**Ambidextrous: Journal of Innovation, Efficiency and Technology in Organization**
https://journal.takaza.id/index.php/ambidextrous
Vol. 3, No. 02, 2025, pp. 125-137
E-ISSN: 3031-7002
E-mail: ambidex@takaza.id

# ANALYSIS OF WORK POSTURE AMONG OPERATORS AT CV. ADILA JAYA USING THE RULA AND REBA METHODS

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**Article History:**
Received:
Revised:
Accepted:

**Keywords:** *Ergonomics, Musculoskeletal Disorders, Posture Analysis, REBA, RULA*

***Abstract:*** *Workplace ergonomic risks significantly impact operator health and productivity, especially in small-scale manufacturing like CV Adila Jaya's hotel sandal production. This study aims to analyze operator working postures using Rapid Upper Limb Assessment (RULA) and Rapid Entire Body Assessment (REBA) methods. A descriptive quantitative design was employed with purposive sampling of operators active in five production stages: measuring and molding, cutting, printing, assembling, and packing. Data were collected through direct observation, photographic documentation, and the Nordic Body Map (NBM) questionnaire to assess musculoskeletal complaints. Postural risks were quantified using RULA and REBA worksheets. Results indicated very high to high ergonomic risk levels particularly in measurement, molding, cutting, and packing stages. Musculoskeletal complaints mainly involved the neck, shoulders, back, and upper limbs. The study concludes that ergonomic interventions are urgently needed to improve working postures and reduce musculoskeletal disorders. Continuous ergonomic assessment and workstation redesign should be implemented to enhance operator comfort, reduce injury risk, and improve productivity in small-scale industries.*

**How to Cite:** First author., Second author., & Third author. (20xx). ANALYSIS OF WORK POSTURE AMONG OPERATORS AT CV. ADILA JAYA USING THE RULA AND REBA METHODST. *Ambidextrous Journal of Innovation Efficiency and Technology in Organization*. *vol*(no). pp. https://doi.org/10.61536/ambidextrous.v3i02.324

https://doi.org/10.61536/ambidextrous.v3i02.324

## Introduction

Workplace comfort and safety are critical factors influencing operator productivity within industrial environments. Ergonomic posture plays a vital role, as non-ergonomic body positions can lead to musculoskeletal disorders (MSDs), which frequently arise from repetitive, bending, or sustained static postures without adequate support (Groover, 2016; Liu et al., 2025). These musculoskeletal complaints represent a significant concern in industries requiring manual, repetitive tasks, potentially impairing worker health and productivity (Prasetya et al., 2024; Varghese et al., 2025). Thus, proper ergonomic assessment is necessary to mitigate these risks and foster healthier working conditions.

In the small-scale manufacturing industry—such as CV Adila Jaya's hotel sandal production—varied production stages involve physically demanding activities, including measuring, molding, cutting, assembling, and packing. Each stage presents unique ergonomic challenges due to repetitive motions, unbalanced postures, and exertion (Tarwaka et al., 2004; Stanton et al., 2020). Prolonged exposure to awkward postures and static loading contributes to increased MSD risks, notably in the neck, back, shoulders, and wrists (Lusi et al., n.d.; Liu et al., 2025). Posture assessment methods like Rapid Upper Limb Assessment (RULA) and *Rapid Entire Body Assessment* (REBA) are invaluable for quantifying these risks and prioritizing ergonomic improvements (Wilson & Sharples, 2015; Kamijantono, 2024).

Given the occupational hazards posed by poor posture across varied stages of CV Adila Jaya's production, this study aims to analyze operator working postures using RULA and REBA methods. The investigation seeks to identify high-risk postures and provide actionable recommendations for ergonomic interventions to reduce musculoskeletal complaints and enhance worker safety and productivity. This research contributes novel insights by applying combined assessment methods to a small-scale manufacturing context, supporting evidence-based ergonomic improvements tailored to this sector's specific production demands (Zaini, 2021; Tiogana & Hartono, 2020). The urgency of this investigation is underscored by the high MSD prevalence in repetitive and physically intensive workplaces, justifying targeted ergonomic assessments and interventions.

## Research Methods

This study employed a descriptive quantitative research design aimed at analyzing the ergonomic risk levels in operator working postures during the hotel sandal production process at CV. Adila Jaya. The research involved observing and evaluating five main production stages: measuring and molding, cutting, printing, assembling, and packing, consistent with established ergonomic study protocols (Groover, 2016; Sugiyono, 2021). Data collection leveraged direct observation methods, photographic documentation of operator postures, and structured interviews using the *Nordic Body Map* (NBM) questionnaire to identify musculoskeletal complaints. The choice of NBM as an instrument aligns with international ergonomics standards for identifying discomfort related to occupational activities (Wilson & Sharples, 2015; Sudaryono, 2023). Furthermore, postural risk was assessed using Rapid Upper Limb Assessment (RULA) for upper body postures and *Rapid Entire Body Assessment* (REBA) for full-body evaluation, which have been validated as effective tools for workplace ergonomic risk


https://doi.org/10.61536/ambidextrous.v3i02.324

identification (Tiogana & Hartono, 2020; Cresswell et al., 2022).

Instrumentation included the Nordic Body Map questionnaire to quantify musculoskeletal complaints, coupled with photographic posture data analyzed through RULA and REBA worksheets. These instruments provided quantitative scores reflecting postural risk and musculoskeletal strain, supporting comprehensive ergonomic risk assessment (Zaini, 2021; Emzir, 2023). The RULA method focused on detailed evaluation of the neck, back, and upper limb postures during assembly and packing tasks, while REBA evaluated dynamic full-body postures for the more physically varied tasks (Korkmaz & Unver, 2024). Data analysis involved calculating risk scores based on standardized worksheets, followed by classification of risk levels and identification of intervention priorities. Statistical descriptive techniques were employed to interpret the risk score distributions and musculoskeletal complaint frequencies within the operator groups (Sugiyono, 2021; Sudaryono, 2023).

The study population comprised operators actively engaged in each production stage at CV. Adila Jaya. The sampling method employed was purposive sampling, selecting workers with active and experienced involvement in the respective production tasks to ensure relevant and reliable data collection, a method widely used in ergonomic field studies to target representative worker samples (Cresswell et al., 2022; Sugiyono, 2021). This approach enabled focused assessment of workers most exposed to posture-related musculoskeletal risks and who provided meaningful feedback through the NBM questionnaire.

The research procedure included several key stages: initial interviews using the NBM to capture musculoskeletal symptom data, direct ergonomic observation with photographic recording of working postures, application of RULA and REBA scoring based on posture photos, and synthesis of data into ergonomic risk classifications (Wilson & Sharples, 2015; Tiogana & Hartono, 2020). Post-assessment, the study formulated actionable workplace ergonomic improvement recommendations aimed at reducing identified risks and enhancing operator comfort and safety. This systematic, multi-method approach ensured a robust investigation of posture-related MSD risks within a small-scale manufacturing context and provided evidence-based guidance for targeted ergonomic interventions.

## Result

### 1. Measurement and Molding Process

The REBA assessment on operator Rofik for the measurement and molding process indicates that the working position involves several body parts that are at high risk for musculoskeletal disorders. The neck shows a flexion position with an angle of approximately 24° *twisted*, earning a score of 3. The *trunk* also experiences a flexion of 45° with a score of 3, while the leg position shows an unbalanced support and a flexion of 320° with a score of 4. From these three body parts, a body posture score of 8 is obtained on Table A, with an additional light workload (0), resulting in a total A score of 8.

For the analysis of the arm and wrist, the upper arm is raised at an angle of 65° with *abduction* and receives a score of 4, the forearm is slightly bent at an angle of 11° with a score of 2, and the wrist is also bent at 30° with a score of 2. Based on the combination of values in Table B, a posture score of 6 is obtained with a *coupling* assessment (ability to hold tools) of +1, resulting in a total B score of 7.


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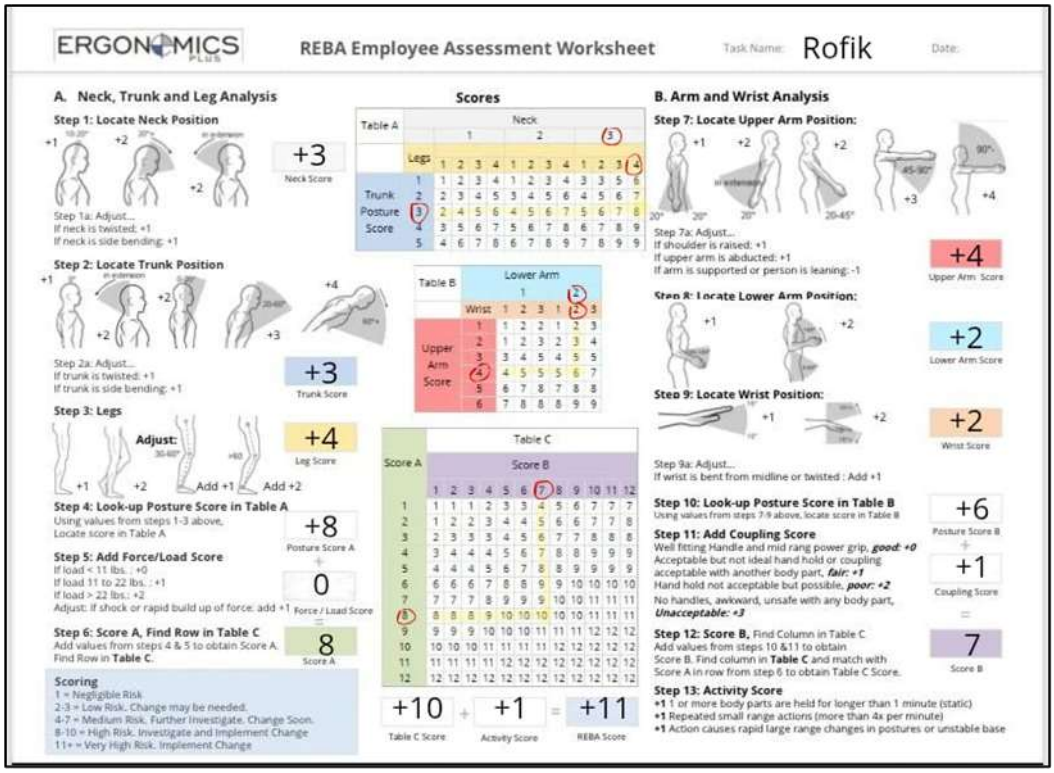


**Figure 1**. **REBA Score Assessment in the Measurement and Milling**
ProcessSource: Processed Data, 2025

The combination of scores A and B in Table C results in a value of 10, plus an activity score of 1 because the activity is performed for a relatively long time or repeatedly. Thus, the total REBA score obtained is 11, which falls into the very high-risk category, indicating that immediate corrective action is required for that work posture.

**2. Cutting Process**

The REBA assessment for operator Wawan in the cutting process shows that the working position involves a high-risk posture for musculoskeletal disorders. In the neck area, the position shows a flexion angle of about 20° and *twisting*, resulting in a score of 3. The *trunk* also experiences a flexion of 31° and *bending* with a score of 4, while the leg position shows an unbalanced support and flexion of 180° with a score of 4. From these three parts, a body posture score of 9 was obtained in Table A, with an additional workload of +1, making the total score A equal to 10.

For the analysis of the arm and wrist, the upper arm was raised at an angle of 54° with *abduction*, receiving a score of 3; the forearm was highly bent at an angle of 50°, scoring 2; and the wrist was bent at 21° and *twisted*, scoring 3. Based on the combination of values in Table B, a posture score of 5 was obtained with a *coupling* assessment of 0, resulting in a total score B of 5.


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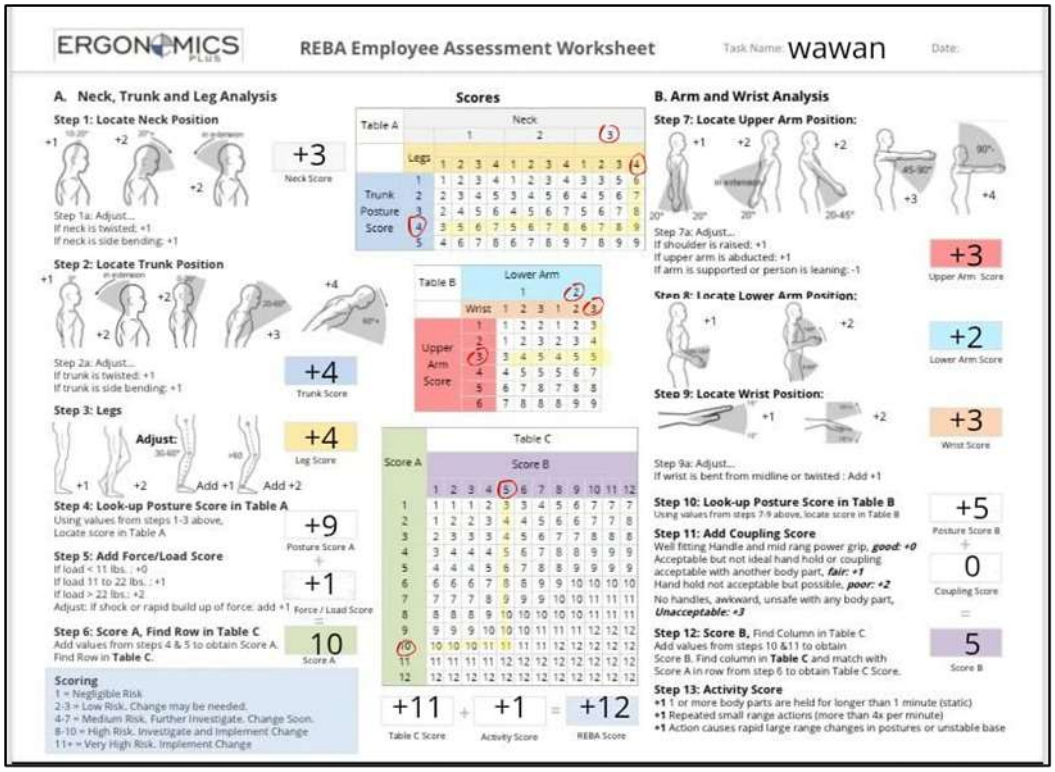


**Figure 2**. **REBA Score Assessment in the Cutting Process Source: Processed** Data, 2025

The combination of scores A and B in Table C resulted in a value of 11, plus an activity score of 1 because the activity was performed for a long time or repeatedly. Thus, the total REBA score obtained is 12, which falls into the very high-risk category, necessitating immediate corrective actions to change or improve the working posture to reduce the potential for injury.

**3. Printing Process**

The REBA assessment for operator Rofik in the printing process indicates that the working positions involve postures at high risk of musculoskeletal disorders. In the neck area, the posture shows flexion at an angle of about 30°, receiving a score of 2. The trunk also experiences 20° of flexion and twisting, scored 3, while the leg position shows balanced support and 30° of flexion, scored 2. From these three parts, a posture score of 6 is obtained in Table A, with an additional workload of +1, making the total score A 7.For the analysis of the arms and wrists, the upper arm is raised at an angle of 95° along with a raised arm, receiving a score of 5; the forearm is slightly bent at an angle of 89°, scoring 1; and the wrist is bent at 10° and bent, scoring 2. Based on the combination of values in Table B, a posture score of 7 is obtained, with a coupling assessment of 2, resulting in a total score B of 9.


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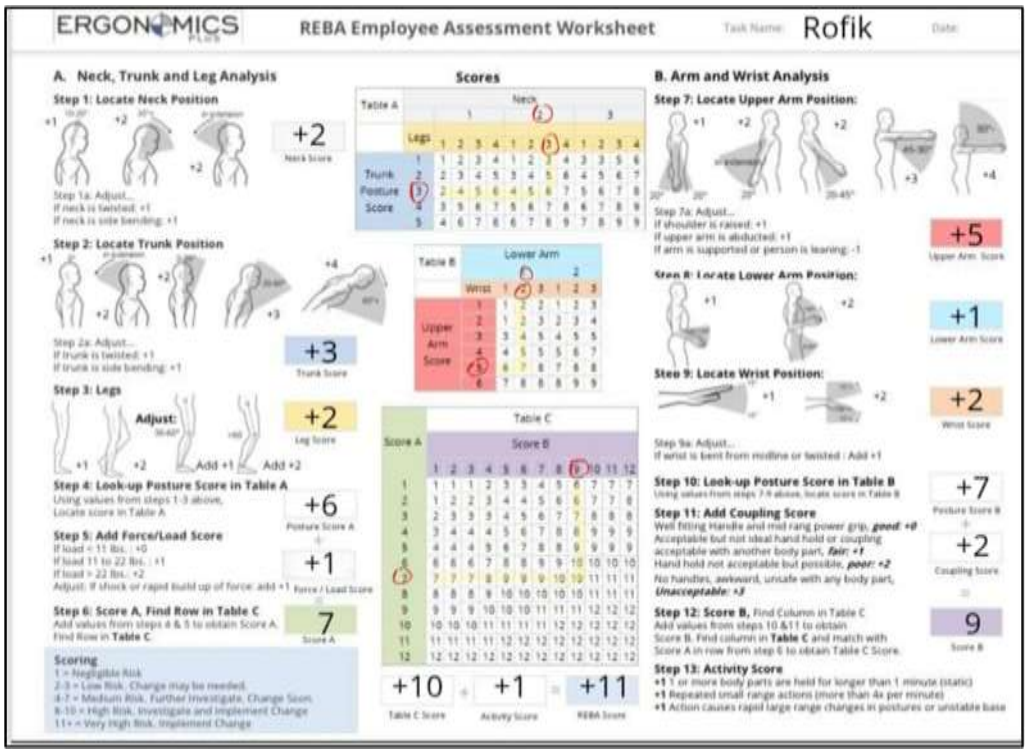


**Figure 3**. **REBA score processing in the printing process Source:** **Processed** Data, 2025

The combination of scores A and B in Table C results in a value of 10, plus an activity score of 1 because the activity is performed for a long duration or repeatedly. Thus, the total REBA score obtained is 11, which falls into the very high-risk category, indicating that immediate corrective actions are required to change or improve the working posture to reduce the potential for injury.

**4. Assembly Process**

The RULA assessment results indicate that the working position of operator Wati during the assembly process poses a risk of musculoskeletal disorders. For the upper arm, the position shows a flexion of approximately 44°, resulting in a score of 2, while the lower arm is slightly bent at 59° and also receives a score of 2. The wrist is in a flexed position of 14° with a score of 2, along with a slight twist of the wrist, adding an additional +1 score. Based on the combined values in Table A, a posture score of 3 is obtained, plus a muscle use score of +1, making the total score for the arm and wrist (Wrist & Arm Score) 4.

In the analysis of the neck, trunk, and legs, the neck position shows a flexion of 23° with a score of 3, the trunk bends at an angle of 22° and is twisted resulting in a score of 4, while the legs are in a position supporting an unbalanced load with a score of 2. Based on the combination of scores in Table B, a posture score of 6 is obtained, plus a muscle use score of +1, so the total for this section is 7.


https://doi.org/10.61536/ambidextrous.v3i02.324

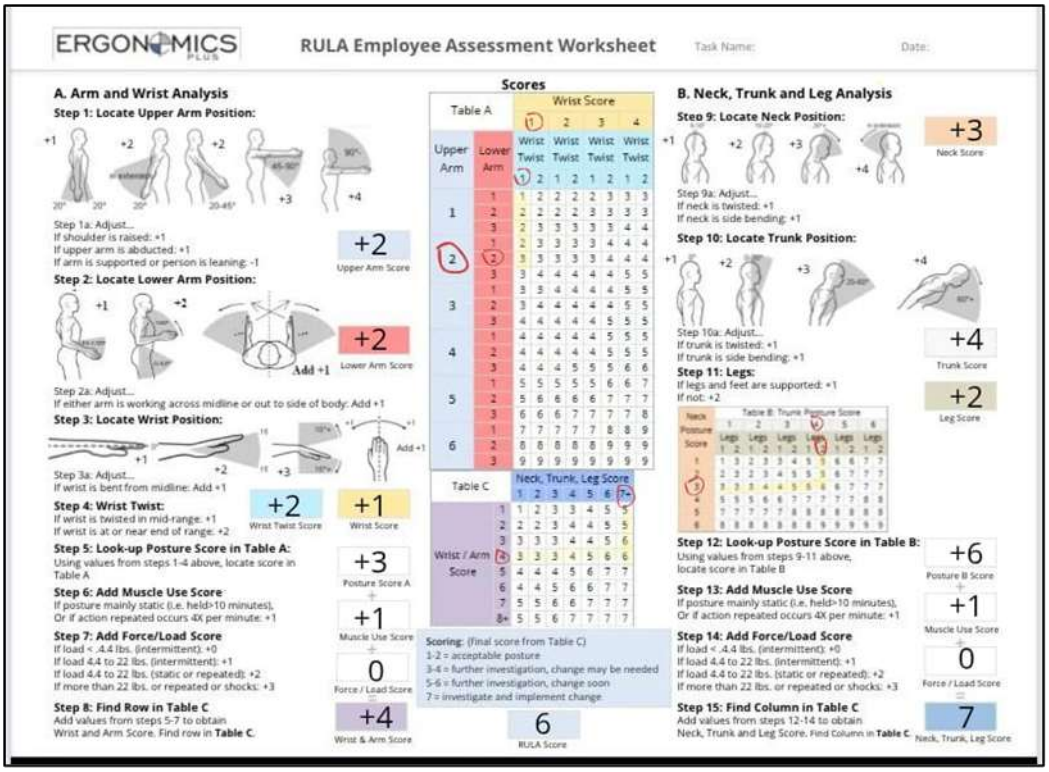


**Figure 4**. RULA Score Processing in the Assembly ProcessSource: Processed Data, 2025

The final result from the score combination in Table C shows a value of 6, which falls into the moderate risk category. This means that the working posture needs to be further evaluated, and changes or adjustments may be necessary to prevent musculoskeletal disorders in the future.

**5. Packing Process**

The RULA assessment results indicate that the working position of operator Wawan during the packing process is at a medium to high risk for musculoskeletal disorders. For the upper arm, the position shows a flexion angle of approximately 39° and is *abducted*, resulting in a score of 3, while the lower arm is also significantly bent at an angle of 65°, earning a score of 1. The wrist is in a flexed position of 16° and *bent*, with a score of 4, plus a slight wrist twist with an additional score of +1. Based on the combination of values in Table A, a posture score of 5 is obtained, plus muscle use and load scores of +1+1, making the total score for the arm and wrist (Wrist & Arm Score) 7.

In the analysis of the neck, torso, and legs, the neck position shows a flexion of 22° and is *twisted* with a score of 4, the torso is *bent* at an angle of 16° and *twisted*, resulting in a score of 4, while the legs are in a balanced weight-bearing position with a score of 1. Based on the combination of values in Table B, a posture score of 1 is obtained, plus the score for muscle use and load +1+1, resulting in a total score of 9 for this section.


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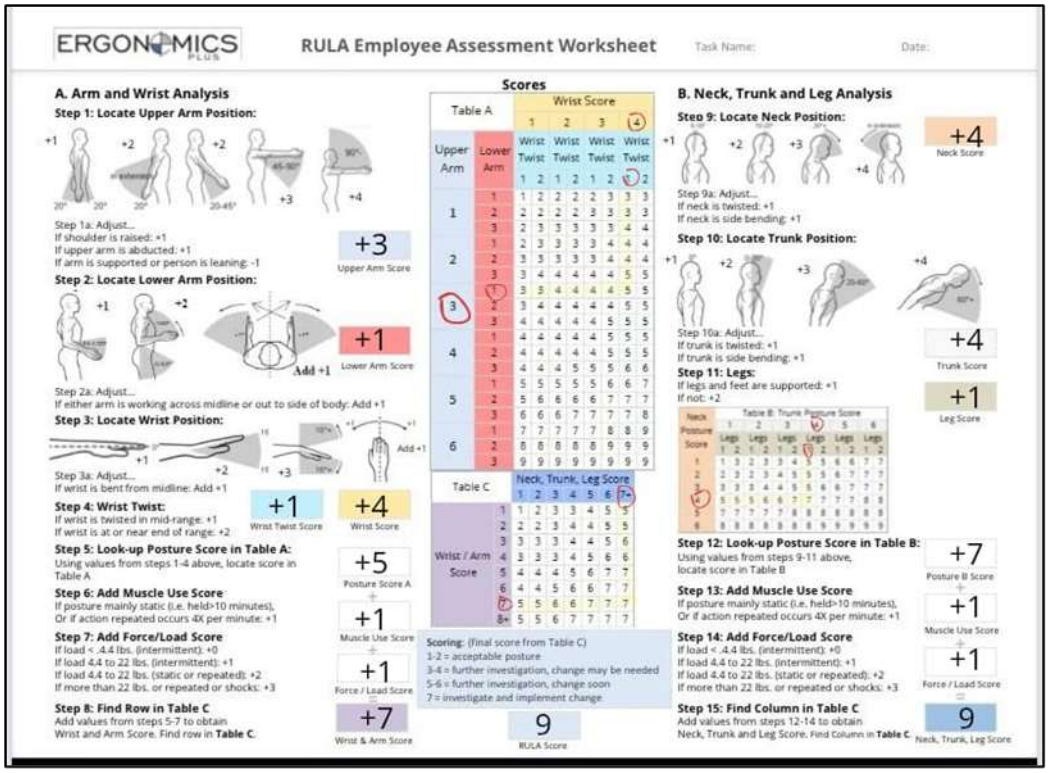


**Figure 5.** RULA Score Processing in the Packing ProcessSource: Processed Data, 2025

The final result from the combination of scores in Table C shows a value of 7, which falls into the high-risk category. This means that the working posture needs to be further evaluated as soon as possible, and changes or adjustments are required to prevent musculoskeletal disorders.

## Discussion

The following are the respondents and the hotel sandal production process at CV. Adila Jaya, as shown in the table below.

Table 1. Hotel Sandal Production Process at CV. Adila Jaya

| No | Process | Operator |
|---|---|---|
| 1 | Measurement and | Rofik |
| 2 | Cutting | Wawan |
| 3 | Printing | Rofik |
| 4 | Assembly | Wati |
| 5 | *Packing* | Wawan |

Source: CV. Adila Jaya, 2025

After identifying the respondents and describing the production process in each work section, the next step is to conduct an analysis of musculoskeletal complaint levels using the *Nordic Body Map* (NBM) questionnaire.

This analysis aims to identify body parts that experience discomfort or pain due to work activities performed by the operators. Below is a table summarizing the results of the NBM interviews with operators at CV. Adila Jaya:


https://doi.org/10.61536/ambidextrous.v3i02.324

1. NBM Rofik (Measurement & Milling Process, and Printing)

**Source 1. NBM Rofik**

| Type of Complaint | Complaint Level | | | |
|---|---|---|---|---|
| | Not Painful | Quite Painful | Painful | Very Painful |
| Pain in the upper neck | | | ✓ | |
| Pain in the lower neck | | | ✓ | |
| Pain in the left shoulder | | | | ✓ |
| Pain in the right shoulder | | | | ✓ |
| Pain in the left upper arm | | | | ✓ |
| Pain in the back | | | | ✓ |
| Pain in the right upper arm | | | | ✓ |
| Pain in the waist | | | ✓ | |
| Pain in the buttocks | | | ✓ | |
| Pain in the lower part of the buttocks | | | ✓ | |
| Pain in the left elbow | ✓ | | | |
| Pain in the right elbow | ✓ | | | |
| Pain in the left forearm | | | ✓ | |
| Pain in the right forearm | | | ✓ | |
| Pain in the left wrist | | | | ✓ |
| Pain in the right wrist | | | | ✓ |
| Pain in the left hand | | | | ✓ |
| Pain in the right hand | | | | ✓ |
| Pain in the left thigh | | | | ✓ |
| Pain in the right thigh | | | | ✓ |
| Pain in the left knee | | ✓ | | |
| Pain in the right knee | | ✓ | | |
| Pain in the left calf | | | | ✓ |
| Pain in the right calf | | | | ✓ |
| Pain in the left ankle | | | | ✓ |
| Pain in the right ankle | | | | ✓ |
| Pain in the left foot | | | | ✓ |
| Pain in the right foot | | | | ✓ |

Source: Processed Data, 2025

Based on the table above, Operator Rofik in the measurement & molding and printing process has the highest score of 99, meaning that musculoskeletal complaints in this process are most frequently experienced by workers. The dominant complaints appear in the neck, shoulders, back, and arms because the activities are mostly performed in a bent position and with repetitive movements. Therefore, this process is considered the most risky and requires improvements in work posture.


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2. NBM Wawan (Cutting and Packing Process)

**Table 2. NBM Wawan**

| Type of Complaint | Complaint Level | | | |
|---|---|---|---|---|
| | Not Painful | Quite Painful | Painful | Very Painful |
| Pain in the upper neck | | | ✓ | |
| Pain in the lower neck | | | ✓ | |
| Pain in the left shoulder | ✓ | ✓ | | |
| Pain in the right shoulder | | | | ✓ |
| Pain in the left upper arm | ✓ | | | |
| Pain in the back | | | | ✓ |
| Pain in the right upper arm | | | | ✓ |
| Pain in the waist | | | | ✓ |
| Pain in the buttocks | | | ✓ | |
| Pain in the lower part of the buttocks | | | ✓ | |
| Pain in the left elbow | | | ✓ | |
| Pain in the right elbow | | | | ✓ |
| Pain in the left forearm | ✓ | | | |
| Pain in the right forearm | | ✓ | | |
| Pain in the left wrist | | | ✓ | |
| Pain in the right wrist | | | | ✓ |
| Pain in the left hand | ✓ | | | |
| Pain in the right hand | | | | ✓ |
| Pain in the left thigh | | | ✓ | |
| Pain in the right thigh | | | ✓ | |
| Pain in the left knee | | ✓ | | |
| Pain in the right knee | | ✓ | | |
| Pain in the left calf | | | ✓ | |
| Pain in the right calf | | | ✓ | |
| Pain in the left ankle | | | ✓ | |
| Pain in the right ankle | | | ✓ | |
| Pain in the left foot | | | ✓ | |
| Pain in the right foot | | | ✓ | |

Source: Processed Data, 2025

Based on the table above, operator Wawan in the cutting and packing process scored 82. This figure indicates that complaints are still quite high, particularly in the lower arms, wrists, and waist due to repetitive cutting and packing activities. The risks in this process still require attention but are lower compared to the work process of operator Rofik.


https://doi.org/10.61536/ambidextrous.v3i02.324

3. NBM Wati (Assembly Process)

**Table 4. NBM Wati**

| Type of Complaint | Complaint Level | | | |
|---|---|---|---|---|
| | Not Painful | Quite Painful | Painful | Very Painful |
| Pain in the upper neck | | ✓ | | |
| Pain in the lower neck | | ✓ | | |
| Pain in the left shoulder | | | ✓ | |
| Pain in the right shoulder | | | ✓ | |
| Pain in the left upper arm | ✓ | | | |
| Pain in the back | | | | ✓ |
| Pain in the right upper arm | | ✓ | | |
| Pain in the waist | | | | ✓ |
| Pain in the buttocks | | | | ✓ |
| Pain in the lower part of the buttocks | | | | ✓ |
| Pain in the left elbow | ✓ | | | |
| Pain in the right elbow | ✓ | | | |
| Pain in the left forearm | | ✓ | | |
| Pain in the right forearm | | ✓ | | |
| Pain in the left wrist | | | | ✓ |
| Pain in the right wrist | | | | ✓ |
| Pain in the left hand | | | | ✓ |
| Pain in the right hand | | | | ✓ |
| Pain in the left thigh | ✓ | | | |
| Pain in the right thigh | ✓ | | | |
| Pain in the left knee | ✓ | | | |
| Pain in the right knee | ✓ | | | |
| Pain in the left calf | ✓ | | | |
| Pain in the right calf | ✓ | | | |
| Pain in the left ankle | ✓ | | | |
| Pain in the right ankle | ✓ | | | |
| Pain in the left foot | | | ✓ | |
| Pain in the right foot | | | ✓ | |

Source: Processed Data, 2025

Based on the table above, Operator Wati in the assembly process has a complaint score of 65, which is the lowest. This means that complaints for Operator Wati are relatively mild and not as severe as those of the other two operators. Complaints still occur in the hands and arms, but the intensity is lower, so this process has the lowest risk of MSD.


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**Table 5. NBM Risk Classification**

| Likert Scale | Total Individual Score | Risk Level | Corrective Action |
|---|---|---|---|
| 1 | 28-49 | Low | No corrective action has been found yet |
| 2 | 50-70 | Busy | Action may be required at a later date |
| 3 | 71-90 | Tall | Immediate action is required |
| 4 | 92-122 | Very High | Comprehensive action is needed as soon as possible |

Source: Wilson & Sharples, 2015

The assessment results were obtained through a questionnaire containing 28 body parts, where respondents indicated the level of complaints for each part on a specific scale. The total score from the responses was then compared to the risk level categories according to the Nordic Council of Ministers (NCM) (Wilson & Sharples, 2015:454).

Table 6. NBM Interview Results

| No | Operator | Score NBM | Risk |
|---|---|---|---|
| 1 | Rofik | 99 | Very High |
| 2 | Wawan | 82 | Tall |
| 3 | Wati | 65 | Busy |

Source: Processed Data, 2025

Based on the results of the NBM questionnaire, it was found that all operators in each production process have complaint scores that are considered medium to very high. This condition indicates a significant ergonomic risk potential in each production process. Therefore, all operators need to be further analyzed using the *Rapid Upper Limb Assessment* (RULA) and *Rapid Entire Body Assessment* (REBA) methods to assess work posture in more depth.

## Conclusion

The study reveals that operators at CV. Adila Jaya face significant ergonomic risks due to high-risk postures during various production stages, particularly in measurement, molding, printing, cutting, assembly, and packing processes. Musculoskeletal complaints were most severe in the measurement and molding processes, followed by cutting and packing, with dominant pain reported in the neck, shoulders, back, and upper limbs. Both *Rapid Upper Limb Assessment* (RULA) and *Rapid Entire Body Assessment* (REBA) confirmed the presence of very high to high risk levels, indicating an urgent need for ergonomic interventions to correct working postures and reduce potential musculoskeletal disorders. The Nordic Body Map assessments provided complementary evidence of discomfort intensity among operators, highlighting a critical area for workplace ergonomic improvements to enhance safety and productivity.

However, this study has limitations, including the small sample size restricted to one company, which may reduce the generalizability of the findings across broader industrial


https://doi.org/10.61536/ambidextrous.v3i02.324

settings. The cross-sectional design also limits understanding of long-term musculoskeletal impacts related to working postures. Future research should expand the sample size and incorporate longitudinal designs to better capture the progression of musculoskeletal disorders over time. Additionally, integrating ergonomic intervention trials would add practical value by demonstrating the effectiveness of proposed corrections. The practical implications of the research emphasize the importance of regular ergonomic assessment using validated tools such as RULA and REBA to identify high-risk postures. Employers should prioritize ergonomic training and redesign workstations to minimize biomechanical strain, ultimately promoting operators' health, reducing injury risk, and improving operational efficiency in small-scale manufacturing contexts.

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