The Indonesian Journal of Occupational Safety and Health
2024, 13 (2): 261-267
p ISSN: 2301 8046, e ISSN: 2540 7872
http://doi.org10.20473/ijosh.v13i1.2024.261-267

LITERATURE REVIEW

Dermatitis among Workers and Its Relation with Personal Protective Equipment

Putri Ayuni Alayyannur[1], M. Malik Al Hakim[2], Rr. Sri Rejeki Eviyanti Puspita Sari[3]

[1]Lecturer, Department of Occupational Safety and Health, Faculty of Public Health, Universitas Airlangga, Indonesia
C Campus, Mulyorejo, Surabaya, East Java 60115, Indonesia,
[2]Udergraduate Student, Faculty of Dentistry, Universitas Airlangga, Indonesia
Mayjen Prof. Dr. Moestopo Street No.47, Tambaksari, Surabaya, East Java 60132, Indonesia
[3]The Global Fund, Pamenang Street No.1-C, Sukorejo, Kediri, East Java 64182, Indonesia

ABSTRACT

Introduction: Every workplace must make an occupational health effort to avoid health problems. Many workers underestimate the risks of the job and, therefore, do not use safety equipment even when available. The most often reported case of occupational skin illnesses, contact dermatitis, accounts for more than 85% of all cases. This study was conducted to occupational dermatitis and its relationship to personal protective equipment (PPE) use. **Methods:** The literature search was carried out in April 2021. The research sources were taken from several databases with the keywords dermatitis, occupational health, and personal protective equipment. The Google Scholar database found 17,710 articles, ScienceDirect found 1,264 articles, ProQuest found 888 articles, and PubMed found 452 articles. Of the entire database, only 36 articles met the inclusion criteria. **Results:** This literature review shows that dermatitis is experienced by workers in various sectors including health workers, hairdressers, scavengers, farmers, fishermen, manufacturing industry workers, printing workers, and construction workers. The use of PPE can reduce the risk of dermatitis. However, in some conditions, the use of PPE has no effect or can even cause dermatitis due to irritation and allergies to the ingredients contained in the PPE. The limitation of this research is that the articles that are the source of this review are only from 2016–2021.**Conclusion:** Dermatitis still occurs in various occupational sectors. The risk of dermatitis can be decreased by using PPE; however, it can also cause the occurrence of dermatitis itself.

Keywords: dermatitis, personal protective equipment, workers

Corresponding Author:
Putri Ayuni Alayyannur
Email: putri.a.a@fkm.unair.ac.id
Telephone: +6281331068808

INTRODUCTION

Occupational health and safety aims to promote and preserve employees' physical, mental, and social well-being while fostering a safe and comfortable work environment. Particularly, occupational health and safety seeks to avoid or lessen accidents and the harm they cause (Hendrawan, 2017). Worker's rights to occupational health and safety apply to both formal and informal workers (Kalalo *et al*., 2016).

According to the International Labor Organization (ILO), 160 people worldwide contract occupational diseases, and 1 worker worldwide dies due to a workplace accident every 15 seconds. The ILO kept track of the number of fatalities from accidents and occupational diseases in 2012, with as many as 2 million instances annually. According to the ILO, more people are experiencing musculoskeletal problems worldwide (International Labour Office, 2013).

Occupational diseases and occupational accidents among the Indonesian people have not been well-recorded. In certain industrialized nations, the number of accidents and occupational illnesses tends to rise. As a causal factor, it frequently happens as a result of inadequate worker awareness and insufficient worker quality and expertise. Many employees fail to use safety equipment even when it is available because they don't realize how dangerous their jobs can be. The clarification of

Cite this as: *Alayyannur, P. A., Al Hakimm M.M. and Sari, Rr. S. R. E. P. (2024) 'Dermatitis among Workers and Its Relation with Personal Protective Equipment', The Indonesian Journal of Occupational Safety and Health, 13(2), pp. 261-267.*

 doi:10.20473/ijosh.v13i2.2024.261-267. Received June 28, 2023; 1st revision November 17, 2023; 2nd revision December 15, 2023; Accepted March 26, 2024; Published: August 2024. Published by Universitas Airlangga.

Health Law No. 23 of 1992 requires every workplace to undertake occupational health efforts to prevent health problems occurring among workers, families, communities and the environment. Occupational diseases are caused by two factors, namely the work environment and work relationships. Occupational or work-related diseases can be caused by exposure in the work environment (Husaini *et al*., 2017).

The skin is one element of the human body that is especially susceptible to several diseases. Contact dermatitis accounts for almost 85% of all instances of occupational skin disease and is the most often reported case (Pardiansyah, 2015). There are two different kinds of contact dermatitis: allergic contact dermatitis, which is brought on by particular immunologic pathways, and irritating contact dermatitis, which is a non-immunological reaction. They can both be long-term or short-term (Ambarsari & Mulasari, 2018).

Irritating materials are the root cause of irritating contact dermatitis (such as solvents, detergents, lubricating oils, acids, alkalis, and sawdust); duration of contact; frequency (continuous or intermittent), occlusion causing the skin to be more permeable; friction and physical trauma; temperature and humidity (Ambarsari & Mulasari, 2018). Based on this context, a literature review study was conducted to gain a deeper understanding of the incidence of occupational dermatitis and its relationship to the use of personal protective equipment (PPE).

METHODS

In April 2021, a literature search was carried out. Researchers connected the key issue terms, such as “dermatitis" AND "occupational health" AND "personal protective equipment”, to find data sources using numerous databases, including Google Scholar, Science Direct, ProQuest, and PubMed. In order to discover reliable sources that are current with the times and not out-of-date, researchers place restrictions on their searches for similar publications, specifically the years 2016 through 2021.

The selection of this literature review study's inclusion criteria required that the journals found relate to the prevalence of occupational dermatitis, the studies found address the connection between the prevalence of occupational dermatitis and PPE use, and the full texts of the journals found be available in either English or Indonesian. The literature review articles were among the exclusion criteria used in the selection of this literature review investigation. The occurrence of occupational dermatitis and the use of PPE were the study's factors.

Inclusion and exclusion criteria

The purpose of the literature review is to respond to the topic of "How the occurrence of contact dermatitis and its relation to the use of PPE?" According to the PICOS strategy, studies had to meet preset criteria in order to be included in this evaluation. The inclusion and exclusion criteria are listed in Table 1.

Data Extraction

Data collection and analysis: The researchers independently chose the journals. The same search terms—"Dermatitis, Occupational Health, Personal Protective Equipment"—were used to browse the ScienceDirect, ProQuest, and PubMed databases. The keywords "Dermatitis, Occupational Health, Personal Protective Equipment" and "Dermatitis, Occupational Health, Personal Protective Equipment" were used to search the Google Scholar database. 20,314 publications were looked up during the data synthesis process using the Google Scholar, ScienceDirect, ProQuest, and PubMed databases. After examining the year the article was published, which was 2016–2021, 14,233 articles were excluded. Following that, 24 articles and 5,892 articles were eliminated by analyzing the abstract and title, respectively. Because the article examined dermatitis in coastal fisherman, 49 studies were deemed pertinent. Another 13 papers were not

Table 1. PICOS Guidelines for Study Inclusion and Exclusion Criteria

Parameter	Inclusion criteria	Exclusion criteria
Patients	Workers in all sectors	Not worker
Intervention	Using PPE	
Comparator	How effective are the different PPE in different sectors	
Outcomes	Dermatitis	
Study Design	Experimental research; with or without control group	Observational studies, literature studies, comments, meta analysis, editorial letters, short communication, and non-English and Bahasa article.

included since their data did not meet the inclusion criteria during the full-text analysis of 49 studies. Finally, 36 pertinent studies that met the criteria for research inclusion were chosen for this systematic review.

The procedure for choosing articles in accordance with the Preferred Reporting Literature Reviews and Meta-analysis (PRISMA) standards is shown in Figure 1. A total of 20,314 articles that were very relevant to the subject under consideration were found in the initial search. After duplicate articles were eliminated and the year of publication, title, and abstract were filtered, 49 publications were included in the next stage, which entailed a full-text review and eligibility based on the inclusion and exclusion criteria provided by the researchers. This final literature review report was prepared by synthesizing 36 research articles that satisfied the requirements after they had been checked for quality.

RESULT

The study results based on the literature review in supplementary table 1 indicate that contact dermatitis is experienced by some workers. Many professions are susceptible to contact dermatitis, including those in the medical field, hair salons, scavengers, farming, fishing, printing, manufacturing, and construction (D'Almeida Miranda *et al*., 2018; Laraqui *et al*., 2018; Lise *et al*., 2018; Loranger *et al*., 2018; Mekonnen *et al*., 2019; Piapan *et al*., 2020; Schubert, Brans *et al*., 2020; Schubert, Geier *et al*., 2020; Shakik *et al*., 2019; Sharma *et al*., 2018). The incidence of dermatitis is related to the use of PPE (Aeni *et al*., 2020; Badriah & Heriana, 2020; Navianti *et al*., 2019; Ola *et al*., 2019; Ramdan *et al*., 2018); Weber *et al*., 2016; Widianingsih & Basri, 2017). The correct and complete use of PPE can reduce the risk of developing contact dermatitis (Mullan *et al*., 2017; Paendong *et al*., 2017; Sari *et al*., 2019; Sumarna & Suhendar, 2019). The most influential PPE to reduce the risk of contact dermatitis are gloves and boots (Janah & Windraswara, 2020; Risal, 2020).

However, the use of PPE in some conditions is not related to the incidence of dermatitis (Audina *et al*., 2015; Sirait & Sinaga, 2020). The use of PPE can also be a cause of the incidence of dermatitis (Bhoyrul *et al*., 2019; Kiely *et al*., 2021). Materials found in gloves, masks, or other PPE can cause irritation or allergies (Alsaidan *et al*., 2020; Dejonckheere *et al*., 2019; Higgins *et al*., 2016; Melo *et al*., 2019; Warshaw *et al*., 2017).

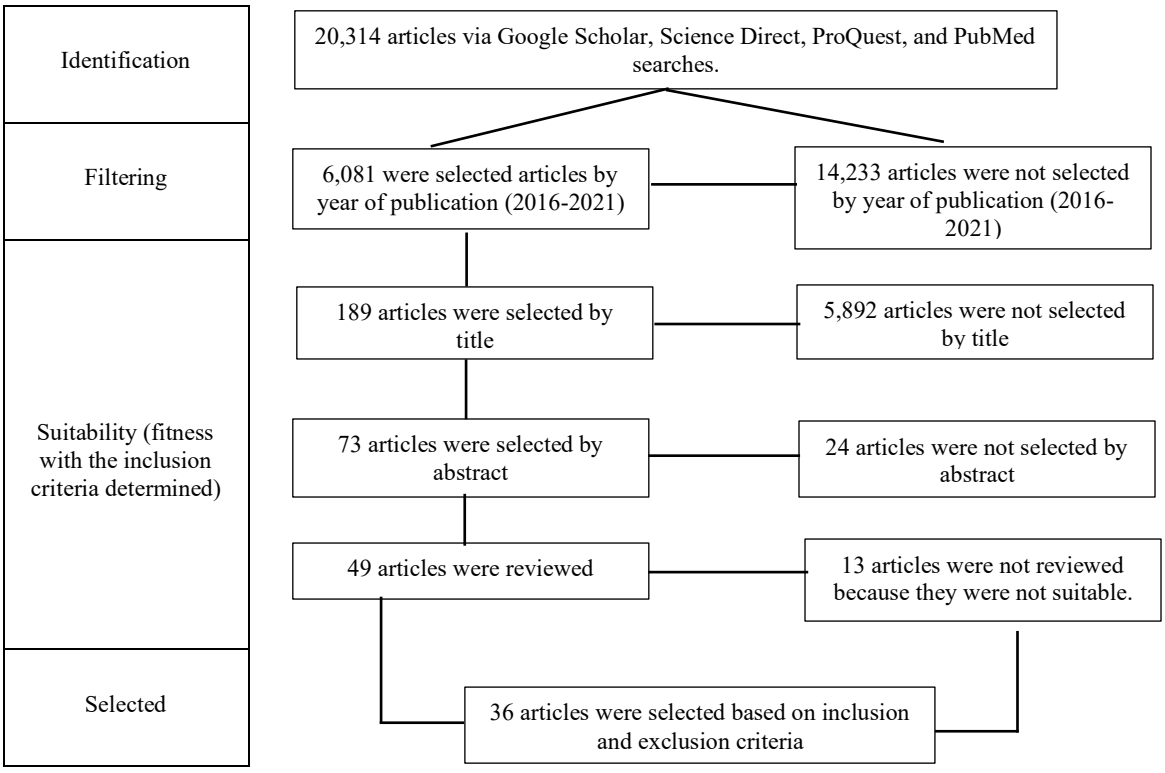

Figure 1. PRISMA Flowchart for Literature Review Study

DISCUSSION

Dermatitis can be experienced by workers from various sectors including health workers, hairdressers, scavengers, farmers, fishermen, manufacturing industry workers, printing workers, and construction workers. Workers who do wet jobs are more likely to develop dermatitis. Hands must be in a moist environment for more than two hours per day, be washed and sanitized more than twenty times, and be protected by protective gloves for more than two hours or changed more than twenty times a day (Bains *et al*., 2019).

The jobs that have the highest risk of developing dermatitis are health workers and jobs that have a humid work environment such as scavengers, fishermen, farmers, and cleaners. A total of 8 articles stated that health workers experienced contact dermatitis, both irritant and allergic. Health workers can experience dermatitis due to contact with antiseptics and disinfectants (Weber *et al*., 2016). Carba mix, Thiuram mix, Zinc diethyldithiocarbamate, cocamide dea, glutaraldehyde, quaternium-15, acrylates benzalkonium, and colophonium are a few substances that might lead to dermatitis among medical professionals (Chu *et al*., 2020). The Coronavirus Disease-2019 (COVID-19) pandemic has also made health workers wash their hands more often. Some health workers experience dermatitis due to irritation or allergies from hand sanitizer and hand washing liquid (Higgins *et al*., 2016).

A total of nine articles mention that dermatitis is experienced by scavengers, fishermen, farmers, and cleaners. The four jobs have almost the same work environment, namely working in a humid place. A humid work environment may make employees more susceptible to dermatitis. A humid workplace makes it easier for contaminants to stick to workers' skin, causing irritation or allergies (Parinduri & Siregar, 2020). Chromium, nickel, cobalt, mercaptobenzothiazole, malathion, thiuram mix, propiconazole, and formaldehyde are among the substances that frequently cause dermatitis in farmers. In the meantime, glyoxal, benzalkonium chloride, glutaraldehyde, thiuram mix, formaldehyde, zinc diethyldithiocarbamate (ZDEC), mercaptobenzothiazole, and chloramine are some substances that might cause dermatitis in the cleaning personnel (Chu *et al*., 2020).

In addition, hairdressers also have the potential to be exposed to dermatitis as they are often exposed to chemicals and also work in wet and humid work environments. Chemicals that can cause irritation or allergies to hairdressers include thiuram mix, p-phenylenediamine, and N-isopropyl-N'-phenylp-phenylenediamine. These chemicals are found in hair dyes, hair whitening products, curling solutions, iron, and chemicals in rubber (Piapan *et al*., 2020).

The most common types of dermatitis that affect workers are allergic and irritating contact dermatitis. A total of eight papers and seven publications documented cases of allergic contact dermatitis in workers, as well as cases of irritating contact dermatitis in workers. Irritant contact dermatitis is a painful or burning skin condition caused by a disruption in the skin layer. The risk of developing irritating contact dermatitis is higher in everyone. However, when employees are exposed to chemicals or compounds that produce irritation in high concentrations, irritating contact dermatitis will happen more frequently (Hollins & Flamm, 2020).

On the other hand, sensitivity to a particular substance creates allergic contact dermatitis, a skin disorder that results in rashes and itchy skin on certain body parts. Allergy-induced contact dermatitis does not always occur. The percentage of workers who can g*et al*lergic contact dermatitis is extremely low. This is because only employees who are hypersensitive to particular components would get this sort of dermatitis. Allergy-related contact dermatitis, as opposed to irritating contact dermatitis, can easily develop just after exposure to low doses (Hollins & Flamm, 2020).

Both allergic and irritating contact dermatitis are common causes of occupational dermatitis, as are detergents, surfactants, disinfectants, and antiseptics. Chemicals such as benzalkonium chloride, acids, and alkalis can result in irritating contact dermatitis. Additionally, equipment like metal, wood, and fiberglass tools might irritate people (Bains *et al*., 2019).

The usage of PPE can lower the risk of dermatitis in employees. There are a total of 16 articles that claim there is a connection between PPE use and dermatitis occurrence. Worker dermatitis is brought on by workers' inappropriate and insufficient PPE use. The risk of acquiring dermatitis is 6.240 times higher for those who do not always use PPE than for those who do (Sumarni & Rukmasari, 2018). PPE has the benefit of protecting part or all of the worker's body from the potential dangers of exposure from outside in the workplace. PPE can prevent the severity of skin conditions due to a humid working environment, so it can prevent contact dermatitis (Rahmatika *et al*., 2020).

However, wearing PPE might also make workers develop dermatitis. The usage of PPE can result in dermatitis, according to a total of eight papers. Compared to health workers who only use PPE for 1.97 hours, those who wear PPE for 3.15 hours are more likely to acquire dermatitis (Kiely *et al*., 2021). This is because some PPE, especially gloves, contain ingredients that can cause allergies or irritation. The ingredients in gloves that often cause dermatitis include carba mix, thiuram mix, tetraethylthiuram disulfide, and 1,3-diphenylguanidine (Dejonckheere *et al*., 2019; Higgins *et al*., 2016; Warshaw *et al*., 2017).

Worker dermatitis incidence is not solely correlated with PPE use. Two articles in total claim that the usage of PPE had no bearing on the prevalence of dermatitis among employees. Based on the two articles, the frequency of exposure and personal hygiene are more influential on the incidence of dermatitis. Direct exposure from the work environment can cause lesions in areas in contact with the work environment and tools. Direct contact with work equipment without using personal protective equipment can cause abrasion which causes the skin to be eroded – and irritants are easier to cause irritation to the skin. Lesions that occur can damage the worker's skin layer, so that it can facilitate the entry of irritants and allergens that cause contact dermatitis (Dewi *et al*., 2019).

The prevalence of dermatitis is directly correlated with personal cleanliness. One of the items that is evaluated in relation to personal hygiene is the practice of washing hands. One of the reasons of dermatitis can be an improper hand-washing routine. The practice of not thoroughly and cleanly washing your hands will leave chemical residues on the skin's surface. The selection of the type of hand soap can also affect the cleanliness and health of the skin. Efforts to dry hands after washing can also play a role in preventing skin conditions from getting worse due to wet hands (Akbar, 2020).

The limitation of this research is that the articles that are the source of this review are only from 2016–2021.

CONCLUSION

Based on several articles collected in this literature review, it can be concluded that dermatitis is a risk for workers from various sectors, such as health workers, hairdressers, scavengers, farmers, fishermen, manufacturing industry workers, printing workers, and construction workers. The risk of dermatitis can be decreased by using PPE. However, certain PPE can also cause dermatitis due to the ingredients contained that can cause irritation or allergies.

ACKNOWLEDGMENTS

We appreciate all of the help in writing this systematic review from the Faculty of Public Health at Universitas Airlangga.

CONFLICT OF INTEREST

The authors declare they have no conflicting agendas.

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