work posture to the process of preparing the raw material, manual cutting of the dough, cutting the dough by machine, and filling flavor variants used for the input of the REBA method are shown in Table II.

Table II. REBA Data

Group	Dimensions	Angle (°) Work Posture 1		Angle (°) Work Posture 2		Angle (°) Work Posture 3		Angle (°) Work Posture 4	
		Initial	Improvement	Initial	Improvement	Initial	Improvement	Initial	Improvement
A	Neck	26	12	10	17	20	8	22	9
	Back	35	0	31	0	20	9	11	0
	Knees	145	19	19	8	104	94	65	54
B	Upper Arm	38	5	78	18	66	40	15	19
	Forearm	85	67	6	46	35	37	95	66
	Wrist	14	15	31	14	15	9	20	14

Based on the REBA worksheet Figure 2, group A posture score is obtained from the results of the analysis on table A and group B posture score is obtained from the results of the analysis on table B. Then group A posture score plus load score yield score A, group B posture score plus coupling score yield score B. Analysis of scores A and B on table C yield table C score, the last step is table C score plus activity score yield REBA score. This REBA score is used to determine the level of risk and improvement required on the work posture. The results of Table II data calculation using the REBA method are presented in Table III.

Table III. REBA Results

Work Posture	REBA Score and Risk Level	
	Initial	Improvement
Posture 1	5, medium risk, change soon	2, low risk, change may be needed
Posture 2	6, medium risk, change soon	3, low risk, change may be needed
Posture 3	6, medium risk, change soon	4, medium risk, change may be needed
Posture 4	6, medium risk, change soon	3, low risk, change may be needed

D. *RULA*

Data of the initial and improvement work posture to the process of preparing the raw material, manual cutting of the dough, cutting the dough by machine, and filling flavor variants used for the input of the RULA method are shown in Table IV.

Table IV. RULA Data

Group	Dimensions	Angle (°) Work Posture 1		Angle (°) Work Posture 2		Angle (°) Work Posture 3		Angle (°) Work Posture 4	
		Initial	Improvement	Initial	Improvement	Initial	Improvement	Initial	Improvement
A	Upper Arm	38	5	78	18	66	40	15	19
	Forearm	85	67	6	46	35	37	95	66
	Wrist	14	15	31	14	15	9	20	14
	Twist	*twist in mid-range*	*twist in mid-range*	*twist in mid-range*	*twist in mid-range*	*twist in mid-range*	*twist in mid-range*	*twist in mid-range*	*twist in mid-range*
B	Neck	26	12	10	17	20	8	22	9
	Back	35	0	31	0	20	9	11	0
	Foot (Supported)	35	17	27	14	27	10	37	15

Based on the RULA worksheet Figure 3, group A posture score is obtained from the results of the analysis on table A and group B posture score is obtained from the results of the analysis on table B. Then group A posture score plus muscle use score and load score yield score A, group B posture score plus muscle use score and load score yield score B. Analysis of scores A and B on table C yield score C, score C is RULA score which is used to determine the level of risk and improvement required on the work posture. The results of Table IV data calculation using the REBA method can be found in Table V.

Table V. RULA Results

Work Posture	RULA Score and Risk Level	
	Initial	Improvement
Posture 1	6, medium risk, change soon	3, low risk, change may be needed
Posture 2	6, medium risk, change soon	3, low risk, change may be needed
Posture 3	7, very high risk, investigate and implement change	3, low risk, change may be needed
Posture 4	3, low risk, change may be needed	3, low risk, change may be needed

II. CONCLUSION

Nordic body map questionnaire results by operators showed that the body segments that suffered from the pain complaints were on the back, waist, upper right arm, and upper left arm. The results of the analysis using REBA method showed that in the process of preparing the raw material has a score of 5 with medium risk level, the process of cutting the dough manually has a score of 6 with medium risk level, the process of cutting the dough by machine has a score of 6 with medium risk level, and the process of filling flavor variants has a score of 6 with medium risk level. The results of the analysis using RULA method showed that in the process of preparing the raw material has a score of 6 with medium risk level, the process of cutting the dough manually has a score of 6 with medium risk level, the process of cutting the dough by the machine has a score of 7 with very high risk level, and the process of filling flavor variants has a score of 3 with low risk level. After the improvement, almost all work postures experienced a decrease in scores and risk levels. This suggests that the improved work posture is relatively safer to use than the work posture before improvement.

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