Hazard evaluation of box packaging process in food seasoning industry based on SNI 9011:2021

Amalia Muslim[1*], Nana Rahdiana[1], Annisa Nurizzati[1]

[1] Department of Industrial Engineering, Universitas Buana Perjuangan, Karawang, West Java, Indonesia
* Corresponding author: ti21.amaliamuslim@mhs.ubpkarawang.ac.id

ARTICLE INFO

Article history
Submission : 23th May 2025
Revised : 19th June 2025
Accepted : 07th July 2025

Keywords
Box Packaging
Ergonomics
Food Seasoning Industry
MSDs
SNI 9011:2021

https://doi.org/10.22441/oe.2025.v17.i2.141

ABSTRACT

Musculoskeletal disorders (MSDs) are one of the most common ergonomic problems in the workplace. These conditions have a negative impact on employee health and productivity and increase healthcare costs for companies. This study aims to analyse the potential for GOTRAK complaints among workers in the box packaging process in the food seasoning industry, in accordance with SNI 9011:2021. This study was conducted using a quantitative approach with a Musculoskeletal Disorder Questionnaire to assess MSD complaints. Data were collected through field observation, questionnaire completion, and work posture analysis using the methods outlined in SNI 9011:2021. The research variables included work posture, work duration and physical strain of the workers. Interviews revealed alarmingly high ergonomic risk levels, with consistent risk scores of 19 and 20 across multiple body regions. Severe pain was most frequently reported in the shoulders, upper back, lower back, and hips—areas critical for manual tasks—indicating a sustained threat to worker health and productivity. The results of the ergonomic assessment of the upper body in carton packing work gave a score of 38, indicating hazardous conditions that require immediate improvement. In addition, the result of the analysis were used to develop ergonomic-based improvement recommendations to increase safety and comfort in the workplace. The findings offer actionable insights for industries aiming to enhance workplace ergonomics. By identifying high-risk zones and providing targeted recommendations, this study contributes to the creation of safer work environments, reduces operational losses, and strengthens long-term workplace sustainability—particularly in labor-intensive sectors like food manufacturing.

1. Introduction

Symptoms of musculoskeletal disorders (MSDs) are one of the problems that arise due to ergonomic mismatches in high-risk workplaces and are one of the leading causes of health problems globally. A total of 1.71 billion people worldwide suffer from musculoskeletal disorders (MSDs) or, in other words, musculoskeletal disorders. In Indonesia, MSDs are often referred to as "*Gangguan Otot Tulang-Rangka Akibat Kerja*" (GOTRAK) (WHO, 2022) MSDs are typically characterised by persistent pain, which leads to reduced mobility and impaired muscle and skeletal function, thereby affecting an individual's ability to work (Yuliani et al., 2021). In every country, MSDs are a significant health issue that requires attention, as they are often associated with work-related injuries (*Musculoskeletal Health*, 2022). In Indonesia, 40.5% of diseases are known to be related to occupational factors. A

Please cite this article as: Muslim, A., Rahdiana, N., & Nurizzati, A. (2025). Hazard evaluation of box packaging process in food seasoning industry based on SNI 9011:2021. *Operations Excellence: Journal of Applied Industrial Engineering*, 17(2), 168-177. doi:http://doi.org/10.22441/oe.2025.v17.i2.141

ISSN-p: 2085-1431
ISSN-e: 2654-5799

study involving 9,482 employees from 12 districts/cities in Indonesia revealed that musculoskeletal disorders (MSDs) were experienced by 16% of the total respondents(Badan Pusat Statistik, 2019). Meanwhile, according to data from the Basic Health Research (Riskesdas) conducted by the Ministry of Health of the Republic of Indonesia, the national prevalence of musculoskeletal disorders reached 7.9%. Aceh Province recorded the highest prevalence at 13.3%, followed by Bengkulu at 10.5%, and Bali at 8.5%(Kementrian Kesehatan, 2018). The industrial sector in Indonesia is currently experiencing rapid growth, both in the formal and informal sectors. The number of workers in the formal sector accounts for 41.65% or approximately 51.87 million people (Mulyati, 2019). According to data from the Central Statistics Agency in 2023, the number of workers in the formal food industry increased to 3.86% from 19.17 million workers (BPS, 2023). This development has prompted companies to optimise production efficiency while prioritising the sustainable improvement of employee welfare. To enhance productivity and worker welfare while reducing the risk of accidents and work-related illnesses, attention to occupational safety and health aspects, including ergonomics, has become extremely important (Deananda et al., 2024).

The risk of musculoskeletal disorders (MSDs) tends to increase due to repetitive work involving the use of non-ergonomic tools that require greater physical effort(Kurnianto, 2018). MSDs are one of the most common occupational health issues. This condition affects workers' physical and social lives, and it causes economic losses for companies due to decreased productivity. Work factors such as manual lifting, repetitive movements, monotonous work, carrying heavy loads, maintaining non-ergonomic body postures and using excessive force continuously can trigger musculoskeletal disorders and increase the risk of MSDs (Arifah et al., 2024). Dominant work postures are generally influenced by the body parts and types of activity that are prone to ergonomic risks. For instance, warehouse workers who lift goods are at greater risk of slipped discs or spinal disorders. Those who stand for long periods are at greater risk of low back pain and swollen feet, while jobs involving a lot of manual handling tend to cause shoulder and neck complaints (Arifah et al., 2024).

Studies in the manufacturing sector reveal that musculoskeletal disorders are most commonly experienced when carrying out manual tasks such as lifting and lowering goods. These disorders generally affect the lower back (63%), followed by the shoulders (17%) and the arms and hands (16%). In contrast, injuries to the legs are rare(Yang et al., 2020).

Based on the results of previous studies, it is clear that intervention is important in reducing the risk of injury during manual labour activities. This study found that manual and repetitive box packaging work can expose workers to physical conditions that may cause injury (Afif & Sudarto 2022). Therefore, more tools are needed to handle objects that are too heavy, large or unstable. In addition, modifying or redesigning work processes can help to reduce the physical strain on workers(Yang et al., 2020). A study explains that the Nordic Body Map (NBM) questionnaire was used in a similar context. However, it was considered less comprehensive as it only assessed respondents' discomfort, thereby making the results more subjective (Nurhidayati, 2021). Another study highlights the limitations of the NBM questionnaire in detecting physical disorders or pain, indicating the need for a more specific and objective instrument. In contrast to the NBM, the GOTRAK questionnaire identifies the location of pain and evaluates its intensity and frequency, offering a more comprehensive assessment of musculoskeletal conditions. This enhances the accuracy of evaluations, which is essential in both clinical research and ergonomic assessments in the workplace. Accordingly, the present study employs the GOTRAK questionnaire as the main tool to measure musculoskeletal complaints, aiming to obtain more valid and representative data(Margaretha, 2022).

This study investigates the potential musculoskeletal disorders (MSDs) in workers engaged in box packaging within the food seasoning industry, using the SNI 9011:2021 ergonomic assessment standard. Despite the critical importance of ergonomics in enhancing worker health and productivity, few studies have focused on assessing ergonomic hazards in this specific industrial setting. The research gap lies not in the lack of recognition of ergonomic risks, but in the limited implementation of ergonomic evaluations and improvements in such work environments. By addressing this gap, this study contributes valuable insights for reducing workplace injuries and improving worker welfare through evidence-based ergonomic interventions.This study aims to identify potential ergonomic hazards and provide recommendations to help companies mitigate losses resulting from their workers' operational activities. This can be achieved by evaluating box packaging workers in the cooking

Please cite this article as: Muslim, A., Rahdiana, N., & Nurizzati, A. (2025). Hazard evaluation of box packaging process in food seasoning industry based on SNI 9011:2021. *Operations Excellence: Journal of Applied Industrial Engineering*, 17(2), 168-177. doi: http://doi.org/10.22441/oe.2025.v17.i2.141

seasoning industry using the SNI 9011-2021 method. The evaluation will determine how many workers experience fatigue due to potential ergonomic injuries.

2. Methods

This cross-sectional study involved six workers selected from those participating in the box packaging process. A Gotrak questionnaire was used to observe the operators' work activities during interviews. Data were collected from 13 to 17 December 2024. The variables studied included Gotrak complaints, job completion frequency and comfort levels. Gotrak complaint analysis was conducted based on SNI 9011:2021, which relates to measuring and evaluating complaints or pain resulting from injuries to muscles, tendons, joints, nerves and other soft tissues. process flow for identifying and analyzing ergonomic risks to workers in the box packaging process of the seasoning industry using the SNI 9011:2021 can be seen in Fig. 1.

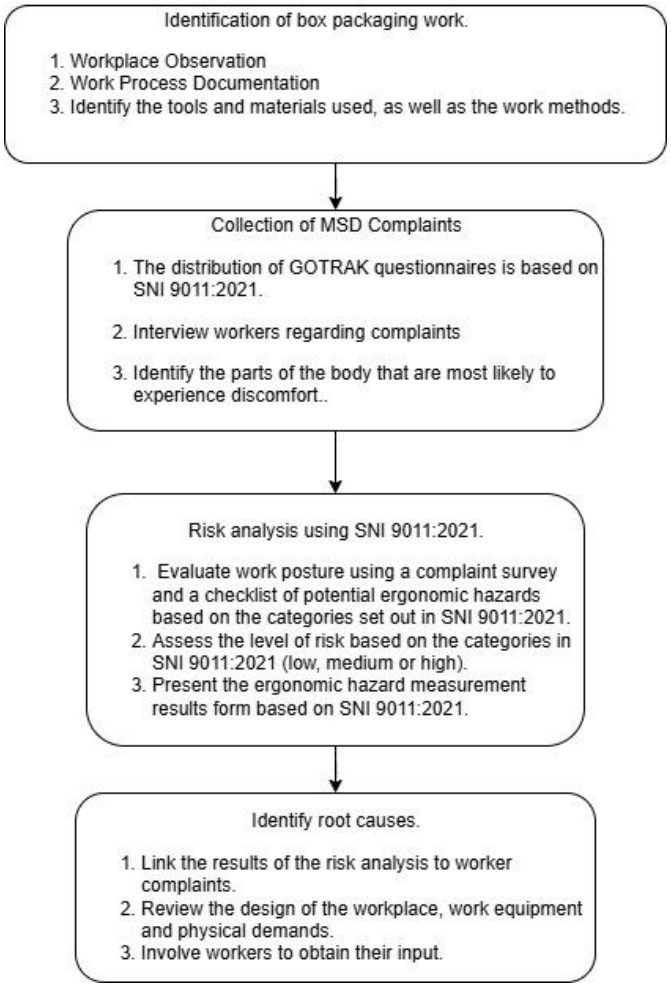

Fig 1 Process Flow for Identifying and Analyzing Ergonomic Risks to Workers in the Box Packaging Process of the Seasoning Industry Using the SNI 9011:2021

The Fig. 1 illustrates the process of identifying and analysing ergonomic risks in box packaging work, with the aim of reducing musculoskeletal disorder (MSD) complaints. The following describes each stage of the process:

1. Identification of box packaging process work. The first step in this process is to identify the box-packing tasks being analysed. This step involves conducting direct observations of the work area to understand the activities taking place, documenting the entire work process and identifying the tools, materials and methods used. The purpose of this stage is to gain an in-

Please cite this article as: Muslim, A., Rahdiana, N., & Nurizzati, A. (2025). Hazard evaluation of box packaging process in food seasoning industry based on SNI 9011:2021. *Operations Excellence: Journal of Applied Industrial Engineering*, 17(2), 168-177. doi: http://doi.org/10.22441/oe.2025.v17.i2.141

ISSN-p: 2085-1431
ISSN-e: 2654-5799

depth understanding of the current working conditions prior to conducting an ergonomic analysis.

2. Collection of GOTRAK complaint data. The next step is to collect musculoskeletal complaint data using the GOTRAK instrument. This is done by distributing GOTRAK questionnaires to workers in accordance with the SNI 9011:2021 standard. Direct interviews are also conducted with workers to gain more in-depth information about their experiences of musculoskeletal complaints. This process enables the body parts most frequently affected by complaints to be identified, providing a crucial foundation for ergonomic risk assessment.
3. Risk analysing using SNI 9011:2021. After the data had been collected, an ergonomic risk analysis was conducted in accordance with the national standard SNI 9011:2021. This analysis included an evaluation of work posture, based on the results of the GOTRAK questionnaire and an ergonomic checklist covering body posture and manual lifting activities. The risks were then classified as low, moderate or high according to SNI criteria. The results of the risk assessment were presented in a standardised format to ensure consistency and accuracy of reporting.
4. Identifying root causes. The final stage is to identify the root causes of the risks that have been highlighted. This involves linking the results of the risk analysis with worker complaint data to identify relevant correlations. Next, the workplace design, the tools used and the physical demands placed on workers are reviewed. Workers are directly involved in this process to provide accurate, contextual input and ensure that the proposed solutions are appropriate for the conditions on the ground.

The process helps to design appropriate ergonomic interventions to reduce the risk of injury and improve comfort and work efficiency.

Table 1 Gotrak Complaint Risk Level Matrix

Frequency	Severity			
	No Issue (1)	Discomforting (2)	Pain (3)	Acute Discomfort (4)
Never (1)	1	2	3	4
Occasionaly (2)	2	4	6	8
Frequently (3)	3	6	9	12
Invariably (4)	4	8	12	16

Source: (Aziza et al, 2024)

Description:
Green: Low risk, no action required
Yellow: Moderate risk, action required
Red: High risk, action required

This study started with an assessment of the Ergonomic Hazard Potential according to SNI 9011 of 2021. The steps in the Ergonomic Hazard Potential assessment are as follows

1. Determine the Ergonomic Hazard Potential
2. Determine the exposure duration of the potential hazard Percentage = Duration of exposure to hazard (hours) x duration of work in one shift x 100%.
3. Add up the scores on the checklist.

This study employed a quantitative descriptive design with a cross-sectional approach to evaluate the ergonomic risks experienced by box packaging workers in a seasoning industry. The research was conducted between 13 and 17 December 2024, and followed the procedures outlined below.

1. **Assumptions.** Several fundamental assumptions were applied when conducting this study to ensure the validity of the approach and the interpretation of the data. Firstly, the six workers selected were considered to be representative of the typical workload involved in the spice

Please cite this article as: Muslim, A., Rahdiana, N., & Nurizzati, A. (2025). Hazard evaluation of box packaging process in food seasoning industry based on SNI 9011:2021. *Operations Excellence: Journal of Applied Industrial Engineering*, 17(2), 168-177. doi: http://doi.org/10.22441/oe.2025.v17.i2.141

packaging process within that industry. Secondly, it was assumed that the musculoskeletal complaints reported by the workers were work-related and not caused by personal health conditions outside of work. Thirdly, the SNI 9011:2021 standard was considered to be an accurate and validated method of evaluating ergonomic risks in industrial settings. Finally, it was assumed that all workers understood the content of the questionnaires and interviews, and that they provided honest and objective responses.

2. **Experimental Setup.** This study was conducted at a food seasoning factory in West Java, Indonesia, with a focus on the box packing workstation. Activities at this station involve the manual handling of goods, including lifting, labelling and sealing boxes. Six workers who were directly involved in the process were selected as participants. All of the participants worked the morning shift, from 6:30am to 2:30pm. To ensure that the data collected reflected the actual operational conditions prevailing on-site, no ergonomic interventions or changes to the work environment were made during the observation period.
3. **Data Analysis.** The data analysis followed the ergonomic assessment procedures outlined in SNI 9011:2021. First, each worker's complaints were assessed using a matrix that multiplied the frequency (1–4) and severity (1–4) of pain, and then categorised as low risk (1–4), moderate risk (6) or high risk (8–16). Scores above 16 are categorized into the high-risk category. Secondly, work postures were evaluated using an ergonomic checklist that included activities such as bending, reaching, lifting and pushing, with specific assessment criteria for certain body parts. The evaluation results showed a total hazard score of 38 for the upper body, indicating a high-risk condition. Thirdly, the duration of exposure to each risk factor was calculated as a percentage of the total working time (7 hours). Finally, the root causes were identified by matching the ergonomic risk scores with the observational data and the workers' complaints. The causal factors were found to be non-ergonomic workplace design, repetitive movements and handling heavy loads.
4. **Statistical Testing.** Due to the small sample size (n = 6), a descriptive statistical analysis was performed. This includes calculating the average complaint score for each body part and the frequency distribution for each risk category, as well as creating a table showing the relationship between physical complaints and observed ergonomic risk factors. No inferential statistical tests, such as t-tests or ANOVA, were conducted because the sample size did not meet the assumptions required for parametric analysis. Consequently, the analysis primarily focuses on risk classification and prioritisation to inform recommendations for ergonomic interventions rather than hypothesis testing.

3. Results and Discussion

Discussion

A survey conducted by Gotrak among six box packers in the spice industry revealed that all six workers performed box packing tasks that included several job descriptions, such as picking pallets, labelling boxes according to contents, and packing packages into boxes.

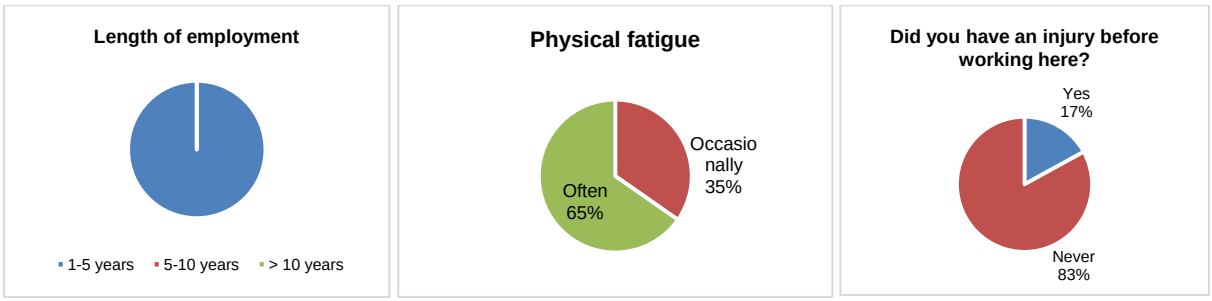

Fig. 1 Gotrak complaint survey on the packaging process for food seasoning industry

Figure 2 shows a survey of complaints about Gotrak in the packaging process of industrial cooking spices. Workers have working hours from 06:30 to 14:30. The results of the survey show that workers

Please cite this article as: Muslim, A., Rahdiana, N., & Nurizzati, A. (2025). Hazard evaluation of box packaging process in food seasoning industry based on SNI 9011:2021. *Operations Excellence: Journal of Applied Industrial Engineering*, 17(2), 168-177. doi: http://doi.org/10.22441/oe.2025.v17.i2.141

ISSN-p: 2085-1431
ISSN-e: 2654-5799

in the packaging of boxes in this cooking industry mainly use their right hands to work (100%). All workers predominantly use their right hands to perform their tasks, given that the right hand serves as a support when performing activities. Workers generally perform repetitive actions such as placing products into boxes with their right hands, manually pushing boxes onto cardboard machines with their right hands, lifting boxes, and supporting them on their right shoulders before placing them on pallets. length of employment workers can be seen in Table 2.

Table 2 Length of employment workers

No	Workers	Length of Employment (Years)	Length of Employment (Month)	Notes
1	Worker 1	2 years	24 month	1 year experience in manufactured industry.
2	Worker 2	1 years 1 month	13 month	13 month experience in this company
3	Worker 3	3 years	36 month	2 years experience in manufactured industry
4	Worker 4	1 years 1 month	13 month	13 month experience in this company
5	Worker 5	2 years	24 month	1 years experience in manufactured industry
6	Worker 6	3 years	36 month	18 month experience in manufactured industry

The table 2 explains that six workers have more than one year of experience working at this company, and four workers have previously worked in a manufacturing company. The average length of employment for workers at this company ranges from 1 to 3 years. The average length of employment in this industry is between 1 and 5 years. Workers also experience occasional mental fatigue, and physical fatigue is frequently reported by 64% of workers. In addition, workers complain of pain or discomfort at the end of their shifts. The physical fatigue workers can be seen in Table 3.

Table 3 Physical fatigue workers

No	Workers	Work Duration (Hours)	Type of Activity	Physical Fatigue Level (1-5)	Notes
1	Worker 1	7 hours	Labelling box, packing boxes & organizing box into pallets.	4 (Quite Tired)	Worker experiences pain in the shoulder & Hand.
2	Worker 2	7 hours	Packing boxes & organizing into pallets.	3 (Slightly Tired)	Feels tired after completing the tasks.
3	Worker 3	7 hours	Labelling box, packing boxes & organizing box into pallets.	3 (Slightly Tired)	Feels tired after completing the tasks.
4	Worker 4	7 hours	Labelling box, packing boxes & organizing box into pallets.	5 (Very Tired)	Experiences back strain and discomfort.
5	Worker 5	7 hours	Labelling box, packing boxes & organizing box into pallets.	4 (Quite Tired)	Experience pain in the Hands & Lower back.
6	Worker 6	7 hours	Labelling box, packing boxes & organizing box into pallets.	4 (Quite Tired)	Experience pain in the Calves, Hands, Upper Back & Lower back.

This table 3 presents the physical fatigue levels experienced by workers based on their work duration and type of activity performed during the workday. The workers involved in the tasks of manual packing, organizing goods, lifting heavy boxes, and automatic packing were assessed for physical fatigue on a scale from 1 to 5, where 1 represents no fatigue and 5 represents extreme fatigue. Worker 1 worked for 7 hours performing Packing boxes & organizing into pallets, and reported a fatigue level of 4, indicating that they felt quite tired, with specific complaints of shoulder & hand pain. Worker 2, working for 7 hours on Packing boxes & organizing into pallets, reported a fatigue level of 3, suggesting they felt slightly tired, but the fatigue did not prevent them from completing the

Please cite this article as: Muslim, A., Rahdiana, N., & Nurizzati, A. (2025). Hazard evaluation of box packaging process in food seasoning industry based on SNI 9011:2021. *Operations Excellence: Journal of Applied Industrial Engineering*, 17(2), 168-177. doi: http://doi.org/10.22441/oe.2025.v17.i2.141

tasks. Worker 3, who worked for 7 hours Packing boxes & organizing into pallets, reported a fatigue level of 5, indicating severe fatigue and back strain, a sign of high physical exertion. Worker 4, with 7 hours of work Packing boxes & organizing into pallets, reported a fatigue level of 5, indicating severe fatigue and back strain, a sign of high physical exertion. Worker 5, who worked for 7 hours Packing boxes & organizing into pallets, reported a fatigue level of 4, indicating that they felt quite tired, with specific complaints of lower back & hand pain. Worker 6, who worker for 7 hours packing boxes & organizing into pallets, reported a fatigue level of 4, indicating that they felt quite tired, with specific complaints in the calves, hand, upper back & lower back. The results of risk level analysis for workers in the seasoning industry's packaging process can be seen in Table 4.

Table 4 Results of risk level analysis for workers in the seasoning industry's packaging process

Body part	Box Packaging Work																	
	S	F	R	S	F	R	S	F	R	S	F	R	S	F	R	S	F	R
Neck	2	2	4	2	2	4	2	3	6	3	2	6	2	2	4	2	2	4
Shoulder	4	4	16	3	3	9	3	3	9	1	1	1	1	1	1	1	1	1
Elbow	1	1	1	2	1	2	2	3	6	1	1	1	1	1	1	1	1	1
Upper Back	3	2	6	3	2	6	3	3	9	3	3	9	3	3	9	2	2	4
Lower Back	2	3	6	2	3	6	2	3	6	3	3	9	2	3	6	3	3	9
Arm	2	3	6	2	3	6	3	3	9	3	2	6	3	3	9	2	2	4
Hand	2	3	6	3	3	9	2	2	4	2	3	6	3	2	6	3	2	6
Hips	1	1	1	1	2	2	3	3	9	2	2	4	2	2	4	3	2	6
Thigh	2	3	6	2	2	4	2	2	4	2	2	4	3	2	6	2	2	4
Knee	1	1	1	1	1	1	2	2	4	1	1	1	1	1	1	2	2	4
Calf	2	3	6	3	3	9	1	1	1	3	2	6	3	2	6	2	2	4
Foot	3	3	9	2	3	6	3	2	6	2	2	4	3	2	6	3	2	6

Description:
S: Severity. The level of discomfort or pain experienced by the workers.
F: Frequency. The frequency at which the discomfort or pain occurs during work.
R: Risk. The calculated risk score, determined by multiplying Severity (S) by Frequency (F), to classify the overall ergonomic risk level.

Table 4 shows the prevalence assessment of complaints in each body part of the carton packers. The survey results were scored based on the severity and frequency of the workers so that the product of the two gives a risk score. The risk score is then classified into 3 categories, namely low, medium and high. The low category has a risk value of 1-4 and is symbolised by the colour green, the medium category has a risk value of 6 and is symbolised by the colour yellow, while the high category has a risk value of 8-16 and is symbolised by the colour red in the risk level table.

The results of observing workers' complaints in terms of body part complaints show that the highest risk level is the highest risk with a risk score of 16. The parts of the body with a high frequency of pain are the shoulders, upper back, lower back, arms, hands and hips. Meanwhile, other parts of the body range from frequent pain to no problems and never complaints. The results of the hazard analysis for workers in the packaging process for cooking spice boxes can be seen in Table 5.

Table 5 Results of the hazard analysis for workers in the packaging process for cooking spice boxes

Body Part	Category	Result Value					
		Box Packaging Workers					
		Exposure Time					
		7 hours					
		1	2	3	4	5	6
A. Potential hazards to the upper body							
Neck	Bending and turning to the front > 20 degrees	4	4	4	4	4	4
Shoulder	Unsupported arm or elbow positioned over the abdomen	5	5	5	5	5	5

Please cite this article as: Muslim, A., Rahdiana, N., & Nurizzati, A. (2025). Hazard evaluation of box packaging process in food seasoning industry based on SNI 9011:2021. *Operations Excellence: Journal of Applied Industrial Engineering*, 17(2), 168-177. doi: http://doi.org/10.22441/oe.2025.v17.i2.141

ISSN-p: 2085-1431
ISSN-e: 2654-5799

Body Part	Category	Result Value					
		Box Packaging Workers					
		Exposure Time					
		7 hours					
		1	2	3	4	5	6
Wrist	Bending forwards or sideways	0	0	0	0	0	0
Arm	Intensive Arm Movement: Fast, stable movements without regular pauses.	6	6	6	6	6	6
Hand	Continuously and quickly lift boxes over 7kg from the conveyor of cartoning machine.	5	5	5	5	5	5
Handicrafts	Continuously hold 2-4 plastic products in a power grip position with a mass greater than >1 kg.	6	6	6	6	6	6
Skin	Fingers and hands are pressed when lifting boxes from the conveyor and when pushing boxes into the cardboard box machine.	5	5	5	5	5	5
Environment	High Temperature and Moderate Humidity	7	7	7	7	7	7
Total Value		38	38	38	38	38	38
B. Potential Hazards to the Back and Lower Body							
Back	The body is bent forward or to the side at an angle of 20–45 degrees.	6	6	6	6	6	6
	The body is bent forward or sideways at an angle of more than 45 degrees.	2	2	2	2	2	2
	Body bent forward >45 degrees	1	1	1	1	1	1
Lower Body	Repeated or prolonged movement of the thighs away from the body and out to the side.	0	0	0	0	0	0
	Torso rotation (body trunk).	0	0	0	0	0	0
	Kneeling or squatting position	3	3	3	3	3	3
	Repeatedly bending the ankle upwards or downwards.	0	1	0	1	0	0
	Body Pressed by a Hard/Pointed Object	0	0	0	0	0	0
	Pushing heavy loads.	7	7	7	7	7	7
	Working while standing or sitting for long periods without adequate foot support.	0	0	0	0	0	0
Total Value		19	20	19	20	19	19

Based on Table 5, the ergonomic hazard analysis of box packaging workers' upper bodies showed a score of 38, According to the GOTRAK complaint risk matrix, the score is above 16, indicating a high risk & dangerous level that needs to be addressed immediately. Similarly, the upper back and lower body scored 19 and 20 respectively, also indicating a dangerous level of risk that requires urgent attention.

Box packaging

Fig. 2 Box packaging worker.

Please cite this article as: Muslim, A., Rahdiana, N., & Nurizzati, A. (2025). Hazard evaluation of box packaging process in food seasoning industry based on SNI 9011:2021. *Operations Excellence: Journal of Applied Industrial Engineering*, 17(2), 168-177. doi: http://doi.org/10.22441/oe.2025.v17.i2.141

Box packaging involves packing items into boxes that have already been packed by operators. The boxes are then sealed using a cardboard sealer, placed on pallets and stored in the finished goods warehouse. Workers in this role lift boxes and take packaging from baskets, the weight of which varies depending on the items being packaged, ranging from 3 to 8 kilograms. Box packaging workers lift heavy loads and work for seven consecutive hours every day.

Those who are shorter in stature tend to require more strength, as their hands and lower body bear the weight of the boxes when placing them on pallets. This aligns with the risk level in Table 2, which indicates that box packaging workers are at high risk of injury to their shoulders, back, hands and hips. They also have a moderate risk of injury to the hands, calves, feet, and neck. This is because they are constantly moving, which leads to fatigue and pain in the lower body. Those working longer hours may also experience musculoskeletal disorders, which can affect mobility, physical strength, quality of life and productivity at work.

They also have a moderate risk of injury to the hands, calves, feet, and neck. This is because they are constantly moving, which leads to fatigue and pain in the lower body. Those working longer hours may also experience musculoskeletal disorders, which can affect mobility, physical strength, quality of life and productivity at work.

Discussion

The results of this study indicate that all workers in the box packaging process of the food seasoning industry experienced musculoskeletal complaints, with the most frequently affected body parts being the shoulders, upper back, lower back, arms, hands, and hips. These findings align with previous studies, which also highlight the significant risk posed by repetitive manual tasks, such as lifting and handling heavy loads, in increasing the likelihood of musculoskeletal disorders (MSDs) (Palange & Dhatrak, 2021). Particularly, the upper body, especially the shoulders and arms, exhibited the highest ergonomic risk score of 38, signifying hazardous conditions that demand immediate corrective actions. This is consistent with earlier research that identified similar ergonomic risks in manual packaging tasks (Arifah et al., 2024). From a causal perspective, poor working postures—such as excessive forward bending (>20 degrees), repetitive lifting of loads over 7 kg, and intensive muscular exertion without sufficient rest—were identified as primary contributors to the onset of MSDs. These findings corroborate the results of Kurnianto (2018), which also observed the detrimental effects of non-ergonomic postures in manufacturing environments.

4. Conclusion

The findings of this study indicate that workers involved in the box packaging process within the food seasoning industry are experiencing significant musculoskeletal complaints, with the most prominent risk areas being the shoulders, upper back, lower back, and hips. The ergonomic assessment yielded a high-risk score of 38, encompassing both the upper body as well as the lower back and hips, which signifies a very high level of musculoskeletal injury risk. This consolidated score highlights that all the evaluated body areas are at substantial risk, thereby necessitating immediate corrective actions to mitigate potential adverse effects on worker health and overall productivity. Consequently, it is imperative to implement ergonomic improvements in the workplace to enhance employee comfort and prevent long-term health complications.

References

Arifah, D. A., Andhika, R., Rahma, A., & Harmini, T. (2024). Ergonomic Hazards related to Musculoskeletal Disorders among Workers of Traditional Manufacturing Industries in Ponorogo Regency. *Article in International Journal of Public Health Science*, *99*(1), 1–1. https://doi.org/10.11591/ijphs.v99i1.23942

Aziza, & Dadan Erwandi. (2024). Analisis Penilaian dan Rekomendasi Desain Ergonomi pada Pekerja Laboratorium Menggunakan SNI 9011-2021. *Media Publikasi Promosi Kesehatan Indonesia (MPPKI)*, *7*(2), 433–441. https://doi.org/10.56338/mppki.v7i2.4639

Badan Pusat Statistik. (2019). *Profil Statistik Kesehatan 2019*.

Kementrian Kesehatan. (2018). *Laporan Nasional RISKESDAS 2018*.

Please cite this article as: Muslim, A., Rahdiana, N., & Nurizzati, A. (2025). Hazard evaluation of box packaging process in food seasoning industry based on SNI 9011:2021. *Operations Excellence: Journal of Applied Industrial Engineering*, 17(2), 168-177. doi: http://doi.org/10.22441/oe.2025.v17.i2.141

ISSN-p: 2085-1431
ISSN-e: 2654-5799

Kurnianto, R. Y. (2018). Gambaran Postur Kerja Dan Risiko Terjadinya Muskuloskeletal Pada Pekerja Bagian Welding Di Area Workshop Bay 4.2 Pt. Alstom Power Energy Systems Indonesia. *The Indonesian Journal of Occupational Safety and Health*, *6*(2), 245. https://doi.org/10.20473/ijosh.v6i2.2017.245-256

Margaretha, N. (2022). Analisis Kegiatan Manual Material Handling Terhadap Gejala Musculoskeletal Disorder pada Operator Gudang. *Jurnal Indonesia Sosial Sains*, *3*(2), 167–190. https://doi.org/10.36418/jiss.v3i2.539

Mulyati, S. (2019). The relationship between work posture and musculoskeletal disorders (MSDs) in laundry workers in the area of Puskesmas Sukamerindu Bengkulu. *In 1st International Conference on Inter-Professional Health Collaboration (ICIHC 2018)*, 171–174.

Musculoskeletal Health. (2022, June). World Health Organization.

Novianti, F., & Windriya, A. (2023). Hazard Analysis of Occupational Health and Safety (OHS) Using The JSA (Job Safety Analysis) Method in Grey Weaving 2 Warehouse PT XYZ. *Asian Journal of Logistics Management*, 2(1), 33–47. https://doi.org/10.14710/ajlm.2023.19038

Nurhidayati, F. (2021). *Analisa Manual Material Handling Dengan Metode Composite Lifting Index Pada Pekerjaan Palletizing Perusahaan Makanan Dan Minuman Di Jawa Timur* [Doctoral dissertation]. Politeknik Perkapalan Negeri Surabay.

Palange, A., & Dhatrak, P. (2021). Lean manufacturing a vital tool to enhance productivity in manufacturing. *Materials Today: Proceedings*, *46*, 729–736. https://doi.org/10.1016/j.matpr.2020.12.193

Produksi Tenaga Kerja Pada Sektor Industri Manufaktur . (2023, January 16). Badan Pusat Statistik .

Rachman Deananda, S., Handoko, L., Natsir Amrullah, H., Studi Teknik Keselamatan dan Kesehatan Kerja, P., Teknik Permesinan Kapal, J., & Perkapalan Negeri Surabaya, P. (2024). Analisis Ergonomi Postur Kerja Pekerja Box Preparation Berdasarkan SNI 9011:2021 di Perusahaan Pengolahan Kelapa Sawit. In *Health Reserch's Journal* (Vol. 01).

Saing, B., Hadita, H., Kustiyah, E., Agustin, D. Y., Amalia, R. Y., & Kurnia, H. (2023). Main hazard control and hazardous material handling in environment testing laboratory. *Operations Excellence: Journal of Applied Industrial Engineering*, 15(2), 175. https://doi.org/10.22441/oe.2023.v15.i2.083

Yang, S. T., Park, M. H., & Jeong, B. Y. (2020). Types of manual materials handling (MMH) and occupational incidents and musculoskeletal disorders (MSDs) in motor vehicle parts manufacturing (MVPM) industry. *International Journal of Industrial Ergonomics*, *77*. https://doi.org/10.1016/j.ergon.2020.102954

Please cite this article as: Muslim, A., Rahdiana, N., & Nurizzati, A. (2025). Hazard evaluation of box packaging process in food seasoning industry based on SNI 9011:2021. *Operations Excellence: Journal of Applied Industrial Engineering*, 17(2), 168-177. doi: http://doi.org/10.22441/oe.2025.v17.i2.141