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Relationship of Ergonomic Risks with Muscoloskeletal Disorders (Msds) in Rubber Production Part Workers at Pt. X Jambi in 2024

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A B S T R A C T

The purpose of this study was to determine the relationship between ergonomic risks and complaints of musculoskeletal disorders (MSDs) in rubber production workers at PT X Jambi in 2024. This study is a quantitative study using an observational design with a cross sectional approach. The population in this study were 52 people with a research sample of 47 people using total sampling as a sampling method. Based on the results of the study, the prevalence of high musculoskeletal disorder (MSDs) complaints was felt by 36 (76.6%) rubber production workers. The results of bivariate analysis showed that the variable duration of work with an unfavorable category was 21 (87.5%) with a value of (p = 0.144 > 0.05), the weight of the load with a risk category was 31 (91.2%) with a value of (p = 0.000 < 0.05), work attitude with a risk category was 31 (91.2%) with a value of (p = 0.000 < 0.05). 05), work attitude with non-ergonomic category as many as 27 (87.1%) with value (p=0.029 < 0.05), ergonomic risk level with high category as many as 28 (82.4%) with value (p=0.246 > 0.05), and work frequency with abnormal category as many as 27 (87.1%) with value (p=0.029 < 0.05).

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INTRODUCTION

As the world's industry has grown and everything is now fully automated, human power is still required to perform some tasks. The degree of safety and comfort in performing work activities is still often neglected in the human functions of workers in many organizations. Every task completed at work should take into consideration the importance of ergonomics (Dwiseptianto & Wahyuningsih, 2022). International Labor Organization (ILO) musculoskeletal disorders (MSDs) are a major contributor to occupational accidents and worker disability. 2.78 million workers die each year as a result of the 430 million cases of occupational diseases and accidents that occur worldwide each year. These cases comprise 160 million (37.2%) cases of occupational diseases and 270 million (62.8%) cases of occupational accidents (International Labor Organization, 2022). Occupational hazards are mentioned by the World Health Organization (WHO) as one of the 10 leading causes of global mortality and morbidity. About 60% of all occupational disorders are MSDs. 60% of permanent disability cases and 49.9% of workers absent for more than three days are related to MSDs (Raraswati et al., 2020). According to the Basic Health Research (2018), workers in Indonesia have a higher incidence of musculoskeletal diseases (MSDs) with injuries to the upper limbs (32%), lower limbs (67.9%), and back (6.5%). Meanwhile, data in Jambi Province shows that workers experience lower limb (64.4%), upper limb (36.0%), and back (5.5%) muscle injuries (Health, 2018).

Rubber production is a labor-intensive industry that requires workers to perform repetitive tasks, often in demanding postures and environments. At PT. X Jambi, one of the leading rubber production facilities in Indonesia, the physical demands placed on workers have raised concerns about the prevalence of musculoskeletal disorders (MSDs). Understanding the relationship between ergonomic risks and MSDs is crucial for developing effective strategies to improve worker health and productivity.

Importance of the Study

Musculoskeletal disorders are a significant occupational health issue worldwide, affecting millions of workers across various industries. In rubber production, the repetitive motions, manual handling of heavy materials, and prolonged standing or awkward postures contribute to the development of MSDs. These conditions can lead to chronic pain, reduced work capacity, and increased absenteeism, impacting both the well-being of employees and the operational efficiency of the company.

Previous Research

Several studies have highlighted the connection between ergonomic risks and the incidence of MSDs. Research has shown that poorly designed workstations, inadequate tools, and insufficient ergonomic training can significantly increase the risk of developing these disorders. However, there is limited research specifically focused on the rubber production industry, particularly within the context of Indonesian workplaces.

Rationale

PT. X Jambi presents a unique case for studying the ergonomic risks associated with rubber production. As a major employer in the region, the health and safety of its workers are paramount. By identifying the specific ergonomic risks and their relationship with MSDs among rubber production part workers at PT. X, this study aims to provide actionable insights that can lead to improved ergonomic interventions and workplace policies.

A company called PT. X produces rubber and converts raw rubber into crumb rubber. The company uses presses, conveyor belts, and other auxiliary machinery and equipment in its production process. To lift, press, and weigh rubber, it often still requires human labor or physical material handling in some places. especially in the weighing part, which requires a lot of lifting. These tasks require many variables to be completed regularly and risk making workers sick or having accidents (Meri et al., 2021). The results of estimating the ergonomic risks faced by rubber factory workers can be determined. This causes the need for further research to analyze the magnitude of the level of ergonomic risk of Musculoskeletal Disorders (MSDs) complaints.

THEORETICAL REVIEW

Musculoskeletal disorders (MSDs) are prevalent among workers in various industries, particularly in rubber production, where physical demands and repetitive tasks contribute significantly to the risk of injury. This review examines the relationship between ergonomic risks and the incidence of MSDs among rubber production workers at PT. X Jambi, highlighting the factors contributing to these disorders and the potential for ergonomic interventions to mitigate risks.

Background on Rubber Production and MSDs

Rubber production involves multiple tasks, including tapping, collecting latex, and processing, which require repetitive movements and awkward postures. Research indicates that such conditions lead to a high prevalence of MSDs among rubber workers. A systematic review of rubber processing workers from various countries, including Indonesia, found that awkward postures and manual load handling were significant contributors to MSDs.

Ergonomic Risks in Rubber Production

Ergonomics risk is the process of matching work tasks to human physical needs to minimize stress.(Hutabarat Julianus, 2021) In an effort to reduce the load in the workspace, measures are taken to adjust the proportions of the human body and control temperature, light, humidity and improve physical and mental well-being through efforts to prevent occupational injuries and diseases, reduce physical and mental workload, seek promotion and job satisfaction, improve social well-being through improving the quality of social contacts and coordinating work appropriately, in order to improve social security both during the period of productive age and after unproductive age, create a rational balance between the technical, economic, and anthropological

aspects of any work system carried out so as to create a high quality of work and quality of life. Ergonomics research aims to improve human performance in the work environment.(Budi Aswin, SKM., M.Kes, Sri Astuti Siregar, SST., M.Kes, Usi Lanita, 2023)

The ergonomic risks faced by rubber production workers can be categorized into several key factors:

1. Awkward Postures : Workers often adopt non-neutral body positions while performing tasks, which can lead to strain and injury over time.
2. Repetitive Movements : The nature of rubber processing involves repetitive actions that can exacerbate fatigue and increase the likelihood of developing MSDs.
3. Manual Handling : Lifting and carrying heavy loads without proper ergonomic support can lead to acute and chronic injuries.
4. Work Environment : Poorly designed workstations and inadequate tools can further increase the risk of ergonomic injuries.

Impact of Ergonomic Interventions

Implementing ergonomic interventions can significantly reduce the incidence of MSDs among rubber production workers. Effective strategies include:

1. Job Rotation : Rotating workers through different tasks can minimize repetitive strain and reduce the risk of injury.
2. Ergonomic Training : Educating workers on proper body mechanics and safe lifting techniques can empower them to avoid risky postures.
3. Workstation Design : Modifying workstations to fit the physical needs of workers can help maintain neutral postures and reduce strain.
4. Use of Personal Protective Equipment (PPE) : Providing appropriate PPE can protect workers from physical hazards associated with rubber processing tasks.

Research Findings and Gaps

Despite the known risks, research on ergonomic interventions specific to rubber production remains limited. Studies indicate a need for more comprehensive assessments of ergonomic risks and the effectiveness of interventions tailored to the unique tasks performed in rubber production. The systematic review conducted in 2024 aims to fill this gap by identifying prevalent MSDs and evaluating the impact of various ergonomic interventions on worker health and productivity.

The collection of conditions known as musculoskeletal diseases (MSDs) affect muscles, joints, cartilage, tendons, ligaments, nerves and supporting structures such as intervertebral discs. Musculoskeletal Disorders are caused by repetitive motion activities, fast movements, using great force, contact stress, extreme postures, vibration and low temperatures.(Dzihni Insani et al., 2023) Complaints in the musculoskeletal system are characterized by decreased muscle endurance when lifting weights, slow relaxation and contraction, and a

long distance between stimulation and the beginning of contraction.(Shobur et al., 2019) When carrying out work activities, uncontrolled muscle exertion can trigger health problems in the musculoskeletal system. The International Encyclopedia of Ergonomics and Human Factors says that factors that are known, based on epidemiological evidence, to be associated with health problems are considered risk factors. There are three ergonomic risk factors related to MSDs, namely Biomechanical risk factors, Psychosocial / work organization risk factors, organization level risk factors.(Halijah et al., 2023)

METHODOLOGY

This type of research is a quantitative study using an observational design with a cross sectional approach. This research was conducted at PT X which is located in East Jambi District, Jambi. The research time took place in March-April 2024. The population in this study were all rubber production workers at PT. X Jambi, namely 52 workers, in this study total sampling was used as a sampling method and a sample of 47 workers was obtained with 4 workers having bone disorders and 1 worker having barriers to verbal communication. data collection using 1) individual characteristics questionnaire, 2) Nordic Body Map (NBM) questionnaire, 3)BRIEF survey observation sheet, 4)Rapid Entire Body Assessment (REBA) assessment sheet, 5)Camera and Coreldraw software, 6) Stopwatch, 7)Data processing can be done with steps such as editing, coding, data entry, data cleaning and data tabulation and data analysis using univariate analysis and bivariate analysis.

RESULTS

Univariate analysis of Respondent characteristics

The following is the result of Univariate analysis based on the characteristics of the respondents.

Table 1 Distribution of Respondents Based on Age in workers of PT. X Jambi

Variabel	Min-Max	Mean	95% CI	SD	Median
Age	23-51	37,19	34,98 – 39,40	7,53	38,00

Table 2 Distribution of Respondents Based on Job Section in workers of PT X Jambi

Work Section	Frekuensi	%
wet production	23	48.9
dry production	24	51,1

Univariate analysis of research variables

This univariate analysis is used to see the distribution and frequency of all variables studied including dependent variables and independent variables. The results of the research that has been carried out, obtained the distribution of respondents from each variable as follows:

Table 3 Distribution of respondents based on research variables in PT. X Jambi workers

Variabel		Frekuensi	%
Keluhan MSDs	Tinggi	36	76,6
	Sedang	11	23,4
Durasi Kerja	Tidak normal	24	51,1
	Normal	23	48,9
Berat Beban	Beresiko	34	72,3
	Tidak beresiko	13	27,7
Sikap Kerja	Tidak ergonomis	31	66,0
	Ergonomis	16	34,0
Tingkat Resiko Ergonomi	Tinggi	34	72,3
	Rendah	13	27,7
Frekuensi Kerja	Tidak normal	31	66,0
	Normal	16	34,0

Bivariate analysis of research variables

Bivariate analysis aims to see the relationship between the independent variable and the dependent variable using the chi square test.

Tabel 4 Relationship between research variables and complaints of musculoskeletal disorders

Variabel		Keluhan MSDs				PR (95%CI)	*P-Value*
		Tinggi	%	Sedang	%		
Berat beban	Beresiko	31	91,2%	3	8,8%	2,371 (1,183-4,752)	0,000*
	Tidak beresiko	5	38,5%	8	61,5%		
Frekuensi kerja	Tidak normal	27	87,1%	4	12,9%	1,548 (0,984-2,435)	0,029*
	Normal	9	56,3%	7	43,8%		
Sikap kerja	Tidak ergonomis	27	87,1%	4	12,9%	1,548(0,984-2,435)	0,029*

	Ergonomis	9	56,3%	7	43,8%		
Tingkat risiko ergonomi	Tinggi	28	82,4%	6	17,6%	1,338 (0,847-2,114)	0,246*
	Rendah	8	61,5%	5	38,5%		
Durasi kerja	Tidak Normal	21	87,5%	3	12,5%	1,342 (0,960-1,875)	0,144
	normal	15	65,2%	8	34,8%		

DISCUSSION

Overview of univariate analysis result

Based on the table above, high MSDs complaints of 76.6% of respondents, abnormal work duration of 51.1%, risky workload of 72.3%, non-ergonomic work attitudes of 66.0%, high level of ergonomic risk of 72.3%, abnormal work frequency of 66.0%.

Overview of bivariate analysis results

Based on the table above, from the results of bivariate analysis obtained that workers who have heavy loads are at risk of 91.2% with a risk of 2.371 times to experience MSDs complaints with a value of (PR 2.371; 95% CI 1.183-4.752). This was proven statistically significant with a P-value of 0.000. Workers with abnormal work frequency amounted to 87.1% with a value of (PR 1.548; 95% CI 0.984-2.435). This was statistically significant with a P-value of 0.029. Workers with non-ergonomic work attitudes were 87.1% with a value of (PR 1.548; 95% CI 0.948-2.435). This was statistically significant with a P-value of 0.029. Workers who have high ergonomics score 82.4% with a value of (PR 1.338; 95% CI 0.847-2.114). However, this was not statistically significant with a P-value of 0.246. Workers with abnormal work duration were 87.5% with a value of (PR 1.342; 95% CI 0.960-1.875). However, this has not been shown to be statistically significant with a P-Value of 0.144.

The weight of the load is the size of an item to be lifted by rubber workers and is expressed in kilograms (kg) in this study showed that it was statistically significant between the weight of the load and Musculoskeletal Disorders in rubber workers. Based on observations that rubber workers carry out activities of lifting, rolling, pulling to push rubber with varying weights, the weight of the load lifted by rubber workers mostly lifts loads exceeding capacity, the weight of the load lifted by rubber workers is not in accordance with the regulations set by the ILO which is 40 Kg.Theory says that loads that are too heavy can cause backbone injuries, muscle tissue and joints due to excessive movement (Suma'mur, 2009)

Work frequency is the number of movements performed at work, within a certain period of time if the work activity is carried out repeatedly, it can be categorized as repetitive. this study shows that statistically significant evidence between work frequency and Musculoskeletal Disorders in rubber workers. According to the results of research, theory and related research, researchers

argue that there is a relationship between work frequency and MSDs because workers who do work continuously and repeatedly or monotonously have a high risk of danger to experience MSDs and the level of risk will increase if the work is carried out with heavy loads and large forces in a very fast time and less recovery time.Muscle complaints occur because the muscles receive pressure due to continuous workload without getting the opportunity to relax. This condition is also found in rubber workers where workers often perform repetitive activities when lifting, pulling, pushing and rolling rubber.(Tarwaka & Bakri, 2004)

Unnatural work attitudes or awkward work postures are work postures that are carried out with the position of the body moving away from natural positions such as a back that is too bent, hands in a raised position, squatting position, twisting body position. this study shows that statistically significant evidence between work attitudes and Musculoskeletal Disorders in rubber workers. From the results of observations show that the cause is doing manually so that the body movements of many workers are forced through natural body positions with incorrect, awkward and out of habit work attitudes so that it will increase the risk of injury to the musculoskeletal part. static work positions will increase ligament tension and can provide higher loads on muscles and tendons. This position leads to an increased risk of pain and soft tissue injury, namely tendon and ligament muscles because if the work is carried out in a sitting position for a long time, the position of the shoulder body tends to bend, the forward head position causes the chest muscles to tighten and the upper back muscles weaken.(Safitri RW, 2022)

The level of ergonomic risk is a combination of posture, duration, frequency, and force. This study shows that there is no statistically significant evidence between the level of ergonomic risk and Musculoskeletal Disorders in rubber workers. This is possible because workers carry out lifting and carrying continuously, workers do their work with a dynamic position in a stable time, workers have rolling time while working, maximizing free time to rest while waiting for rubber to be processed and the distance traveled by workers is not too far and the load being transported can still be tolerated by the muscle strength of each worker. Ergonomic risks in work carried out with improper manual handling such as bending work, doing work in uneven places and doing repetitive lifting can cause weakening of each spine.(Tarwaka, 2015)

Work duration is the period during which repetitive activities are performed continuously without rest. If the duration is too long, it can cause MSDs complaints. This insignificant result may be due to the fact that the average worker has similar working hours and workers take advantage of free time while working to rest. The free time obtained by workers is usually obtained when waiting for the rubber to be baked and when the rubber is chopped again and the rest time set by the company. In theory, the longer a worker is exposed to risk factors, the greater the risk of MSDs complaints. Balanced work and rest time arrangements that are adjusted to work and environmental conditions will be able to prevent overexposure to Musculoskeletal Disorders.(E, 2000)

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the study work attitude, load weight, and work frequency have a relationship with musculoskeletal disorder (MSDs) complaints. In the duration of work and ergonomic risks there is no relationship with complaints of Musculoskeletal Disorder (MSDs) in rubber production workers at PT Hok Tong Jambi. Researchers suggest working with health workers to provide socialization about musculoskeletal disorders, improve work attitudes, and adjust the weight and frequency of work with K3 ergonomic guidelines.

FURTHER STUDY

In collecting data, observation sheets such as Nordic Body Map (NBM) and REBA are used with less than optimal time due to time constraints, data collection of musculoskeletal disorders is only subjective so that it is not very accurate because it is only based on complaints felt by workers not supported by medical data and taking pictures of respondents while working not from all directions.

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