



RISK ANALYSIS OF WORK POSTURE ON COMPLAINTS OF MUSCLE MOVEMENT DISORDERS (GOTRAK) BASED ON SNI 9011: 2021 IN THE PACKING PLAN UNIT INDARUNG PT SEMEN PADANG

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Abstract

Complaints of skeletal muscle disorders are disorders of skeletal muscles with low, medium and high risk levels that can interfere with workers resulting in work accidents and occupational diseases. Therefore, this study is to see the relationship between factors associated with GOTRAK complaints in packer and transport (loading) workers in the Indarung Packing Plan Unit of PT Semen Padang. This study used a quantitative analytical method with a cross-sectional design and filling out a GOTRAK complaint survey in accordance with SNI 9011: 2021. While primary data is obtained from video recordings when workers do work. The results of statistical tests with the chi-square test stated that there was a relationship between GOTRAK complaints and work position (p-value=0.001, length of work (p-value=0.001), physical fatigue (p-value=0.001), and pain (p-value=0.001). The survey results of GOTRAK complaints SNI 9011: 2021 showed a number 4 with a moderate risk level so that it requires improved work regulations and improved workplace design. 38 workers in the packer and transport (loading) section experienced GOTRAK complaints.

Keywords: Indarung Packing Plan, Packer, Transport, SNI 9011: 2021

Introduction

Occupational health and safety is an important element in the study of methodologies to improve and maintain the physical, mental, and social well-being of employees in various work sectors. A safe work environment is an important part of implementing occupational health and safety and increasing the productivity of a company's employees. A safe work environment serves as an important component in reducing risk factors associated with occupational injuries and diseases (Yovita Erin Sastrini, et al 2023). Risk factors present in the work environment include many elements of improper practices, including ergonomic risks related to work methods, materials used, and machines used by workers in an organization. Ergonomics is a discipline that explains the interactions that occur between human activities and various elements within a systemic framework, with the fundamental goal of optimizing not only efficiency but also health, safety, and comfort in work settings. This science is devoted to delving deeply into various human dimensions, using a comprehensive review that includes physical anatomy, psychological factors, management strategies, and design principles, thus ensuring a holistic understanding of how these components are interrelated (Tarwaka et al., 2004). The application of ergonomic principles in the workplace environment can significantly contribute to the establishment of a safe and conducive working atmosphere, effectively reducing the risks associated with work-related injuries and illnesses that often arise from the application of non-ergonomic postures. (Nabilah, 2020).

According to the International Labour Organization (ILO) in 2018, it has been reported that more than 1.8 million deaths related to work-related incidents occur each year in the Asia and Pacific region. On a broader global scale, it is estimated that more than 2.78 million people tragically lose their lives each year as a direct result of occupational accidents or diseases (ILO, 2018). In addition, alarming statistics reveal that approximately 374 million non-fatal work-related injuries and illnesses are reported each year, often causing absenteeism among workers (Islah et al., 2024). In 2023, the incidence of work accidents in Indonesia, as reported by BPJS Ketenagakerjaan by membership type, included 159,127 cases involving Wage Earners, 7,845 cases involving Non-Wage Earners, and 1,363 cases involving Construction Service Workers. In addition, 91 cases of occupational diseases were reported (Rillo Pambudi, 2024).

The increased risks associated with workplace hazards require a comprehensive strategy to protect consumers, businesses, the workforce, and the wider community. One effective approach involves applying principles related to safety, health and environmental sustainability. This is in line with the Decree of the Head of the National Standardization Agency (BSN) Number 21 December 2021 which establishes Indonesian National Standard (SNI) 9011:2021. SNI 9011:2021 serves as a guideline for identifying and evaluating various physical hazards that can cause occupational musculoskeletal disorders (GMK) in the work environment. This standard not only helps in assessing how much risk of injury workers face, but also provides concrete recommendations regarding the preventive measures that need to be taken. All of these recommendations are in line with applicable occupational safety and health regulations in Indonesia, such as the Minister of Manpower Regulation No. 5/2018 (Susanto et al., 2022).

Established in 1910, PT Semen Padang has long been involved in the cement industry. The cement production process in this company begins with the extraction of raw materials from the mine through the blasting method. The mined raw materials are then coarsely ground, then burned in a rotating furnace (kiln) to form clinker. The clinker is then finely ground with additives to produce cement. The cement produced can be in the form of bulk cement or packaged in bags. In addition to cement, PT Semen Padang also offers derivative products such as split stone for construction and porous concrete that has air pores (Semen Padang et al., 2023).

While there are various methods to analyze posture risks, the Indonesian National Standard (SNI) 9011:2021 has now become the latest reference in measuring ergonomic factors in the workplace. This SNI provides a comprehensive framework for identifying, measuring and evaluating various potential ergonomic hazards, as well as formulating effective control strategies (Handoko & Rachmat, 2023).

Research Method

This study adopted a quantitative method with a cross-sectional design to analyze all workers in the packaging and transportation section at the Indarung Packing Plan Unit, PT Semen Padang (38 people). All members of the population were involved in this study (total sampling). Data collection was carried out during the period June to October 2024 using the GOTRAK questionnaire and observation of work postures. Secondary data in the form of company overview and worker data were also collected. This research refers to the Indonesian National Standard (SNI) 9011:2021 to identify ergonomic hazards, assess the level of risk, and design effective controls in accordance with the Minister of Manpower Regulation No. 5 identifying potential hazards related to ergonomics, conducting a thorough assessment to determine the level of risk whether high or low related to ergonomic factors. In addition, this regulatory framework also includes important considerations that must be taken into account when developing and implementing effective control measures, as stipulated in the Minister of Manpower Regulation No.5 of 2018 (National Standardization Agency, 2021). Secondary data was used to enhance the research analysis. Quantitative data analysis was conducted in two stages, consisting of univariate

analysis and bivariate analysis. Univariate analysis serves to describe the characteristics of respondents, while bivariate analysis with chi-square test statistics is used to test the relationship between variables. Meanwhile, in analyzing and determining the category of GOTRAK complaints using risk analysis of work exposure time and a checklist of potential hazards to the worker's body.

Results

Univariat Test

This study measured the variables of work position, dominant hand, length of work, physical complaints, pain, and pain level with GOTRAK complaints. The distribution of each variable is shown in table 3.1 univariate analysis results.

Tabel 3.1 Hasil analisis univariat

Variable	Frequency	Persentase
Position		
Transport	23	60,5%
Packer	15	39,5%
Dominant hand		
Right	23	60,5%
Left	15	39,5%
Lengthof employment		
3 month- 1 year	14	36,8%
1-5 year	19	50%
5-10 year	3	7,9%
More than10 year	2	5,3%
Physical Complaints		
Frequently	26	68,4%
Sometimes	12	31,6%
Pain		
Yes	26	55,3%
No	12	31,6%
Pain level		
No problem	17	44,7%
Uncomfortable	8	21,1%
Pain	13	34,2%

The majority of respondents with a working position in the transport section (60.5%) who have worked 1-5 years (50%) with the dominant hand, namely the right hand (60.5%) often experience physical complaints (68.4%) with the category of pain and the level of pain is not a problem (44.7%).

GOTRAK Complaint Survey Results

From the results of data collection in the form of a GOTRAK survey on packer workers at the Indarung Packing Plan Unit. The work is carried out in the morning shift from 07.00 - 15.00 WIB with the work activity of packaging cement products that have been processed to be marketed.

Table 3.2 Complaints of Packer Skeletal Muscle Disorders

Body Parts	How Often	How Severe	Possible Cause
Hand 	Ofte	Uncomfortable	Position of repetitive tasks in seclusion
Foot 	Often	Sick	Packing activities carried out standing and added to the vibration of the machine so that it makes the legs that become the impact in this activity Punngu atas
Upper back 	Often	Uncomfortable	Repetitive task hand positions that make the upper back experience repetitive movements unconsciously

From the table above, it was found that GOTRAK complaints in packer workers in the hand section with frequent and uncomfortable categories, the legs with frequent and painful categories, and the upper back with frequent and uncomfortable categories.

From the results of data collection in the form of GOTRAK surveys on transport workers (loading) at the Indarung Packing Plan Unit. The work is carried out in the morning shift from 07.00 - 15.00 WIB with the work activity of arranging the packed cement which is channeled by the belt conveyor into the truck.

Table 3.3 Complaints of skeletal muscle disorders of loading operators

Body parts	How Often	How Severe	Possible Causes
Hand 	Often	Uncomfortable	Repetitive task position in loading
Feet 	Often	Sick	Loading activities are carried out standing which adjusts the tools that distribute cement from the packing results
Elbow 	Often	Uncomfortable	The repetitive task position of the hand becomes a heel to lower the cement and stack it into the truck.

From the table above, it was found that GOTRAK complaints in the loading section workers on the hands with frequent and uncomfortable categories, the feet with frequent and painful categories, and the elbows with frequent and uncomfortable categories.

Results of Risk Analysis of GOTRAK Complaints in Packer and Transport Workers Unit Packing Plan Indarung PT Semen Padang

The GOTRAK risk level is an assessment of the prevalence of complaints presented in the form of a matrix on each part of the body of workers who have complaints. The assessment of the GOTRAK survey results is based on the questionnaire data distributed. Risk scores are classified into 3 categories: low, medium, and high. The low category has a score of 1-4 symbolized in green. The medium category has a score of 6 symbolized in yellow. And the high category has a score of 8-16 symbolized in red.

Table 3.4 risk matrix of GOTRAK complaints in packer workers

Frequency	Severity			
	No problem (1)	Uncomfortable (2)	Sick (3)	Severe pain (4)
Never (1)	1	2	3	4
Sometimes (2)	2	4	6	8
Often (3)	3	6	9	12
Always (4)	4	8	12	16

From the results of the survey analysis of GOTRAK complaints on packer workers, a score of 4 was obtained with a low risk level category that requires handling in a short time. GOTRAK complaints of Indarung Packing Plan unit workers on loading workers as follows:

Table 3.5 risk matrix of GOTRAK complaints in transport workers (loading)

Frequency	Severity			
	No problem (1)	Uncomfortable (2)	Sick (3)	Severe pain (4)
Never (1)	1	2	3	4
Sometimes (2)	2	4	6	8
Often (3)	3	6	9	12
Always (4)	4	8	12	16

From the results of the analysis of the GOTRAK complaint survey on packer workers, a score of 6 was obtained with a moderate risk level category that requires immediate handling.

Factors associated with GOTRAK complaints

This study looked at the relationship between the variables of work position, length of work, dominant hand, physical complaints, dominant hand, pain, and pain level with GOTRAK complaints. The distribution of each variable is shown in table 3. bivariate analysis results

Bivariate Analysis

Bivariate analysis uses the chi square test statistical test to see the relationship between the variables of job type, dominant hand, length of work, physical complaints, pain, and level of complaints with GOTRAK complaints. The distribution of each variable is shown in table 3.4 of the bivariate analysis results.

Table 3.4 Bivariate analysis results

Variable	GOTRAK Complaints				
	There isn't any	Low	Currently	Total	P.value
Type of work					
Transport	10 (43,5%)	0 (0,0%)	13 (56,5%)	23 (100%)	0,001
Packer	7 (46,7%)	89 (53,3%)	0 (0,0%)	15 (100%)	
Dominant Hand					
Right	8 (34,8%)	6 (26,1%)	9 (39,1%)	23 (100%)	0,301
Left	9 (60%)	2 (13,3%)	4 (26,7%)	15 (100%)	
Length of working					
3 months – 1 year	12 (85,7%)	0 (0,0%)	2 (14,3%)	14 (100%)	0,001
1 - 5 years	5 (26,3%)	3 (15,8%)	11 (57,9%)	19 (100%)	
5 – 10 years	0 (0,0%)	3 (100%)	0 (0,0%)	3 (100%)	
More than 10 years	0 (0,0%)	2 (100%)	0 (0,0%)	2 (100%)	
Physical Complaints					
Often	6 (23,1%)	7 (26,9%)	13 (50,0%)	26 (100%)	0,001
Sometimes	11 (91,7%)	1 (8,3%)	0 (0,0%)	12 (100%)	
Pain					
Yes	0 (0,0%)	8 (38,15)	13 (61,9%)	21 (100%)	0,001
No	17 (100%)	0 (0,0%)	0 (0,0%)	17 (100%)	
Complaint Level					
Does not matter	15 (88,2%)	2 (11,8%)	0 (0,0%)	17 (100%)	0,001
Uncomfortable	2 (25%)	6 (75%)	0 (0,05)	8 (100%)	
Sick	0 (0,0%)	0 (0,0%)	13 (100%)	13 (100%)	

From the results of the analysis using chi square, it was found that the factors associated with GOTRAK complaints were: type of work, physical complaints, pain, and level of complaints. The higher the complaints of these variables will provide a high value for the GOTRAK survey results.

These results are in line with a study conducted by Muhammad Yusuf et al. in 2024 on the identification of skeletal muscle disorders (GOTRAK) in laser cutting workers with a case study of PT INKA Multi Solusi which states that the variables of work position, physical complaints, pain, and level of complaints are risk factors for GOTRAK complaints in workers (Yusufa et al., 2021). Repetitive work activities over long periods of time can cause significant strain on workers' muscles, resulting in fatigue that not only reduces their overall productivity but can also be the cause of workplace accidents and the development of various occupational diseases.

Discussion

The study results show that workers in the packer and transport (loading) sections experience skeletal muscle disorders where workers who experience pain and moderate GOTRAK complaints are 13 workers. Based on the results of the GOTRAK survey questionnaire, the parts of the body that experience complaints include: shoulders, arms, wrists, elbows, and torso twisting.

Skeletal muscle disorders due to work position or abbreviated as GOTRAK are complaints that often occur in various types of workplaces, these complaints vary from low, medium and high levels. Identification of GOTRAK Complaints Based on SNI 9011: 2021. The skeletal muscle disorder survey was conducted on PT Semen Padang workers in the Indarung Packing Plant unit in the packer and loading section workers, namely there were 23 for the loading section workers and 15 people for the packer section workers. All workers filled out an assessment questionnaire in accordance with the skeletal muscle disorder complaint survey and took videos of workers from several angles. In addition, observations and observations of workers were made as preliminary data for the study. Based on observations, packer workers carry out cement packing activities using a rotating machine after which

the full cement bags are immediately separated by the machine itself and continued to the loading section into the truck. In the observation of packers doing work with shift division per one shift. In one shift there are workers who stand by. The division of labor in one shift in the packer section is 5 people as spouting, 3 people who supervise the belt. Each worker will take turns doing the spouting. Based on the checklist of muscle movement disorders in packer workers who have complaints or feel discomfort in the right hand and leg.

Relationship between type of work and complaints of Skeletal Muscle Disorders (GOTRAK)

Based on the results of the chi square test, there is a relationship between work position and complaints of GOTRAK problems with the results ($p\text{value} \leq 0.05$) which means there is a relationship. Results from observations in the field there is a relationship with work position to GOTRAK complaints, but the difference is the work section. The transport worker (loading) section has a higher risk of GOTRAK complaints than workers in the packer section because transport workers (loading) have a manual load weighing more than 23 kg.

This finding is in accordance with research conducted by Shof Wtunnida et al in 2023 on risk factors for skeletal muscle disorders (GOTRAK) in health workers (Watunnida S & Widanarko B, 2023).

Relationship between the dominant hand and complaints of Skeletal Muscle Disorders (GOTRAK)

Based on the results of the chi-square test, there is no correlation between the dominant hand and GOTRAK complaints with the results ($P\text{value} \geq 0.05$). It can be concluded that for the dominant hand variable with GOTRAK complaints there is no significant relationship in packer and transport (loading) workers of the Indarung PT Semen Padang Packing Plan unit.

This finding is in accordance with research conducted by Sugiamtoro et al in 2024 on analyzing the level of knowledge based on workers' complaints about skeletal muscle movement disorders (GOTRAK) at UD. Radalla Collection (Susanto et al., 2022).

Relationship between length of work and complaints of Skeletal Muscle Disorders (GOTRAK)

Based on the results of the chi-square test, there is a correlation between GOTRAK complaints and length of work ($P\text{value} \leq 0.05$) which means there is a significant relationship. From the observations in the field, the longer workers work in the Indarung Packing Plan unit, especially the packer and transport (loading) section, the higher the risk of GOTRAK complaints with repetitive work and less ergonomic work positions.

This finding is in accordance with research conducted by 2016 and Rodriguez and Barrero, 2017 there is a relationship between length of work with GOTRAK complaints. There is a relationship between the relationship between length of work and GOTRAK complaints (Dodi et al., 2019).

Relationship between physical complaints and complaints of Skeletal Muscle Disorders (GOTRAK)

Based on the results of the chi-square test, there is a correlation between physical complaints and GOTRAK complaints with a value ($P\text{value} \leq 0.05$) so it can be concluded that the physical complaint variable and GOTRAK complaints have a significant relationship. The results of observations in the field of workers who experience physical complaints will trigger the risk of GOTRAK complaints with work positions that are always done repeatedly for a long time.

This finding is in line with several studies related to the relationship between physical complaints and GOTRAK complaints. This is also in accordance with the research of Alias et al 2020 there is a significant relationship between physical factors and GOTRAK complaints.

Researchers' previous findings have shown that older workers with extended working hours are more prone to GOTRAK complaints. Specifically, individuals aged 23-29 were found to be 2.37 times more likely to experience GOTRAK compared to those in the 40-49 age group, while those aged 50-70 were 1.93 times more likely to report GOTRAK incidents. In addition, workers with 16-36 years of computer experience were 2.42 times more likely to face GOTRAK events than those with 6-15 years of experience. In addition, physical complaints were a significant factor that increased the risk of GOTRAK events. This is in line with previous research which showed that the prevalence of GOTRAK incidents in the back and upper arm was lower when compared to the control group (Hijami & Kurniawidjaja, 2022).

The variables of length of work and physical complaints have a relationship with GOTRAK complaints in line with several previous studies. If these physical complaints are carried out repeatedly, they can cause injury or trauma to the soft tissues. So that it can cause pain, tingling, aches, and muscle weakness which then manifests as a major problem.

Conclusions

Based on the results of the study it can be concluded that 38 workers in the packer and transport (loading) section in the Indarung PT Semen Padang Packing Plant unit, experienced low complaints for the packer section with a matrix score of "4" and transport (loading) had moderate GOTRAK complaints with a matrix score of "6". And the results of statistical tests of variables that have a relationship are variables of work type (Pvalue = 0.01), length of work (Pvalue = 0.01), physical fatigue (Pvalue = 0.01), and pain (Pvalue = 0.01) with the variable complaints of skeletal muscle disorders.

Recommendations

Based on the results of the statistical test analysis using the GOTRAK survey in accordance with SNI 9011: 2021, there are several recommendations that can be given to reduce the risk of Musculoskeletal Disorders (MSDs) in packer and loading workers at PT Semen Padang's Indarung Packing Plant.

In packer and transport (loading) workers to overcome GOTRAK complaints for several recommendations including:

1. Rotation of working time
Periodic change of tasks to reduce repetitive workload on certain body parts for a long time.
2. Workplace design improvements
Optimizing the layout of equipment so that workers can reach all work areas easily without the need to make movements that burden the worker's body.
3. Improved monitoring and periodic evaluation
Policy makers and the SHE Unit conduct regular monitoring of working conditions and workers' health to detect early MSDs complaints.
4. Implementation of stretching and physical exercise programs
Implementing a light physical exercise program and stretching regularly before, during, and after work can increase workers' muscle strength.

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