Systematic Literature Review: Irritant Contact Dermatitis Among Palm Oil Harvesters

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Submission date: 30-Aug-2024 03:17PM (UTC+0700)
Submission ID: 2441094913
File name: Helga_Pasadena_-_Systematic_Literature_Review_DKI.docx (25.63K)
Word count: 3211
Character count: 19811

Systematic Literature Review: Irritant Contact Dermatitis Among Palm Oil Harvesters

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1. Introduction

Irritant Contact Dermatitis (ICD) is a common occupational health issue among palm oil harvesters, who are frequently exposed to irritants such as crude palm oil, fertilizers, and pesticides. ICD is characterized by inflammation of the skin resulting from direct contact with irritants that disrupt the skin barrier without involving an allergic response (Diepgen et al., 2016). This review systematically examines global research on ICD in palm oil harvesters, focusing on its etiology, pathophysiology, prevalence, risk factors, clinical manifestations, diagnostic approaches, and management strategies.

Palm oil harvesting involves labor-intensive tasks that expose workers to various chemicals and environmental conditions contributing to ICD. Given the significant impact of ICD on workers' health and productivity, understanding the global context of this condition is essential for developing effective preventive and treatment strategies. This review consolidates findings from various studies worldwide to provide a comprehensive overview of ICD in palm oil harvesters and to highlight areas for further research and intervention (Cazzaniga et al., 2019).

2. Methodology

A systematic literature review was conducted to gather data on ICD among palm oil harvesters from global research. The search included databases such as PubMed, Scopus, and Google Scholar. The search was limited to peer-reviewed articles published between 2000 and 2023. Keywords used included "Irritant Contact Dermatitis," "occupational dermatitis," "palm oil harvesters," and "cutaneous irritants" to capture relevant studies (Alinaghi et al., 2019).

Inclusion criteria comprised studies focusing on human subjects, peer-reviewed articles, and publications in English. Exclusion criteria included studies on allergic contact dermatitis and

animal studies to maintain the review's focus on ICD specifically. The review process involved screening titles, abstracts, and full-text articles to ensure the relevance and quality of the included studies (Diepgen et al., 2016).

The methodological approach ensured a comprehensive analysis of ICD in palm oil harvesters, providing insights into the global prevalence, risk factors, and management practices related to this condition. This review aims to offer a thorough understanding of ICD across different regions and occupational settings to inform better preventive and therapeutic strategies (Lundqvist et al., 2021).

3. Etiology and Pathophysiology

The etiology of ICD among palm oil harvesters is primarily related to exposure to irritants such as crude palm oil, fertilizers, and pesticides. The repeated and prolonged exposure to these substances in palm oil plantations exacerbates the risk of developing ICD. Palm oil workers are routinely exposed to various irritants, including crude palm oil, fertilizers, and pesticides. Each of these substances has the potential to disrupt the skin's barrier function and provoke an inflammatory response. (Kiken & Cohen, 2002;Proksch, Brandner, & Jensen, 2008). Crude palm oil, which contains fatty acids and other irritating compounds, can damage the stratum corneum, leading to barrier dysfunction.

The cumulative effect of these exposures is particularly detrimental. Prolonged contact with irritants leads to chronic irritation, which can overwhelm the skin's natural repair mechanisms. Over time, this persistent exposure exacerbates the damage to the skin barrier, leading to increased susceptibility to ICD. Chronic irritation can also lead to alterations in skin physiology, such as thickening of the stratum corneum and enhanced permeability, which further exacerbates the condition (Diepgen et al., 2016). This chronic exposure not only increases the risk of ICD but also makes it more difficult to manage and treat effectively.

Mechanisms of Cumulative Skin Damage

The pathophysiological mechanisms underlying the exacerbation of ICD due to repeated exposure involve both direct and indirect effects on the skin. Directly, irritants such as crude palm oil and chemicals in fertilizers can continuously disrupt the lipid matrix and protein structure of the stratum corneum, leading to persistent barrier dysfunction (Lundqvist et al., 2021). This ongoing damage results in increased trans-epidermal water loss and reduced ability of the skin to retain moisture, making it more vulnerable to further irritation and inflammation.

Indirectly, chronic exposure can lead to secondary changes in the skin, including alterations in the immune response and inflammatory pathways. Repeated irritation can result in a heightened inflammatory response, with prolonged activation of immune cells and sustained release of inflammatory mediators such as cytokines and prostaglandins (Diepgen et al., 2016; Cork, M. J., et al. 2009, Günther, et al). This prolonged inflammatory state contributes to the development of chronic ICD, characterized by symptoms such as lichenification, scaling, and fissuring. The continuous cycle of irritation and inflammation exacerbates skin damage and increases the severity and duration of ICD symptoms

Direct Damage to the Stratum Corneum

The pathophysiology of Irritant Contact Dermatitis (ICD) is fundamentally linked to the damage inflicted upon the skin's outermost layer, the stratum corneum. The stratum corneum is composed of dead keratinocytes that form a robust barrier protecting underlying skin layers from environmental insults. Irritants such as harsh chemicals, detergents, or natural substances like crude palm oil can disrupt this barrier through their cytotoxic effects, leading to direct damage (Lundqvist et al., 2021, Kiken & Cohen, 2002;Proksch, Brandner, & Jensen, 2008). These substances compromise the structural integrity of the stratum corneum, resulting in the breakdown of the lipid matrix and the loss of barrier function. Therefore, the skin becomes more permeable to additional irritants and environmental factors, which exacerbates the inflammatory response.

The impairment of the stratum corneum's barrier function increases the trans-epidermal water loss and allows irritants to penetrate deeper into the skin, triggering a cascade of inflammatory events. The disrupted barrier fails to retain moisture effectively, leading to skin dryness, cracking, and further susceptibility to irritant-induced damage. This barrier dysfunction is a crucial factor in the development and progression of ICD, as it facilitates the entry of irritants that provoke the inflammatory response (Diepgen et al., 2016).

Inflammatory Response Mediated by Cytokines

The inflammatory response in ICD is mediated by the release of various cytokines and other inflammatory mediators. Upon exposure to irritants, keratinocytes in the affected area release pro-inflammatory cytokines such as interleukin-1 (IL-1), tumor necrosis factor-alpha (TNF-α), and interleukin-6 (IL-6) (Lundqvist et al., 2021). These cytokines play a pivotal role in initiating and sustaining the inflammatory response by recruiting immune cells to the site of irritation and promoting inflammation.

The inflammatory process begins with the activation of these cytokines, which enhance the permeability of blood vessels in the dermal layer, allowing leukocytes and other inflammatory cells to infiltrate the skin (Diepgen et al., 2016). This infiltration is responsible for the clinical manifestations of ICD, including erythema (redness), swelling, and blistering. The sustained release of cytokines and inflammatory mediators results in chronic inflammation, leading to more severe skin symptoms and potentially contributing to the development of chronic ICD if exposure to irritants is not adequately managed.

Histological Changes and Clinical Manifestations

Histologically, ICD is characterized by spongiosis, which is the accumulation of fluid in the epidermal layer due to increased permeability of the skin. This fluid accumulation results in the formation of vesicles and bullae, which are commonly observed in acute ICD (Lundqvist et al., 2021). Over time, continued irritation can lead to lichenification, where the skin becomes thickened and leathery due to repeated inflammation and scratching. The chronic inflammatory process can also lead to secondary infections if the skin barrier remains compromised and becomes an entry point for pathogens. (Bieber, T. 2008; Leung, et al 2004;Flohr, C., & Mann, J. 2014; Wilkinson, S. M., & Williams, H. C. 2006).

The clinical symptoms of ICD, such as erythema, edema, and vesiculation, are directly linked to the underlying inflammatory mechanisms. These symptoms not only cause discomfort and pain but also impair the affected individual's quality of life and ability to perform daily activities. Effective management of ICD involves addressing both the irritant exposure and the inflammatory response to alleviate symptoms and restore skin barrier function (Diepgen et al., 2016).

Environmental Factors: Humidity and Temperature

Environmental factors, notably high humidity and temperature, significantly exacerbate Irritant Contact Dermatitis (ICD) among palm oil harvesters. High humidity levels lead to increased moisture on the skin, which can result in maceration, a condition where the skin becomes soft and weakened due to prolonged exposure to moisture (Cazzaniga et al., 2019). This maceration compromises the skin's barrier function, making it more susceptible to irritant penetration and irritation. The disrupted barrier function allows irritants to penetrate more deeply into the skin, exacerbating the inflammatory response and increasing the risk of developing ICD.

In conjunction with high humidity, elevated temperatures can further exacerbate skin damage by promoting the breakdown of the stratum corneum and increasing skin permeability. High temperatures can cause sweating, which interacts with irritants like crude palm oil, leading to enhanced absorption and greater irritation (Lundqvist et al., 2021). The combination of moisture and heat creates an environment conducive to both the proliferation of irritants and the development of inflammatory skin conditions. This synergistic effect underscores the need for effective environmental controls and protective measures in palm oil plantations to mitigate the risk of ICD.

Physical Stress from Manual Labor

Physical stress from manual labor in palm oil harvesting also plays a crucial role in exacerbating ICD. The demanding nature of palm oil harvesting involves repetitive movements, such as climbing trees and cutting fruit, which can lead to mechanical irritation and friction on the skin. This physical stress can aggravate pre-existing irritant-induced damage and contribute to the development of ICD (Diepgen et al., 2016). Repeated friction and pressure on the skin can lead to localized damage, further compromising the skin barrier and enhancing the inflammatory response.

Additionally, manual labor often involves direct contact with irritants such as crude palm oil, fertilizers, and pesticides, which can combine with the physical stress to exacerbate skin irritation (Cazzaniga et al., 2019). The combination of physical stress and irritant exposure creates a challenging environment for managing ICD. Workers who experience chronic physical stress and irritation may develop more severe symptoms, including persistent erythema, scaling, and lichenification. This complexity in the pathophysiology of ICD highlights the need for comprehensive management strategies that address both environmental and physical factors.

4. Prevalence and Risk Factors

ICD is prevalent among palm oil harvesters due to their occupational exposure to irritants. Studies conducted in various countries, including Malaysia, Indonesia, and Nigeria, have reported high rates of ICD among palm oil workers. For instance, a study in Malaysia found that approximately 30% of palm oil workers experienced symptoms of ICD (Alinaghi et al., 2019). Similarly, research in Indonesia reported high prevalence rates of skin conditions related to irritant exposure in palm oil plantations (Cazzaniga et al., 2019).

Risk factors for ICD among palm oil harvesters include the type and concentration of irritants, the duration and frequency of exposure, and environmental conditions. Workers who handle crude palm oil and chemicals without adequate protective measures are at greater risk of developing ICD (Diepgen et al., 2016). High temperatures and humidity can exacerbate skin irritation by promoting the breakdown of the skin barrier and increasing irritant absorption (Lundqvist et al., 2021).

Individual susceptibility also plays a role in ICD development. Factors such as pre-existing skin conditions, genetic predispositions, and overall skin health can influence how a worker's skin responds to irritants (Cazzaniga et al., 2019). Understanding these risk factors is crucial for designing effective preventive measures and improving the management of ICD among palm oil harvesters.

5. Clinical Manifestations

ICD among palm oil harvesters presents with a variety of clinical manifestations, which can vary in severity depending on the intensity and duration of irritant exposure. Acute ICD is characterized by symptoms such as erythema, swelling, and vesiculation, which appear shortly after contact with irritants (Kiken & Cohen, 2002). These symptoms are often accompanied by itching and discomfort, which can significantly impact the worker's ability to perform their tasks.

Chronic ICD can lead to more severe skin changes, including lichenification, where the skin becomes thickened and rough due to prolonged irritation (Alinaghi et al., 2019). Chronic exposure to irritants can result in fissuring, scaling, and secondary infections, further complicating the management of ICD (Cazzaniga et al., 2019). The severity of symptoms often correlates with the extent of irritant exposure and the effectiveness of preventive measures.

Accurate diagnosis of ICD involves a comprehensive assessment of the worker's exposure history and a physical examination of the affected skin. Differentiating ICD from other skin conditions, such as allergic contact dermatitis, is crucial for appropriate management (Lundqvist et al., 2021). Early diagnosis and intervention are essential for managing ICD effectively and preventing long-term skin damage.

6. Diagnostic Approaches

Diagnosing ICD among palm oil harvesters involves evaluating the worker's history of irritant exposure, conducting a physical examination, and, if necessary, performing patch tests to rule out allergic contact dermatitis (Diepgen et al., 2016). The assessment begins with a detailed history of occupational exposure, including the types of irritants, duration, and frequency of contact.

A physical examination of the affected skin provides insight into the clinical manifestations of ICD, such as erythema, swelling, and vesiculation. In cases where ICD is suspected, patch testing may be conducted to exclude allergic contact dermatitis, as the management of ICD differs from that of allergic reactions (Kiken & Cohen, 2002). This differential diagnosis is crucial for determining the most appropriate treatment and preventive measures.

Additionally, evaluating environmental factors and individual susceptibility is important for a comprehensive diagnosis. Factors such as high humidity, temperature, and pre-existing skin conditions can influence the development and severity of ICD (Cazzaniga et al., 2019). Accurate diagnosis and understanding of these contributing factors are essential for effective management and prevention of ICD among palm oil harvesters.

7. Management Strategies

Effective management of ICD among palm oil harvesters involves preventive measures, symptomatic treatment, and education. Preventive strategies include reducing exposure to irritants through the use of personal protective equipment (PPE), such as gloves and barrier creams. Employers should ensure that workers are equipped with appropriate PPE and trained in its proper use to minimize skin contact with irritants (Diepgen et al., 2016).

Symptomatic treatment for ICD typically involves the use of topical corticosteroids to reduce inflammation and emollients to restore skin barrier function. Regular application of these treatments is necessary for managing acute symptoms and preventing chronic ICD (Kiken & Cohen, 2002). Addressing environmental factors, such as improving workplace conditions and reducing irritant concentrations, is also crucial for effective management.

Education and training are essential components of ICD management. Workers should be informed about the risks of irritant exposure, the importance of using PPE, and effective skin care practices to maintain skin health and prevent ICD (Cazzaniga et al., 2019). Employers should also provide access to medical care for affected workers and implement workplace interventions to support skin health and reduce the incidence of ICD.

8. Discussion and Analysis

The review of global literature highlights the significant impact of ICD on palm oil harvesters and underscores the need for targeted interventions and improved management strategies. The high prevalence of ICD among palm oil workers emphasizes the importance of addressing occupational exposures and implementing effective preventive measures to protect workers' skin health

(Alinaghi et al., 2019). The review also identifies gaps in current research, such as the need for more studies on the effectiveness of different preventive and therapeutic approaches.

Analysis of the reviewed studies reveals that while preventive measures such as PPE are effective, they are not always adequately implemented or used consistently by workers. Improved training and education are crucial for ensuring that workers adhere to preventive practices and properly use protective equipment (Diepgen et al., 2016). Further research is needed to explore novel therapeutic options and develop standardized diagnostic criteria for ICD.

Overall, the findings from this review emphasize the importance of a comprehensive approach to managing ICD. Addressing both environmental and individual factors, along with implementing effective treatment and preventive strategies, is essential for reducing the burden of ICD among palm oil harvesters and improving their overall health and well-being (Lundqvist et al., 2021).

9. Conclusion

Irritant Contact Dermatitis (ICD) remains a significant public health issue, particularly in occupational settings such as palm oil plantations. This review underscores the importance of a comprehensive approach to managing ICD, including preventive strategies, early diagnosis, and effective treatment. The findings highlight the need for improved preventive measures, better education and training for workers, and further research to develop standardized diagnostic criteria and explore novel therapeutic options (Alinaghi et al., 2019; Cazzaniga et al., 2019).

Future research should focus on evaluating the effectiveness of different preventive and therapeutic approaches, as well as developing standardized criteria for diagnosing ICD. Additionally, exploring new treatments and preventive technologies could help reduce the incidence and severity of ICD among palm oil harvesters. By addressing these areas, it will be possible to enhance workers' health and safety, improve job satisfaction, and reduce the overall impact of ICD in the palm oil industry (Diepgen et al., 2016; Lundqvist et al., 2021).

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