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ANALYSIS OF FACTORS AFFECTING THE INCIDENCE OF MUSCULOSKELETAL DISORDERS (MSDs) AMONG RUBBER FACTORY FIELD WORKERS: A LITERATURE REVIEW

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ABSTRACT
Musculoskeletal disorders (MSDs) are common complaints experienced by field workers, especially in industrial sectors such as rubber factories that require heavy, repetitive physical activity and non-ergonomic working postures. These complaints have a negative impact on work productivity and quality of life of workers. This study is a literature review study by reviewing scientific articles from databases such as PubMed, ScienceDirect, and Google Scholar. Inclusion criteria include publications in the last 10 years (2015–2025) that discuss the relationship between risk factors and the incidence of MSDs in field workers in the industrial sector. Articles that are not available in full-text, are of low quality, or are irrelevant were excluded from the analysis. From the results of the review of 20 articles that met the criteria, it was found that the factors most often associated with the incidence of MSDs include ergonomic factors, individual factors. MSDs in rubber factory field workers are influenced by a combination of ergonomic, individual, and psychosocial factors. Prevention can be done through a work ergonomics approach, physical training, provision of work aids, and work stress management.

Keywords: field workers; musculoskeletal disorders; rubber factory

INTRODUCTION
Occupational diseases are something that is unavoidable from exposure to hazards from the workplace. Each workplace has a different risk of hazards depending on the type of work. Health problems in the workplace must be addressed and prevention programs developed. Some occupational diseases that often occur in the workplace include ergonomic hazards such as musculoskeletal, gastroduodenal ulcers, respiratory diseases and psychological disorders. Musculoskeletal disorders (MSDs) are complaints in the skeletal muscles that can be felt by workers ranging from very mild complaints to very painful. Work activities that cause muscle pain and aches can be called MSds complaints (Darnoto, 2021).

Field workers in the rubber manufacturing industry are a group of workers who have a high physical workload, with activity demands such as lifting heavy loads, pushing or pulling large objects, and performing repetitive movements for long periods. These activities, which are carried out every day with minimal application of ergonomic principles, put workers at high risk of experiencing musculoskeletal disorders or MSDs. The problem of musculoskeletal complaints has an impact on decreasing productivity and work quality, and increasing the number of absences in those who experience musculoskeletal complaints often have to lose time from work for the recovery or healing process which is difficult and takes a long time, thus having a detrimental impact on the company or business owner (Djaali, 2019). The European Supervisory Commission report calculated that cases of Musculoskeletal Disorders caused 49.9% of absences from work for more than three days and 60% of cases of permanent disability. In 2020, Argentina reported 22,013 cases of work-related diseases, with Musculoskeletal Disorders being the most common occurrence. Musculoskeletal Disorders in

Korea experienced a very high increase from 1,634 in 2001 to 5,502 in 2010 (Harahap and Harahap, 2024).

Globally, around 20%-33% of people live with musculoskeletal disorders. As many as 498,000 workers in the UK experience musculoskeletal disorders. These disorders are often experienced in the lower extremities (19%). In Indonesia, in 2018 based on the results of the Basic Health Research, the prevalence of musculoskeletal disorders was 7.30%. The prevalence of musculoskeletal disorders based on a doctor's diagnosis was highest in Aceh (13.26%). Based on the population aged ⩾15 years. Based on the type of work, namely farmers/farm laborers (9.86%), civil servants/military/BUMN (7.46%), fishermen (7.36%) and laborers/drivers/domestic helpers (6.12%) (Kemenkes RI, 2018).According to BPJS Ketenagakerjaan (2018), there were 123,041 workers with Occupational Diseases, up from a higher number in 2016. Since 2012, there has been a continuous increase in the high number of work-related accidents in the workplace. It is estimated that around 32% of documented cases are musculoskeletal injuries caused by work-related activities such as lifting weights (43%). If employees perform their work tasks in unnatural or non-ergonomic positions or methods, the prevalence of musculoskeletal symptoms can continue to increase (Ayu, 2020).

Several studies in the industrial sector show that more than half of field workers have experienced at least one type of MSDs complaint in the past year. In a study conducted by Fauzan, (2021). With respondents of the rubber plantation tappers of PT. Bakrie Sumatera Plantations, Tbk. An initial study using the Nordic Body Map (NBM) found musculoskeletal disorder (MSDs) complaints in 48 people (62%), located in the waist, 41 people (53%), located in the right shoulder, 38 people in the upper neck, 30 people in the right elbow, 28 people in the left elbow, 26 people in the lower back, 24 people (31%) located in the lower neck, 23 people in the left shoulder, and 22 people (29%) located in the buttocks. Meanwhile, for the lower left arm, lower right arm, and upper left arm, only one person (1%), reported problems with this area. The assessment using QEC revealed that 61 people (79%) were unsafe or at risk of developing MSDs.

However, data specifically examining the risk factors for MSDs in field workers in rubber processing factories in Indonesia are still limited. Therefore, it is important to conduct an analysis of the factors that influence the incidence of MSDs in this group. The aim of this study is to analyze the factors that influence the occurrence of MSDs among rubber factory field workers. By reviewing and summarizing findings from previous research, this study seeks to identify common risk factors such as repetitive movements, poor posture, heavy lifting, and prolonged working hours. Understanding these contributing elements can help in developing effective strategies to prevent MSDs and improve the occupational health and safety of workers in the rubber industry.

METODE

This study is a literature review study that aims to identify and analyze factors that influence the incidence of musculoskeletal disorders (MSDs) in field workers in the rubber factory industry. The literature search process was carried out systematically through several trusted electronic databases such as PubMed, ScienceDirect, Google Scholar, and ResearchGate. Keywords used in the search include "musculoskeletal disorders", "risk factors", "industrial workers", "rubber factory workers", "occupational health", and "ergonomics", both in English and Indonesian. The reviewed literature was selected based on inclusion criteria, namely articles published in the last 10 years (2015–2025), using quantitative or qualitative research designs, focusing on the population of field workers in the industrial sector, and discussing

the relationship between risk factors and the incidence of MSDs. Articles with low methodological quality, no full-text available, or irrelevant to the topic were determined as exclusion criteria. All eligible articles were then analyzed narratively and thematically to identify consistent patterns regarding risk factors that influence MSDs, such as ergonomic, individual, psychosocial, and work environment factors. The selection and analysis process of articles was carried out independently and systematically to ensure the objectivity and reliability of the review results.

RESULT

Definition of Musculoskeletal Disorder

A variety of tendon, muscle, and nerve pain is referred to as musculoskeletal problems, according to the 2007 Occupational Health and Safety Council (OHSCO) report. High-repetition exercises have the potential to damage muscle tissue, which can result in muscle pain and discomfort. A collection of conditions known as musculoskeletal disorders affect the nerves, muscles, ligaments, tendons, bones, and joints of the upper and lower body, including the shoulders, hands, elbows, and wrists, as well as the neck and back (feet, knees, and hips). Workplace interactions exacerbate these problems. Musculoskeletal disorders can trigger pain, numbness, swelling, stiffness, tingling, shaking, difficulty sleeping, or burning, ranging from mild to very severe (Susanti, 2019).

Musculoskeletal disorders are one of the most common occupational diseases. Musculoskeletal disorders are very dangerous for employees throughout Europe and cause companies to suffer many losses. The same is true for rubber tappers and other field workers with non-ergonomic work postures, the position of rubber tappers who often look up and bend for more than 3 hours and must meet a target of 600-650 rubber trees, this can also trigger musculoskeletal complaints (Susanti, 2019).

Symptom

There are several common symptoms of musculoskeletal disorders (MSDs), namely:
1. Stiffness around the waist and neck.
2. Pain, stiffness, or lack of flexibility in the shoulder.
3. Pain in the hands and feet that feels like a knife.
4. Elbow or ankle pain, edema, and stiffness.
5. Pain or tenderness along with edema of the wrist and hand.
6. Burning, numbness, feeling cold or weak.
7. Fingers become less sensitive, stiff, and lose their strength.
8. Feet and heels can experience tingling, coldness, stiffness, or heat (Anggraini, 2024).

Factors Causing Musculoskeletal Disorders

a. Job Factors

1. Excessive muscle stretching

Workers usually experience excessive fatigue or excessive muscle stretching when their demanding jobs require a lot of energy, such as pulling, lifting, pushing, and holding large loads. Extreme muscle stretching occurs due to the provision of force required beyond the optimal strength of the muscle. Such as lifting loads when collecting latex by tappers. If it happens often, the risk of muscle complaints will be high, and can even cause skeletal muscle injuries (Mayasari et al., 2016).

2. Repetitive activities

Repetitive activities are activities carried out continuously, such as hoeing rice fields, splitting large trees, etc. For more than 3 hours, tappers face upwards or even bend over, then muscle

complaints arise due to the workload providing continuous load without getting the opportunity to relax (Mayasari et al., 2016).

3. Unnatural Work Attitude
Unnatural work posture is the position of body parts that move to avoid natural positions, for example, hands raised, head raised, back bent. The possibility of musculoskeletal complaints increases when the body is positioned far from its center of gravity. higher too. Unnatural work postures are usually due to special work demands, work stations and tools that are not suitable for the abilities and limitations of workers. Workers with the wrong work posture or outside of a comfortable position will increase the risk of injury to the musculoskeletal system carried out continuously and repeatedly. Based on the results of observations carried out in the field, it shows that workers who have an unergonomic work posture because in doing their work, workers still do it manually and repeatedly so that many movements in the worker's body are forced through the wrong and unusual work position or posture so that it can increase the risk of MSDs complaints (Masayu, 2019).

b. Secondary Factors
1. Pressure
When holding a tool, a person must use their hands to apply direct pressure to the muscle tissue of their hands. If this is done repeatedly, it can cause chronic muscle pain (Anggraini, 2024).

2. Vibration
Vibration has a high frequency, which increases muscle contractions. These contractions result in poor blood circulation, which increases the levels of stored lactic acid and injures the muscles (Anggraini, 2024).

3. Microclimate
Exposure to extreme temperatures can reduce the agility, sensitivity and capacity of workers, resulting in workers becoming slow, having difficulty moving, followed by decreased muscle strength. In the body The body will use some energy to adjust to the environment when there is a significant temperature difference between the body and the environment. There will be less energy available to the muscles if it is not in line with the appropriate energy source (Anggraini, 2024).

c. Individual factors
1. Age
When middle-aged, capacity and resistance begin to decline in muscles so that the risk of complaints increases. For example, maximum muscle strength is between the ages of 20 and 29 years, there will be degradation according to increasing age. When the age reaches 60 years, muscle strength generally decreases by 20% and the risk of increasing muscle complaints arises. Age has a very strong relationship with muscle complaints, especially in the shoulder and neck muscles, even a number of other scientists have revealed that the main cause of muscle complaints is age. According to Bridger's theory (2013) states that age is one of the factors causing MSDs complaints because increasing age can affect bone degeneration in the form of damage to body tissue or muscles so that it can cause bones and muscles to experience decreased function which will be the risk of MSDs complaints (Ferusgel and Rahmawati, 2018).

This is in line with the results of a study conducted by Syafira (2021) which explains that there is a relationship between age and MSDs complaints in workers where the relationship

value of the two variables is (p-value = 0.038). Because most respondents who are > 35 years old are at risk of experiencing MSDs complaints which can lead to increased muscle complaints and work productivity (Umima, 2021).

2. Gender
Physiologically, muscle capacity in women is lower than in men. So that the durability of male muscles is higher than in women. Women's muscle strength is often only 60% of men, especially in terms of back, arm, and leg muscles. Men and women complain at a ratio of one to three. According to the description, it is necessary to estimate gender in designing workloads (Anggraini, 2024).

3. Working period
Working period is the length of time a person does a job starting from the time they first start work until the research is conducted. Working period shows the length of time workers are exposed to the workplace. The longer the working period, the longer the exposure in the workplace which results in an increased risk of occupational diseases. Mongkareng (2018) emphasized that extended working hours will result in continuous finger repetition over a long period of time. Carpal tunnel syndrome can be caused by working for more than five years, which puts pressure on the carpal tunnel tissue.

4. Length of work
Working hours or often also known as work duration is the duration of a person working to complete their tasks within one day. The tappers themselves differ in the length of time to complete their work. Work that uses muscles for a long time can increase the potential for MSDs complaints if the rest time or recovery time of the body is insufficient. The longer the worker does his work, the longer the rest time needed for the body. Working hours are related to muscle complaints that can increase MSDs complaints in a person, especially for types of work that require quite a lot of work strength so that workers will feel tired quickly if the rest time is insufficient (Bilondatu, 2018).

5. Smoking Habit
Although specialists continue to disagree about the impact of smoking on the likelihood of muscle complaints, certain studies have shown a strong correlation between the duration and intensity of smoking and increased muscle complaints. The intensity of muscle complaints increases with the duration and frequency of smoking. Smoking has the potential to reduce lung capacity, which in turn decreases oxygen consumption and, ultimately, decreases the body's fitness level (Maulana et al., 2021).

6. Workload
Workload is a heavy load on a worker's body structure in transporting goods that are categorized as heavy which have a greater chance of experiencing complaints in the limbs due to the provision of heavy loads for a long duration. This condition can also cause muscle conditions to become stressed and can also be associated with disorders or tension in the spinal muscles that bend repeatedly when carrying loads. According to Paterson's theory (2013), one of the risks of MSDs complaints that can affect workers is work stress and excessive workload experienced by workers can cause feelings of fatigue after doing their work (Asmawati, 2020).

Prevention of Musculoskeletal Disorders
1. Engineering
   a. Elimination, or removing the source of the threat.

b. Substitution, which involves upgrading outdated equipment and supplies with new, safe alternatives to optimize production protocols and equipment use.
c. Partitioning, or distancing employees from sources of risk.
d. Ventilation, which reduces the risk of disease by increasing ventilation (Anggraini, 2024).

2. Engineering Management
a. With education and training, employees have a greater understanding of their environment and tools.
b. Schedule rest time and working hours harmoniously.
c. Comprehensive supervision (Anggraini, 2024).

CONCLUSION

Musculoskeletal disorders (MSDs) are common occupational health problems among field workers in rubber factories, caused by a combination of various risk factors. Based on the results of a literature review, the factors that most influence the incidence of MSDs include ergonomic factors (such as unnatural working positions, repetitive movements, and lifting heavy loads), individual factors (age, body mass index, length of service, and fitness level). An unsupportive work environment and lack of application of ergonomic principles also exacerbate the risk of musculoskeletal disorders. Increasing awareness of the importance of ergonomics, physical training, provision of work aids, and management of physical and mental workloads need to be a primary concern in efforts to prevent MSDs in the rubber processing industry. The results of this study are expected to be a basis for companies and stakeholders to design appropriate interventions to create a safe, healthy, and productive work environment.

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