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The Implementation of the RULA (Rapid Upper Limb Assessments) Method on Stamping Workers to Determine the Risk of Musculoskeletal Disorders Complaint

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ABSTRACT

In today's era, there are numerous businesses thriving, one of which is packaged honey production. One of the beekeeping industries that produces honey and other bee products is CV Madu Apiari Mutiara. The stamping activity in this business has workstations that are highly uncomfortable. The workstation, in the form of a table set at the height of human knees, causes discomfort for the workers and leads to MSD complaints. Therefore, a risk assessment calculation was conducted using the TULA method, resulting in a total score of 7, categorized as "Very High," requiring further investigation and immediate improvement. If this musculoskeletal disorder risk condition is not promptly addressed, it will impact the workers' health and cause workers to suffer injuries It can even cause disability in several parts of the body due to the pain experienced. Thus, the corrective action that can be taken involves designing work aids such as a workstation table that considers the anthropometric factors of the workers.

Keywords: Ergonimic, RULA, MSD, Honey

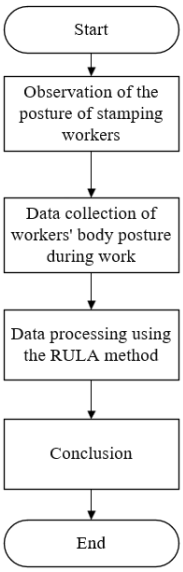
1. Introduction

In manufacturing industries, activities always involve interactions between humans and machines. This interaction occurs in various production activities. However, in reality, humans and work facilities are not always synchronized. [1] Due to this condition, humans or workers often experience complaints in their musculoskeletal system.
Risk Analysis of Musculoskeletal Complaints using the Rapid Upper Limb Assessment (RULA) method is an essential process in ensuring the ergonomic safety and well-being of workers, especially in physically demanding environments like a honey factory. Musculoskeletal complaints, such as strains, sprains, and repetitive motion injuries, can significantly impact worker productivity, morale, and overall health. Therefore, implementing a systematic approach like RULA can help identify and mitigate potential risks effectively. [2]
In a honey factory setting, where workers may be involved in tasks such as lifting heavy honey containers, repetitive arm movements during processing, or prolonged periods of standing, the risk of musculoskeletal complaints is heightened. The RULA method provides a structured framework for assessing these risks by evaluating various aspects of posture and movement.
The RULA method offers a systematic approach to evaluate ergonomic risks by assessing the postures adopted by workers during tasks. It considers factors such as joint angles, muscle exertion, and repetition, providing a comprehensive framework for identifying high-risk activities. By analysing these factors, organizations can pinpoint areas where ergonomic interventions are needed to minimize the risk of musculoskeletal complaints. [3]
Moreover, the RULA method facilitates the prioritization of interventions based on the severity of ergonomic risks identified. This

allows organizations to allocate resources efficiently and implement targeted interventions to mitigate the most significant hazards. Additionally, regular application of the RULA method enables ongoing monitoring and evaluation of ergonomic interventions' effectiveness, ensuring continuous improvement in occupational health and safety practices.[4]
In stampling division, workers have several musculoskeletal complaints such as leg stiffness, tingling feet, neck pain, and body stiffness. Based on this, the researcher conducted RULA calculations to determine the level of risk of the work posture being performed.
Based on the aforementioned, this research was conducted to determine the MSD risk based on the RULA method among stamping workers in this honey factory.

2. Material and Methods

The research method used in this study can be seen in Figure 1.



Based on Figure 1, the following is an explanation of the steps taken in this research:
a. Observation of the posture of stamping workers.
The first step is to observe the posture of stamping workers in the honey production process. Observation is necessary to assess ergonomic risks in the workplace [5]. Observations are made by carefully observing the body posture of workers during work. To complement the observation results, interviews with workers are necessary [6]. Interviews are conducted to identify any complaints experienced by workers during the work process.
b. Data collection of workers' body posture.
After observation, the next step is to collect data for processing. The data used in this study are photos of the body posture of stamping workers.
c. Data processing using the RULA method.
The data obtained from the previous process are photos of the body posture of workers while performing their tasks. The method used for this research is the RULA method. Rapid Upper Limb Assessment (RULA) is a method in the field of ergonomics used to assess working positions in the upper body [7]. This method provides a calculation of the level of Musculoskeletal Disorders (MSDs) burden in a job that poses risks to the operator's upper body from the abdomen to the neck or upper limbs [8]. Analysis using this method is conducted when there are complaints in the upper body of the operator caused by non-ergonomic body postures [9].
d. Conclusion
After processing the data, conclusions will be drawn containing the objectives of this research.

3. Results and Discussions

The following is the RULA calculation for stamping workers in honey production The following is an analysis of both workers:

1. Worker 1

Based on the posture of worker 1 above, there are several angles formed by the worker's body. The angle at the upper arm is 35 degrees. The angle at the lower arm is 70 degrees. The wrist forms an angle of 10 degrees. Based on the following data, the RULA value for group A for worker 1 is 4.

Table SEQ Table * ARABIC 1 : Score Group A Worker 1

Lengan Atas	Lengan Bawah	Pergelangan Tangan							
		1		2		3		4	
		Pergelangan tangan Memuntir		Pergelangan tangan Memuntir		Pergelangan tangan Memuntir		Pergelangan tangan Memuntir	
		1	2	1	2	1	2	1	2
1	1	1	2	2	2	2	3	3	3
	2	2	2	2	2	3	3	3	3
	3	2	3	3	3	3	3	4	4
2	1	2	3	3	3	3	4	4	4
	2	3	3	3	3	3	4	4	4
	3	3	4	4	4	4	4	5	5
3	1	3	3	4	4	4	4	5	5
	2	3	4	4	4	4	4	5	5
	3	4	4	4	4	4	5	5	5
4	1	4	4	4	4	4	5	5	5
	2	4	4	4	4	4	5	5	5
	3	4	4	4	5	5	5	6	6
5	1	5	5	5	5	5	6	6	7
	2	5	6	6	6	6	7	7	7
	3	6	6	6	7	7	7	7	8
6	1	7	7	7	7	7	8	8	9
	2	8	8	8	8	8	9	9	9
	3	9	9	9	9	9	9	9	9

Based on the body posture and body angle of worker 1, a score of 3 was obtained for the upper arm, 2 for the lower arm, 3 for the wrist, and 1 for twisting the wrist. From these scores, Group A score is obtained as 4.

Worker 1's neck forms a 20 degree angle, worker 1's body forms a 20 degree angle, and the legs are not well-supported. Based on this, the score for group B for worker 1's posture is 7.

Table SEQ Table * ARABIC 2 : Score Group B Worker 1

Leher	Badan (Trunk)											
	1		2		3		4		5		6	
	Kaki		Kaki		Kaki		Kaki		Kaki		Kaki	
	1	2	1	2	1	2	1	2	1	2	1	2
1	1	3	2	3	3	4	5	5	6	6	7	7
2	2	3	2	3	4	5	5	5	6	7	7	7
3	3	3	3	4	4	5	5	6	6	7	7	7
4	5	5	5	6	6	7	7	7	7	7	8	8
5	7	7	7	7	7	8	8	8	8	8	8	8
6	8	8	8	8	8	8	8	9	9	9	9	9

Based on the posture of worker 1, scores of 4 for the neck, 4 for the body, and 2 for the legs were obtained. With these values, the score for Group B is 7.

Based on the scores of Group A and Group B, combined with the muscle usage score, the combined score for worker 1's posture is 7. With a final score of 7, worker 1's posture falls into the very high category, indicating the need for investigation and improvement as soon as possible.

Table SEQ Table * ARABIC 3 End Score for Worker 1

Skor C	Skor D						
	1	2	3	4	5	6	7+
1	1	2	3	3	4	5	5
2	2	2	3	4	4	5	5
3	3	3	3	4	4	5	6
4	3	3	3	4	5	6	6
5	4	4	4	5	6	7	7
6	4	4	5	6	6	7	7
7	5	5	6	6	7	7	7
8	5	5	6	7	7	7	7

Table 4 Action levels according to the final score obtained.

Score	Level	Action
1 or 2	1	Acceptable Risk
3 or 4	2	Task changes may be required; further study is recommended
5 or 6	3	Task redesign is required
7+	4	Urgent changes in the task are required

For the final score, it is calculated from scores C and D. Scores C and D are obtained by adding muscle usage scores to Groups A and

B. With a score of 5 for Score C and 8 for Score D, the final score for worker 1 is 7.

2. Worker 2

Based on the posture of worker 2 above, there are several angles formed by the worker's body. The angle at the upper arm is 35 degrees. The angle at the lower arm is 70 degrees. The wrist forms an angle of 10 degrees. Based on the following data, the RULA value for group A for worker 2 is 4.

Table 5 Score Group A Worker 2

Lengan Atas	Lengan Bawah	Pergelangan Tangan							
		1		2		3		4	
		Pergelangan tangan Memuntir		Pergelangan tangan Memuntir		Pergelangan tangan Memuntir		Pergelangan tangan Memuntir	
		1	2	1	2	1	2	1	2
1	1	1	2	2	2	3	3	3	3
	2	2	2	2	2	3	3	3	3
	3	2	3	3	3	3	3	4	4
2	1	2	3	3	3	3	4	4	4
	2	3	3	3	3	3	4	4	4
	3	3	4	4	4	4	4	5	5
3	1	3	3	4	4	4	4	5	5
	2	3	4	4	4	4	4	5	5
	3	4	4	4	4	4	5	5	5
4	1	4	4	4	4	4	5	5	5
	2	4	4	4	4	4	5	5	5
	3	4	4	4	5	5	5	6	6
5	1	5	5	5	5	5	6	6	7
	2	5	6	6	6	6	7	7	7
	3	6	6	6	7	7	7	7	8
6	1	7	7	7	7	7	8	8	9
	2	8	8	8	8	8	9	9	9
	3	9	9	9	9	9	9	9	9

Based on the body posture and body angle of worker 2, a score of 3 was obtained for the upper arm, 2 for the lower arm, 3 for the wrist, and 1 for twisting the wrist. From these scores, Group A score is obtained as 4.

Worker 2's neck forms a 20 degree angle, worker 2's body forms a 20 degree angle, and the legs are not well-supported. Based on this, the score for group B for worker 2's posture is 7.

Table 6 Score Group B Worker 2

Leher	Badan (Trunk)											
	1		2		3		4		5		6	
	Kaki		Kaki		Kaki		Kaki		Kaki		Kaki	
	1	2	1	2	1	2	1	2	1	2	1	2
1	1	3	2	3	3	4	5	5	6	6	7	7
2	2	3	2	3	4	5	5	5	6	7	7	7
3	3	3	3	4	4	5	5	6	6	7	7	7
4	5	5	5	6	6	7	7	7	7	7	8	8
5	7	7	7	7	7	8	8	8	8	8	8	8
6	8	8	8	8	8	8	8	9	9	9	9	9

Based on the posture of worker 2, scores of 4 for the neck, 4 for the body, and 2 for the legs were obtained. With these values, the score for Group B is 7.

Based on the scores of Group A and Group B, combined with the muscle usage score, the combined score for worker 2's posture is 7. With a final score of 7, worker 2's posture falls into the very high category, indicating the need for investigation and improvement as soon as possible.

Table 7 End Score for Worker 2

Skor C	Skor D						
	1	2	3	4	5	6	7+
1	1	2	3	3	4	5	6
2	2	2	3	4	4	5	6
3	3	3	3	4	4	5	6
4	3	3	3	4	5	6	7
5	4	4	4	5	6	7	7
6	4	4	5	6	6	7	7
7	5	5	6	6	7	7	7
8	5	5	6	7	7	7	7

Table 8 Action levels according to the final score obtained.

Score	Level	Action
1 or 2	1	Acceptable Risk
3 or 4	2	Task changes may be required; further study is recommended
5 or 6	3	Task redesign is required
7+	4	Urgent changes in the task are required

For the final score, it is calculated from scores C and D. Scores C and D are obtained by adding muscle usage scores to Groups A and B. With a score of 5 for Score C and 8 for Score D, the final score for worker 2 is 7

4. Conclusion

Based on the calculation results of the MSD complaint risk experienced by workers using the RULA method, there is a final score of 7 which falls into the highest level, namely level 4 with the category of "Very High" risk. Therefore, further investigation and urgent changes are needed. The solution to improve or reduce the MSD complaints experienced by workers can be the use of ergonomic workstation design. This workstation is designed considering the anthropometric factors of the workers and can be easily adjusted in height (table legs) to suit the workers' needs. This is important because the dominant complaints experienced by workers are mainly in the back, legs, and arms, which make them quickly feel tired.

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