

Potential Hazards and Associated Causal Factors in the Occupational Environment of Palm Oil Workers

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ABSTRACT

Introduction: Palm oil workers are exposed to numerous hazards in the work environment associated with accidents and occupational diseases. Work-related accidents are typically influenced by a combination of internal and external factors. Therefore, this study aimed to analyze the potential hazards and influencing factors affecting the safety of workers in palm oil gardens. **Method:** PRISMA guidelines with Boolean operators were used alongside specified keywords "Safety Work " OR " Health Work " AND " Hazard" AND " Palm Oil " AND " Worker." The inclusion criteria for the review included articles published from 2019 to 2023. **Results:** The results showed that factors psychologically influencing work accidents among palm oil workers included length of service, knowledge, attitudes, as well as the use of PPE, and overtime system. In terms of potential ergonomic hazards, the influencing factors identified were work posture, workload, and repetitive movements while working. From the aspect of potential biological and chemical hazards, the use of PPE when spraying pesticides and cleanliness were found to play a crucial role in the prevention of infection and exposure to chemical materials. **Conclusion:** Based on the results from several studies, smallholder palm oil workers have the potential to experience occupational accidents and diseases in the form of physical, biological, chemical, and ergonomic hazards. However, by adopting a comprehensive approach to mitigating these complex hazards, stakeholders can create a safer and more sustainable work environment.

Keywords: health and safety, palm oil, work, workers

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INTRODUCTION

Palm oil production is predominantly carried out in Malaysia, Indonesia, and Nigeria (Fathullah *et al.*, 2021). Indonesia has an area amounting to 12,000,000 ha of palm oil plantations with more than 4 million workers (Purnomo *et al.*, 2020). Meanwhile, occupational safety and health of palm oil company workers is a challenge, with only a few industries implementing good harvesting practices. Palm oil plantation workers in Indonesia work at low wages, and in hazardous conditions, posing a great risk (Novita *et al.*, 2023). As stated by the International Labor Organization, palm oil workers are always at risk of accidents when attention is

not paid to occupational health and safety (OHS) guidelines (International Labor Organization, 2019). Therefore, it is necessary to implement safety protocols to prevent work-related accidents and diseases.

According to the International Labor Data Organization, approximately 270 million and 160 million workers worldwide experience work-related accidents and diseases each year, respectively (ILO, 2022). As stated by the Occupational Safety and Health (OSHA) Administration in the United States, work accidents occur because workers experience stress, as well as due to a lack of supervision, and training in implementing occupational safety and health (Onn, 2017). In Indonesia, there is a regulatory body responsible for providing social security and employment-related benefits, called BPJS Ketenagakerjaan. This body offers a range of programs and services aimed at safeguarding

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the rights and welfare of workers, including aspects of labor insurance, pension benefits, and work accident insurance. BPJS Ketenagakerjaan also collects and maintains data on work accidents to ensure fair compensation for affected workers, enhance workplace safety, support evidence-based policymaking, and contribute to overall improvements in OHS across the country. Based on available data, the number of work accidents reached 221,740 cases in 2020, increasing to 234,370 in 2021, and 265,334 in November 2022 (BPJS Ketenagakerjaan, 2022). According to a previous study, 70% of palm oil workers have a history of accidents that impact work productivity (Dian, 2023).

The occurrence of work-related accidents and diseases constitutes a potential setback that can affect both organizations and individuals, leading to a decline in work discipline and overall productivity. This notion is corroborated by a previous study stating that the implementation of health and safety protocols by palm oil workers had a significant impact, leading to a 42.8% enhancement in work discipline and productivity. Beyond these preventative measures, it is important to gain a comprehensive understanding of the specific hazards existing within the work environment (Dian, 2023).

Work-related accidents or hazards experienced by palm oil workers include physical and biological. Potential physical hazards include exposure to ambient temperature, sunlight, rain, vibrations from truck engines transporting palm oil, as well as the risk of falling and being crushed by palm fruit bunches (Myzabella *et al.*, 2019). Meanwhile, biological hazards include exposure to worms, snake bites, and mosquito bites which can cause malaria. Potential chemical hazards experienced by workers are exposure to chemical material from pesticides and fertilizers, while ergonomic hazards include back pain or musculoskeletal disorders due to loads and wrong work postures when lifting palm bunches. Psychological hazards are in the form of stress on farmers due to heavy work pressure and low income (Solidarity *et al.*, 2015). The informal sector of palm oil plantations shows a significant gap in awareness regarding the implementation of occupational safety and health (Nana-Otto, 2016). However, as stated in a previous study, the awareness and motivation of workers are not the only factors supporting the implementation of OHS protocols (Rahman and Dwiyaniti 2020). Experience from work accidents affects the perceptions about Personal Protective

Equipment (PEE), which are safety gear and clothing worn by palm oil workers to protect themselves from various occupational hazards and risks. This equipment may include items such as helmets, gloves, safety goggles, boots, and other protective gear. Farmers or workers with experience of work accidents have a good interest in using PPE (Novita *et al.*, 2023). This study aimed to conduct a further review of the literature and previous investigations regarding the types of potential hazards experienced by palm oil workers and influencing factors.

METHOD

This scientific investigation used a literature review approach, with the search process following the Preferred Reporting Item Systematic Review Meta-Analysis (PRISMA) guidelines. The search terms included the use of Boolean operators alongside the specified keywords: "Safety Work" OR "Health Work" AND "Hazard" AND "Palm Oil" AND "Worker." The inclusion criteria included articles published from 2019 to 2023, written in English and Indonesian, open-access journals, and full text. The articles reviewed were relevant qualitative and quantitative studies.

RESULTS

Based on the search conducted, 179 articles were obtained from ScienceDirect, 6970 from Google Scholar, 82 from EbscoHost, and four from Scopus. After extraction was carried out, only 13 articles were considered feasible and in accordance with the inclusion criteria for review. Extracted data were presented in tabular form and analyzed descriptively, while Table 1 shows a summary of the articles related to this study.

Based on the results, workers in the palm oil industry experience not only physical hazards but also psychological and economic. The intricate interplay of environmental, chemical, biological, and mechanical risks, combined with factors such as insufficient training and prolonged working hours, presents a significant challenge. The consensus among the scholarly articles is that focusing on the enhancement of Occupational Health and Safety (OHS) in the palm oil sector is of crucial importance. The protection of workers from harm is not only a moral and ethical obligation but also a practical necessity, serving the well-being of the workforce as well as the sustainability and accountability of

the industry. The implementation of comprehensive measures, including rigorous training, access to suitable protective gear, and the enhancement of ergonomic conditions, are crucial measures to alleviate these hazards and ensure a safer and more secure future for palm oil workers.

DISCUSSION

The palm oil industry plays a crucial role in agriculture and global trade. During work, palm oil workers face several possible hazards influencing health and safety. This study examined the various hazards faced by palm oil plantation workers and explored the complex factors that not only create risks but also complicate mitigation efforts. The results underscore the importance of comprehensive occupational health and safety (OHS) measures in

protecting the welfare of workers, with a particular focus on understanding the causal factors.

Physical Hazards

Physical hazards result from the reluctance of palm oil workers to use Personal Protective Equipment (PPE) leading to work-related accidents (Novita, *et al.*, 2023). These hazards include physical danger that may arise during the cultivation process, for instance, workers are susceptible to injuries resulting from falling branches or being trodden upon by sharp stones or thorny vegetation while laboring in the plantations, as well as potential eye injuries. The utilization of knives to fall or cut trees poses a substantial risk. Therefore, workers need to acquire knowledge on safeguarding themselves against these risks, ensuring well-being and safety while engaged in labor (Siahaan, 2023).

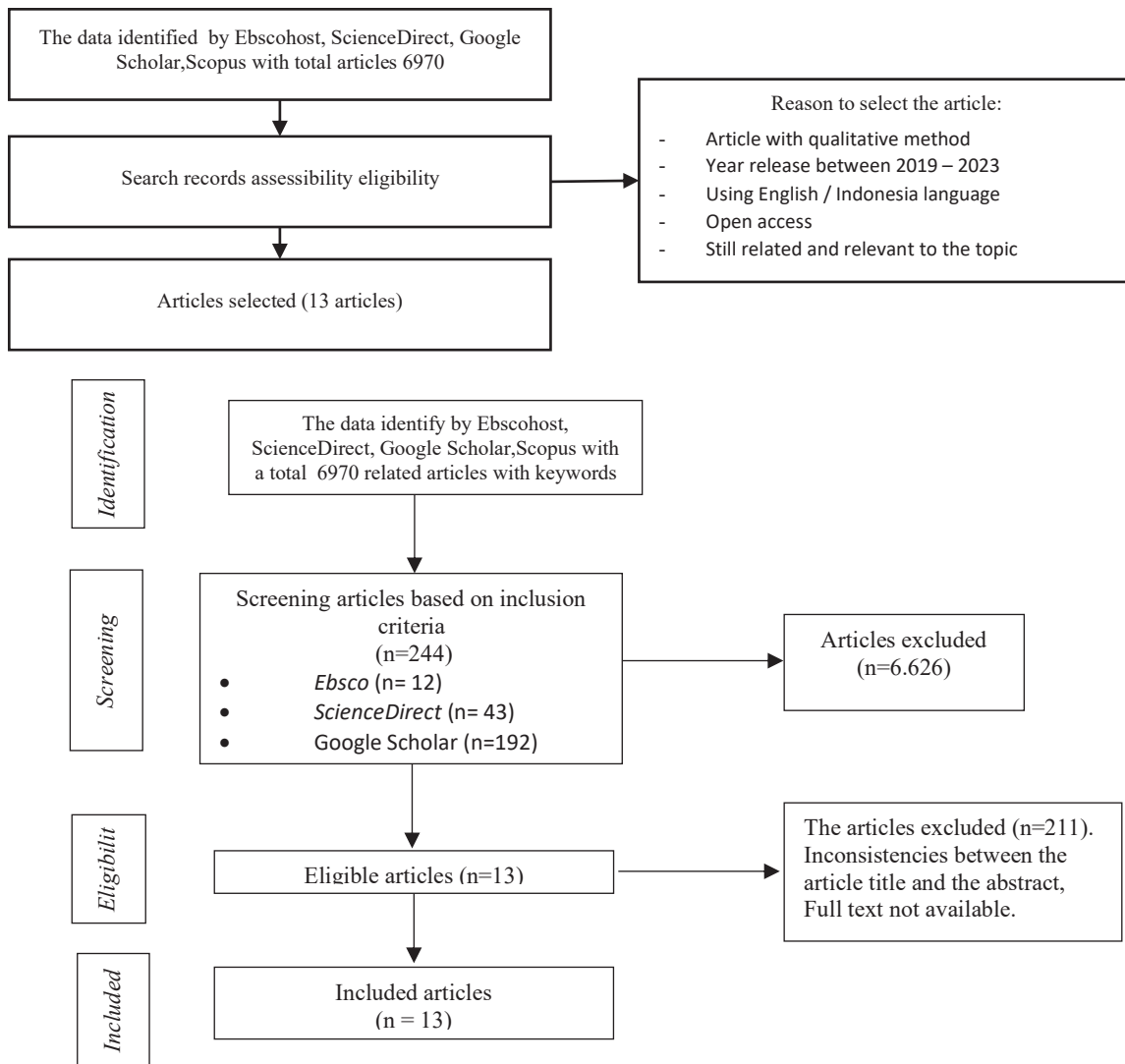


Figure 1. PRISMA Flow Diagram

Table 1. Summary of Review Study

Author	Title	Year	Respondent	Study Design	Results
(Novita <i>et al.</i> , 2023)	Palm Oil Farmers Perceptions on the Use of Personal Protective Equipment (PPE) in Rantau Rasau District, Tanjung Jabung District, Jambi Province	2023	There were five informants	Qualitative	The results of the study showed that several palm oil workers had experienced work accidents. The experience of palm oil workers influenced perceptions of the use of personal protective equipment (PEE). The response of palm oil workers towards the use of PEE is positive. Respondents know several types of PEE and have a good interest in using PPE.
(Aishakina, Dewi and Purnawati Rahayu, 2021)	Factors Related to Work Accidents for Workers in the Production Division of Palm Oil Mills, Bangkinang District, Kampar Regency in 2021	2021	The study used 86 samples	Quantitative	The results showed that the factors associated with occupational accidents of palm oil workers were age, years of service, knowledge, attitudes, occupational safety and health training, and use of personal protective equipment (PEE). The most dominant factor is the use of PEE for protection against physical, biological, and chemical hazards. The results showed that economic, physical, and chemical hazards are the main factors causing damage to humans, systems, and the environment. The assessment was carried out in the plantation area, with processes such as harvesting and gathering operations, fertilization, as well as care and maintenance. The identified hazards include slippery, awkward postures, repetition, falling objects, and gas.
(Fathullah <i>et al.</i> , 2021)	HIRARC analysis of a palm oil factory in Malaysia	2021	Observation and evaluation	Qualitative	The results showed that the highest noise exposure was at station 2 with a range of 90.3 dB (A) to 101.2 dB (A). Station 1 (Ramp Station) had the lowest noise level, 82.2 to 98.1 dB (A). Additionally, quantitative results show the work. Noise exposure has a negative impact on workers' health.
(Wondi, Norziah Ismail and Ruslan, 2020)	Occupational Noise Exposure and its Impact on Palm Oil Mills Workers' Health	2020	The sample in this study amounted to 80 people	Quantitative	The results showed that there was a relationship between individual hygiene and the use of personal protective equipment (PEE) with a history of skin infections in palm oil workers.
(Fitriangga, Rialita and Adawiah, 2020)	Factors Affecting Contact Dermatitis On Palm Oil Plantation Workers of PT. X In Semitau Sub-district	2020	The sample in this study amounted to 72 people	Quantitative	The results of the study from 66 questionnaires distributed by palm oil workers had accidents while working. The highest case of non-fatal work accidents was reported in Press Plant (19%) with a moderate risk rating. The most frequently reported type of injury by palm oil mill workers was minor abrasions (43%).
(Ruslan and Baba, 2020)	Prioritizing non-fatal occupations injuries prevention using risk matrices assessment among palm oil mills ' workers	2020	The sample in this study amounted to 66 people	Quantitative	

Advanced Table 1. Summary of Review Study

Author	Title	Year	Respondent	Study Design	Results
(Rasasoran <i>et al.</i> , 2021)	Hearing Losses and Associated Factors among Noise-Exposed Workers in Palm Oil Mills	2021	The sample in this study amounted to 312 people	Quantitative	The results showed that among 312 respondents, factors affecting hearing loss in palm oil workers were old age, married status, blue-collar type of worker, smoking, working with noisy machines, working duration, and overtime hours per week.
(Noraiman, Fadzil and Tamrin, 2019)	The Effect of Hand Arm Vibration Symptoms Among Palm Oil Harvesters with The Usage Of Cantas Machines In Selangor	2019	The sample in this study amounted to 30 people	Quantitative	The results showed that 39.4% of respondents experienced hand-arm symptoms of vibration syndrome (HAVS). Ergonomics risk factor average score is 2.93 out of 4. Ergonomic design problems are severe, maintainability, portability, ease of use, and efficiency.
(Waren, Ayuningtiyas and Wahyuda, 2021)	Relationships Between Personal Protective Equipment Use and Contact Dermatitis in Palm Oil Pesticide Workers	2021	The sample in this study amounted to 37 people	Quantitative	The results showed that 62.2% of pesticide workers had contracted skin infections in the last three months, and there was a significant association between inadequate use of PPE and contact dermatitis.
(Sulaiman, Ibrahim, and Jeffree, 2019)	Evaluating the perception of farmers towards pesticides and the health effect of pesticides: A cross-sectional study in the palm oils plantations of Papar, Malaysia	2019	The sample in this study amounted to 270 people	Quantitative	The results showed that most of the palm oil workers were aware of the dangers of using pesticides and felt the effects on health within three days such as vomiting, diarrhea, skin irritation, and dizziness. Most workers did not take advantage of training and medical assistance such as using personal protective equipment (PEE) when applying pesticides (hats), as well as goggles, masks, and gloves.
(Bhuanantanondh <i>et al.</i> , 2021)	The Prevalence of and Risk Factors Associated with Musculoskeletal Disorders in Thai Palm Oil Harvesting Workers: A Cross-Sectional Study	2021	The sample in this study amounted to 334 people	Quantitative	The results showed that factors associated with the occurrence of musculoskeletal disorders were the type of task, workload, work stress, and repetitive movements. The type of work with the most musculoskeletal disorders is fruit cutting or bunching.
(Mongkonkansai <i>et al.</i> , 2020)	Factors related to musculoskeletal disorders in quality control palms workers at palms purchasing establishments in Sichon District, Nakhon Si Thammarat, Thailand	2020	The sample in this study amounted to 50 people	Quantitative	The results showed that almost all the samples were male, with an average age of 34 years. Approximately 76% of workers had a working duration of 4.9 years and 46% worked overtime. The related factors are the amount of palm oil controlled per day, overtime work, the type of car used for transportation, and the level of ergonomic risk, which are significantly related to musculoskeletal disorders.

Advanced Table 1. Summary of Review Study

Author	Title	Year	Respondent	Study Design	Results
(Ammar <i>et al.</i> , 2022)	Screening for Noise-Induced Hearing Loss among Palm Oil Mills Workers in Peninsular Malaysia: A Comparison across Noise Exposure Levels	2022	The sample in this study amounted to 420 people	Quantitative	The overall prevalence of NIHL was 50.8%. Noise exposure level and age are significant among workers.

Previous studies on OHS aspects delved into the factors impacting work-related accidents associated with physical hazards. The internal factors include age, tenure, knowledge, attitudes, training, and the utilization of PPE (Aishakina *et al.*, 2021). Palm oil workers also experience hearing loss caused by noise factors such as age, marital status, office workers, active smokers, machine noise, and length of overtime (Ammar *et al.*, 2022).

Biological and Chemical Hazards

Biological hazards include possible diseases transmitted through direct or non-direct contact, water droplets, or other means. Common biological hazards in the palm oil industry are bacteria and viruses, leading to infection and diseases, including tetanus, neonatal tetanus, rabies, as well as hepatitis B and C (Mahfuth *et al.*, 2019). Other examples are animal bites, insect stings, and poisonous plants. To prevent these biological hazards, farmers or workers are to use appropriate protection equipment including hand gloves, masks, glasses, or other protective devices, with adequate training (Awaluddin *et al.*, 2023). A previous study stated that personal hygiene, PPE implementation, and training history have a close relationship with the level of safety management system for workers (Fitriangga, 2020).

The implementation of PPE and awareness of safety at work are crucial for preventing the consequences of chemical exposure (Waren *et al.*, 2021). Dermatitis that occurs in palm oil workers is triggered by a lack of use of PPE, and failure to read safety management (Sulaiman *et al.*, 2019; Wondy *et al.*, 2020). Furthermore, chemical hazards in the palm oil industry arise from the use of pesticides and herbicides on plantations, as well as from the processing and refining steps. These chemicals have potential adverse effects on the health of workers, including skin irritation, respiratory problems, and long-term chronic conditions (Darras *et al.*, 2019).

Ergonomic Hazards

In occupational safety and health, ergonomic hazards refer to conditions or factors in the work environment that may increase the risk of musculoskeletal disorders and other injuries. These include physical factors such as lifting heavy objects, repetitive movements, poorly designed workplaces, and prolonged periods of sitting or standing (Choi, 2020). According to the World Health Organization, ergonomic hazards are considered one of the potential health risks faced by workers in various industries (Chen *et al.*, 2020). Most palm oil-related jobs require manual labor, often causing long-term musculoskeletal disorders such as chronic back pain and debilitating repetitive strain injuries. Besides, the level of overtime and the type of work handled by palm oil workers are also important factors in reducing accidents and occupational safety awareness. The heavier the transportation equipment and lengthier the overtime period, the greater the possibility of workers experiencing musculoskeletal disorders (Mongkonkansai *et al.*, 2020). A study conducted by Bhuanantanondh *et al.* (2021) explained that transporting fresh-cut fruit impacted the shoulders and necks of palm oil workers, causing frequent pain in these regions. The Hand security level Arm Vibration Syndrome (HAVS) is considered safe at 2.30 m/s. ² When the hand vibration is above this value, there is a high possibility of experiencing musculoskeletal disorders (Noraiman *et al.*, 2019). These results suggest that ergonomic hazards in the palm oil industry have a significant impact on worker health (Moon *et al.*, 20219). The dominant factors causing work accidents include age, length of service, knowledge, use of PPE, and the overtime system, while the most prevalent potential diseases are dermatitis and musculoskeletal disorders. Neglecting work safety, particularly the use of PPE can lead to several work accidents, potentially resulting in death (Mongkonkansai *et al.*, 2020).

CONCLUSION

In conclusion, potential hazards among palm oil workers could be categorized based on the causes, namely biological, physical, chemical, and ergonomic. Factors contributing to these hazards were identified to be age, length of service, knowledge level, attitude, compliance with Personal Protective Equipment (PPE) protocols, and overtime systems. Furthermore, job position, workload, and repetitive motions during work significantly impact musculoskeletal disorders. Skin infections among these workers are influenced by the use of PPE during pesticide spraying and cleanliness. The health and safety challenges faced by the palm oil industry are intricate and deeply ingrained. However, stakeholders can establish a safer and more sustainable working environment by adopting a comprehensive approach to address these intricate hazards. These measures not only safeguard the well-being of the workforce but also contribute to the long-term sustainability and ethical responsibilities of the industry.

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Conflict of Interest

We have no conflict of interest to disclose. All authors certify that they have no conflict of interest

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